

COUNCIL OF OUTDOOR LEARNING

2010 OUTDOOR CLASSROOM SYMPOSIUM

Make and Take Sessions

Global Buckets: A Global Initiative, Locally Implemented

Cindy Wolfe, Communications Specialist, Georgia Green & Healthy Schools
Contact: cindy.wolfe@dnr.state.ga.us
www.greenandhealthy.org

Wingin' It! A Butterfly Medley Kit

Vicki Culbreath, Environmental Education Specialist, Cobb County Water System
Contact: vicki.culbreath@cobbcounty.org

Amphibian Monitoring with Georgia Adopt-A Stream

Tara Muenz, State Coordinator, Georgia Adopt-A-Stream
Contact: tara.muenz@dnr.state.ga.us
www.georgiaadoptastream.org

Must-Have Outdoor Teaching Kits

Kim Bailey, Environmental Outreach Coordinator, EEinGeorgia.org
Contact: kim@eeingeorgia.org
www.eeingeorgia.com

The Herbarium as a Learning Tool

Catherine Mercier-Baggett, Environmental Programs Assistant, Cobb County Watershed Stewardship
<http://watershed.cobbcountyga.gov/>

Bird Nesting Basics

Linda May, Environmental Outreach Coordinator, GA DNR Nongame Conservation Section
Contact: linda.may@dnr.state.ga.us

GEORGIA
Adopt-A-Stream

Department of Natural Resources
Environmental Protection Division
Winter 2010



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. October 2010

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

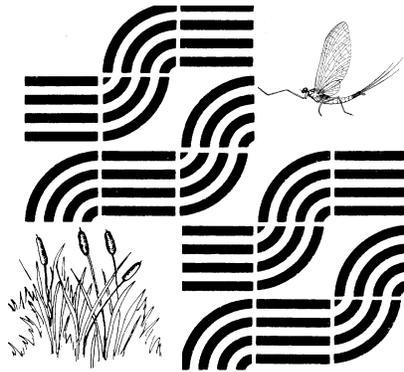
Georgia Department of Natural Resources: Environmental Protection Division and Wildlife Resources Division; Joseph W. Jones Ecological Research Center.

Writers/Editors

Georgia Adopt-A-Stream staff

Lucrecia Vizcaino

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



Georgia Adopt-A-Stream
4220 International Parkway, Suite 101
Atlanta, Georgia 30354
(404) 675-1639 or 1636
www.GeorgiaAdoptAStream.org

Table of Contents

Acknowledgements.....	2
Table of Contents	3
Georgia Adopt-A-Stream.....	5
Resources Available from Georgia Adopt-A-Stream.....	6
Chapter 1. Amphibian Biology and Ecology	7
What is an Amphibian?.....	7
About the Biology and Ecology of Amphibians.....	7
Life Cycle.....	7
Range and Habitat.....	8
Physical Characteristics	8
Internal and Anatomy	8
Vocalizations	9
Behavior	9
Reproduction.....	10
Risks to Amphibians.....	10
Species Richness in the country, the Southeast, and in Georgia.....	11
Chapter 2. Amphibian Monitoring Protocols.....	12
Amphibian Monitoring Activities	12
Other Ways to Get Involved	12
Before you Begin Monitoring: Guidelines to Protect you and the Amphibians	14
Georgia’s Permits and Regulations.....	14
Amphibian Handling Guidelines.....	14
Amphibian Monitoring Methods: Attracting Treefrogs and Salamanders.....	15
Treefrogs.....	15
Salamanders	16
Stream Layout: Coverboards and treepipes.....	17
Wetland Layout: Coverboards and treepipes	18
Chapter 3. Amphibian Monitoring Forms	19
Amphibian Monitoring Data Sheet: Example	20
Amphibian Monitoring Data Sheet: Blank	21
Malformation Data Sheet: Example.....	22
Malformation Data Sheet: Blank	22
Appendix A. Identification.....	23
Key to the Identification of Treefrogs	24
Key to the Identification of Salamanders	27
Appendix B. Websites, Links, Organizations, and Helpful References.....	36
Web Links.....	37
Identifications Guides	37

Other Helpful Publications 37
Organizations and Contacts 38
Appendix C. Glossary of Terms and County Map..... 39
Glossary of Terms 40
County Map..... 42

Georgia Adopt-A-Stream

Georgia Adopt-A-Stream (AAS) is housed in the Nonpoint Source Program in the Water Protection Branch of the Georgia Environmental Protection Division. The program is funded by a Section 319(h) grant. The goals of Georgia Adopt-A-Stream are to (1) increase public awareness of the State's nonpoint source pollution and water quality issues, (2) provide citizens with the tools and training to evaluate and protect their local waterways, (3) encourage partnerships between citizens and their local government, and (4) collect quality baseline water quality data.

To accomplish these goals, Georgia Adopt-A-Stream encourages individuals and communities to monitor and/or improve sections of streams, wetlands, lakes or estuaries. Manuals, training, and technical support are provided through Georgia EPD and more than 50 established local Adopt-A-Stream organizers.

The local Adopt-A-Stream coordinators organize Adopt-A-Stream groups in their watershed, county, or city. These local Adopt-A-Stream programs are funded by counties, cities and nonprofit organizations and use the Georgia Adopt-A-Stream model, manuals and workshops to promote nonpoint source pollution education and data collection in their area. The State office works closely with these programs to ensure that volunteers are receiving appropriate support and training.

The Adopt-A-Stream program offers different levels of involvement. At the most basic level, a new group informs their local government about their activities and creates partnerships with local schools, businesses and government agencies. They must conduct a watershed survey and 4 visual surveys within a year. Volunteers can also create a "Who To Call List" so that if something unusual is sighted, the appropriate agencies can be notified. The *Getting to Know Your Watershed* and *Visual Stream Survey* manuals provide guidance in these activities.

If volunteers wish to learn more about their adopted body of water, they are encouraged to conduct biological or chemical monitoring. The *Biological and Chemical Stream Monitoring* and *Bacteria Monitoring* manuals guide volunteers through the monitoring process. Workshops are provided at regular intervals across the State. These workshops are listed on our website, GeorgiaAdoptAStream.org. Volunteers who pass the QA/QC test will be considered quality data collectors under the Georgia Adopt-A-Stream Quality Assurance Plan. QA/QC data collected is posted on the Adopt-A-Stream database located on our website.

Georgia Adopt-A-Stream also provides manuals and training for lake and wetland monitoring. The *Wetland Monitoring* manual and workshops highlight wetland values and functions and guides volunteers through the monitoring of soils, vegetation and hydrology. A separate *Coastal Wetland Monitoring* manual created by UGA Marine Extension Service provides guidance for volunteers interested in monitoring coastal habitats and the biological and chemical parameters specific to marine conditions. The Adopt-A-Lake program is a collaborative effort between Georgia Adopt-A-Stream and Georgia Lake Society. The Georgia Lake Society provides training workshops and technical advice throughout the state. An *Educator Guide* is also offered that helps teachers put Adopt-A-Stream activities into a lesson plan format.

Georgia Adopt-A-Stream has teamed up with government and non-government groups to provide access to technical information and assistance to citizens interested in preserving and restoring the banks and vegetation along their waterways. This network will assist local governments educate citizens about the importance of protecting riparian corridors and provide landowners with the

information they need to restore the riparian zone on their property to reduce erosion, improve water quality and provide wildlife habitat with native plantings.

*As of January 2009, Georgia Adopt-A-Stream has more than 10,000 volunteers with over 100 active groups collecting data in Georgia.

Resources Available from Georgia Adopt-A-Stream

- Getting to Know Your Watershed Manual
- Visual Stream Survey Manual
- Biological and Chemical Stream Monitoring Manual
- Bacterial Monitoring Manual
- Wetland Monitoring Manual
- Amphibian Monitoring Manual
- Aquatic Macroinvertebrate Field Guide for Georgia's Streams
- Adopt-A-Lake Manual
- Adopt-A-Stream Educator's Guide
- Georgia Outdoors: Georgia Adopt-A-Stream & Rivers Alive Video
- You're the Solution To Water Pollution Brochure and Poster
- Life at the Water's Edge: A guide to stream care in Georgia
- How to Organize a Waterway Cleanup Resource Guide
- Georgia Adopt-A-Stream Newsletter
- Online Water Quality Database
- Training Workshops
- Teacher PLU Credits

Chapter 1

AMPHIBIAN BIOLOGY AND ECOLOGY

What is an Amphibian?

There are three main groups of amphibians:

- *Anura* (frogs and toads)
- *Caudata* (salamanders and newts)
- *Gymnophiona* (caecilians, which are worm-like amphibians)

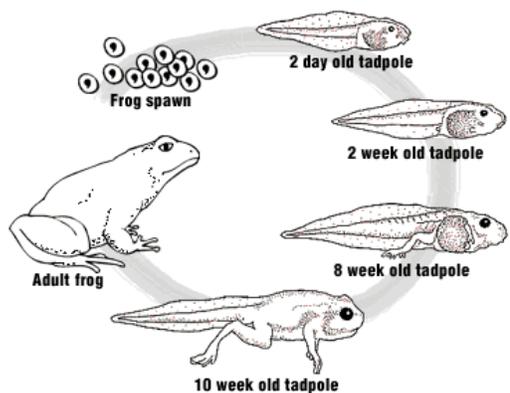
Amphibian means double life. Many species have two phases during their life cycle, the first one, as larvae, they spend in an aquatic (water) environment while their adult stage, they spend in a terrestrial (land) environment. For example, tadpoles are a larval stage of frogs and toads.

Amphibians are cold-blooded (or *poikilothermic*) vertebrates, which means they cannot generate body heat on their own. They regulate their body temperature by moving into areas that provide the right temperature for their survival. They hide under rotten logs for insulation to keep from freezing. Amphibians, unlike reptiles, do not have scales and generally return to water to breed.

Scientists have recognized more than 4,000 species of amphibians. Frogs and toads are the most abundant of all amphibians, with 3,500 species. You can differentiate a frog from a toad in that frogs have smooth skin and long limbs and toads, in contrast, have warty skin and short limbs.

About the Biology and Ecology of Amphibians

Life Cycle



Most amphibians undergo a process called *metamorphosis*. After hatching into a larval form, they endure a dramatic change in anatomy, diet, and lifestyle. During this time, amphibian larvae slowly change from fishlike, water-dwelling animals to animals better suited for life on land. In addition to developing lungs, salamanders and frogs grow limbs during metamorphosis. Most amphibians lose their gills, and the tails of frogs and toads disappear. The length of time required for metamorphosis varies widely among different species.

Many amphibians exhibit biphasic life cycles with metamorphosis separating the larval ("tadpoles" in frogs) and adult stages. Some species, such as the slimy salamander, do not have a free-living larval stage, essentially completing metamorphosis within the egg. Still other species, such as the sirens, have

abandoned metamorphosis altogether, retaining the larval morphology and aquatic habitat throughout their lives while reproducing like "normal" adults.

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

The most widespread of all amphibians are the frogs, which inhabit every continent except Antarctica. Salamanders are found in the western hemisphere, from North America to the northern part of South America. Caecilians have a more limited range; they are found in Central and South America, parts of Southeast Asia, and from India and Sri Lanka to the Philippines.

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

Physical Characteristics

Amphibians range in size from the Japanese giant salamander, which can exceed 1.5 m (5 ft) in length, to tiny frogs, such as the gold frog, that reach only 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 aquatic and have many features in common with fish. Frog larvae, which are sometimes called pollywogs or tadpoles live in water and have internal gills that enable them to obtain oxygen from water. Salamander larvae have busy external gills. Larvae of both groups have tails that they use for swimming. Most amphibian larvae have tiny tooth-like structures. Adult amphibians typically have limbs that enable them to move about on land as well as in the water. Frogs and toads have hind legs that are longer and stronger than their fore legs for use in jumping, their primary mode of locomotion on land. Aquatic species have webbed hind toes for swimming. In contrast, 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. Most adult amphibians retain their teeth, but in some species, teeth are reduced in size or not present at all.

Internal Anatomy and Skin

Amphibian internal anatomy is similar to that of other vertebrates. Adult amphibians typically have lungs, rather than gills, 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 cold-blooded, or more correctly, poikilotherms—that is, they are not able to generate their own body heat. Instead, their body temperature is determined by their surroundings. In cold weather, many species become sluggish, and some enter a state of reduced activity, or *torpor*, which is similar to hibernation.

Always hairless and rarely scaled, amphibian skin provides the animals with 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 helps them to adjust their body temperature because light colors reflect heat more than dark colors, and it also acts as a camouflaging mechanism, helping them to escape notice by predators.

Amphibians use their permeable skin to obtain both oxygen and water from their environment. Their skin also contains numerous glands that produce secretions that prevent them from drying out or are toxic or unpalatable to predators.

Vocalizations

Amphibians lack external ears but have well-developed internal ears. Male anurans (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 them. Neither salamanders nor caecilians have a true voice box, but when threatened, some salamanders can produce yelps or barking sounds (see more about frog calls below in the section 'Reproduction')



Behavior

Much of an amphibian's lifestyle is dictated by the necessity of keeping its skin moist and preventing its body temperature from becoming too hot or too cold. Some species bask in the sun in order to raise their body temperature. In hotter climates, many adult amphibians are active at night rather than in the day to avoid excessive heat and guard against water loss. In cold areas, amphibians become torpid, or inactive, during the cooler months. Nearly all adult amphibians are carnivorous; their diet includes insects, spiders, crustaceans, worms, small reptiles, and sometimes, smaller amphibians.

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, many amphibians:

- Pretend to be dead; or rely on cryptic coloration to hide
- Rely on toxins in their skin to give them a bad taste or make them poisonous to predators
- Make use of their impressive tails in defense (Salamanders)
- Leap away from predators using their strong hind legs (Frogs)
- Puff up their bodies so that they appear much larger than their real size (Frogs and Toads)

Reproduction

Little is known about courtship among the secretive caecilians; much more is known about the reproductive behavior of salamanders and frogs. 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. Frogs gather in huge numbers—sometimes thousands of individuals—when conditions are right for breeding. Male frogs rely on their calls which are familiar to humans as *croaks* but may also consist of *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 placed 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. Many species of frogs show remarkable forms of parental care.

Risks to Amphibians

Amphibians have survived more than 300 million years through 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. One study, which monitored more than 900 amphibian populations from 1950 to 1997, found that amphibian populations have been declining at an average rate of 4 percent per year for the past 40 years. 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 they more likely suggest that humans are changing the environment more rapidly than amphibians can adapt. One such change is the destruction and modification of amphibian habitats, such as the cutting down of forests and the draining of wetlands.

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 their habitat is not being destroyed. In Australia, two species of gastric 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; and 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 those amphibians 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 country, the Southeast, and in Georgia

The continental United States is home to at least 260 amphibian species: 90 frog and toad species, and 170 species of salamanders. The Southeastern USA is unique in that it harbors many amphibians, with over 144 species living in a variety of freshwater habitats. In particular, Georgia has 32 species of frogs and toads in five families. They range in size from the little Grass Frog, 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.

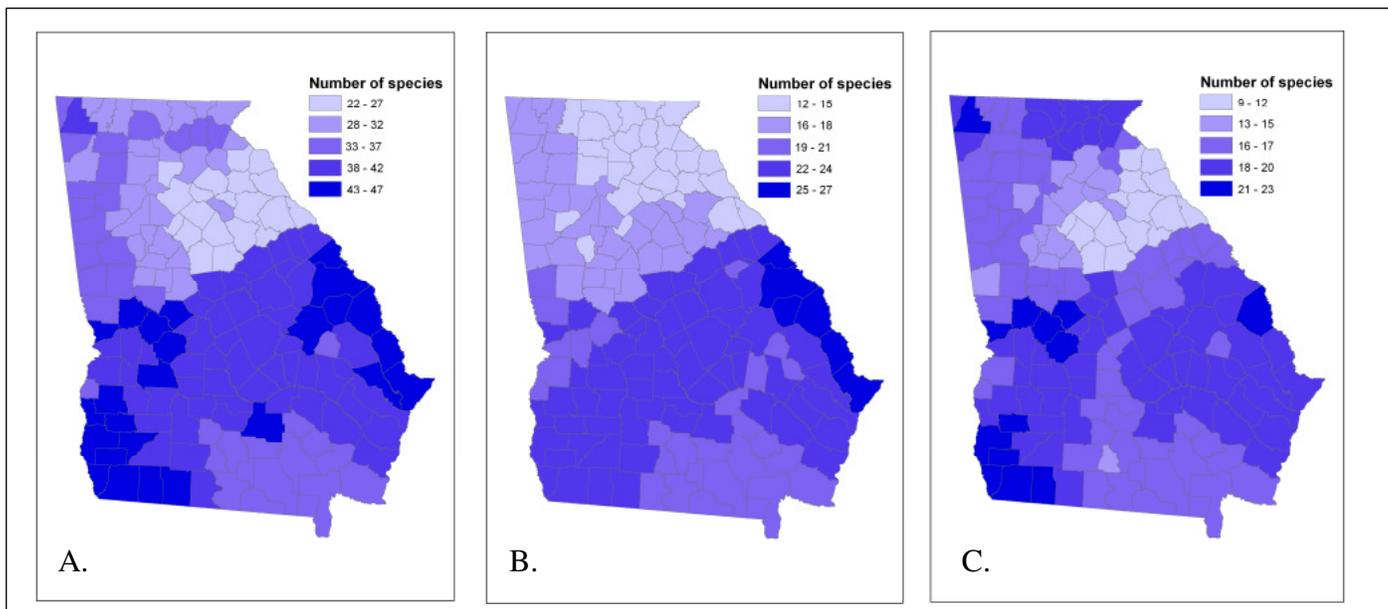


Figure 1. Amphibian species richness in Georgia by county for all species (A), Anurans (B), and Salamanders (C), from the book Amphibians and Reptiles of Georgia, J.B. Jensen et.al., 2008.

Chapter 2

Amphibian Monitoring Protocols

- Handling procedures
- Treefrog Monitoring Directions
- Salamander Monitoring Directions
- Treefrog and Salamander Data Form

Amphibian Monitoring Activities

In Georgia, amphibian monitoring activities by volunteers is in its infancy. Without a nationally established protocol for monitoring amphibians other than identification of anuran (frogs and toads) calls, the Georgia volunteer monitoring program will consist of assessing amphibian populations of tree frogs and stream salamanders. This is a pilot program that hopes to engage volunteers in the process of learning about amphibian populations.

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 American Zoo Association. 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" call Georgia DNR/WRD, Nongame Wildlife & Natural Heritage Section at 478-994-1438.

Other Ways to Get Involved

In addition to amphibian monitoring, Georgia Adopt-A-Stream provides volunteers with a variety of conservation activities. These activities would compliment the information you collect during your amphibian surveys. *Getting to Know Your Watershed* focuses on map assessments and a watershed survey as evaluation tools. *Visual Stream Monitoring* introduces a diversity of low-cost, hands-on methods for analyzing the physical health of your adopted stream and habitats important to amphibians.

These other opportunities for monitoring 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. Optional participation includes biological and/or chemical monitoring, and/or a habitat enhancement project.

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

Biological, chemical and bacterial monitoring requires training. Training workshops are available at Adopt-A-Stream Regional Training Centers, some community Adopt-A-Stream programs and through the State Office. Training includes an overview of the program, monitoring techniques and quality assurance tests.

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, however, 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. Habitat enhancement projects may stop a streambank from eroding, and therefore 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. Sometimes in small headwater streams, salamanders replace fish as the top vertebrate predators, serving 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 determine whether stream salamanders are effective indicators of ecological conditions across biogeographic regions and gradients of human disturbance.

Before you begin monitoring: Guidelines to protect you and the amphibians

➤ **Georgia Permits and Regulations: Still to come!**

➤ **Amphibian Handling Guidelines: Still to come!**

1. Hands FREE of CHEMICALS
2. Never grab by legs or squeeze too tight!
3. Minimize handling time & keep MOIST
4. Use plastic baggie for identification: Different baggie for each pipe/board
5. Always put creature back near to where you found it
6. If in multiple locations: DISINFECT boots/equipment before changing sites

Amphibian Monitoring Methods: Attracting treefrogs and salamanders

Important: When handling frogs, toads or salamanders, please keep hands clean of sunscreen lotion, insect repellent and other chemicals or 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 or wetland ecotone.

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 anti bacterial sponge).
- Zip lock bags.

Placement:

At stream (Figure 1): Using a rubber mallet, place one pipe at zero feet and one at 3 feet from stream edge at 6 stations located within your stream reach. All pipes should be placed perpendicular to the horizon. Stations should be evenly distributed along the reach, approximately 15-20 feet apart.

At wetland (Figure 2): Using a rubber mallet, place two pipes, 2 feet from each other, around the perimeter of the wetland, so there are 6 stations of pipes (12 pipes total). The **ecotone** is the edge of the wetland and transitional zone between the wetland and upland. It typically does not flood and can be identified by a distinct change in vegetation. All pipes should be perpendicular to the horizon. Stations should be evenly distributed along the perimeter of the wetland.

* Mark pipes with station number and distance code (i.e. pipe at station 2 (at 0ft) would be marked '2a' and pipe at station 2(3ft) would be marked '2b,'etc).

Identification: Check pipes every 1 to 3 months (when conducting regular AAS monitoring). If treefrog is found, gently remove pipe from the ground. Using the dowel with sponge, gently coax the treefrog from the PVC pipe and into a zip lock bag for ID. Use the AAS key or other identification guides to identify frogs. Identify species and document numbers; note malformations.

Salamanders

Objective: Obtain count of salamander populations in riparian corridors and forested 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 (see appendix).

Placement:

At stream(Figure 1): Place one pair of boards at each station within the stream reach, with one board placed at zero feet from stream edge and one at 3 feet. If the streambank is incised, place cover board on top of streambank. Stations should be evenly distributed along the reach.

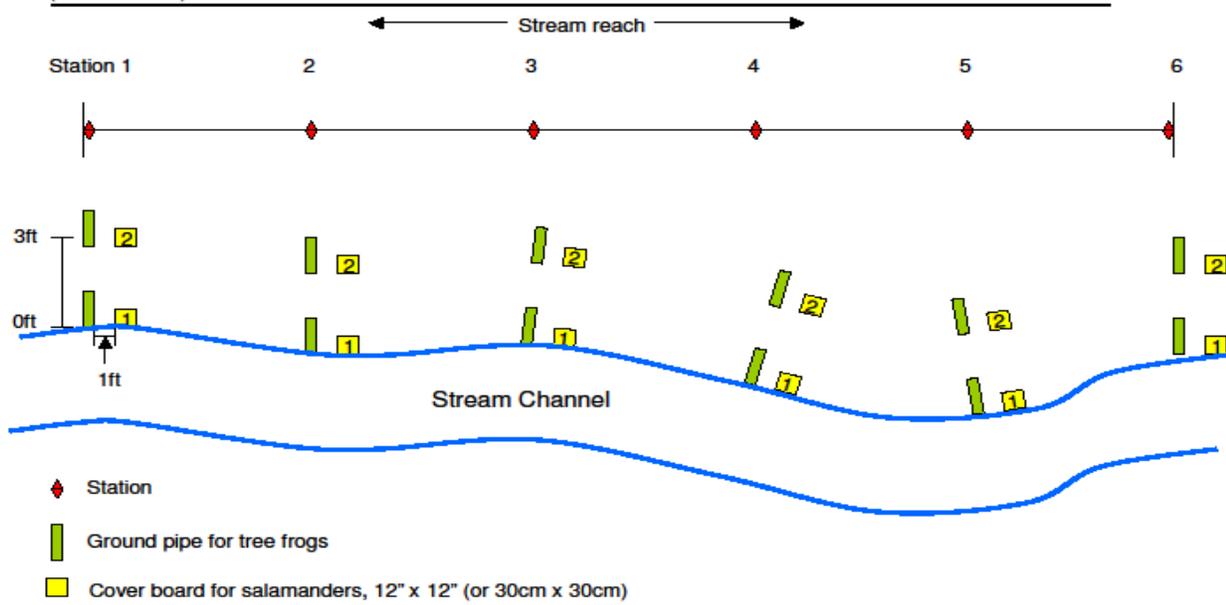
At wetland (Figure 2): Place pairs of boards around the perimeter of the forested wetland (note* this type of wetland is best for expecting salamanders; you probably will not attract salamanders that used the coverboards at other wetland types), within the **ecotone** at 6 stations (total of 12 boards). The **ecotone** is the edge of the wetland and transitional zone between the wetland and upland. It typically does not flood and can be identified by a distinct change in vegetation.

- Mark boards with permanent marker (or tree tags) with station number and distance [i.e. boards at station 2 would be marked '2a' and '2b,'etc]. Permanent marker may fade over time, so if both ground pipes and coverboards are both used, simply mark ground pipes and use these as a reference for the boards.
- Secure boards into the ground by drilling a hole about 1" from one of the edges of the board and inserting a 'sod staple' or metal rod. Sod staples can be found at your local garden hardware store (see Appendix C).

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 on page 8 to identify salamanders to the family level. Identify family and document numbers; note malformations.

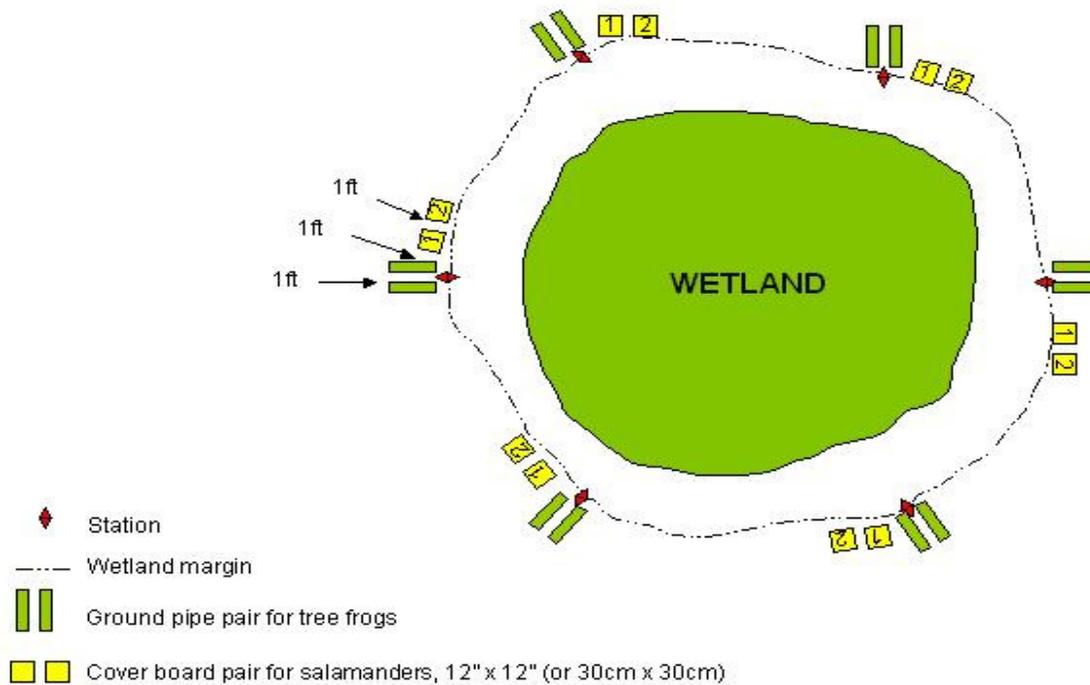
Stream Layout: Coverboards and ground pipes

Figure 1. Amphibian sampling framework at a stream site. Comprised of six (6) evenly spaced stations along the selected stream reach, on one side of the stream channel. Each Station can consist of: A) one (1) pair of ground pipes (one pipe placed at 0ft and one placed at 3ft), and/or B) one (1) pair of cover boards (one board placed at 0ft and one at 3 ft). If both survey techniques are used (A & B), place cover boards 1 ft from the ground pipes up/down (be consistent) the reach.



Wetland Layout: Coverboards and ground pipes

Figure 2. Amphibian sampling framework at a wetland site. Comprised of six (6) evenly spaced stations around the perimeter of the wetland, within the ecotone (margin of the wetland where vegetation changes and that will not flood during rain events). Each station can consist of A) one (1) pair of ground pipes (both placed within a foot of each other), and/or B) one (1) pair of cover boards (both placed within a foot of each other). If both survey techniques are used (A&B), place cover board pair 1 ft (along the wetland perimeter; be consistent) from ground pipes.



Chapter 3

Amphibian Monitoring Forms

- Amphibian Monitoring Datasheet
- Malformations Datasheet

GEORGIA ADOPT-A-STREAM: Amphibian Monitoring Data Sheet

Ground Pipes and Coverboards: Example

To be conducted quarterly

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

AAS group name: Creek Keepers County: Franklin
 Group ID number AAS-G 5901 Topo Map _____
 Site ID Number AAS-S 35201 Quadrant: _____
 Investigators: Hap Along
 Stream/Wetland name Scummy Pond
 Date MM/DD/YY: 08/15/10 Time: 15:30 Picture/Photo Documentation? yes / no
 Site/location Description:

Rain in last 24 hours Present Conditions
 heavy rain steady rain heavy rain steady rain intermittent rain
 intermittent rain none overcast partly cloudy clear/sunny
 Amount of rain, if known? 2.0 Inches in last 48 hours/days

Air Temperature (°C): 25.3
 Water Temperature (°C): 28.1

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'	2	0	0	0	0	0	/						
b	3'	0	0	1	0	3	0	/						
2 a	0'	0	0	0	0	0	0	/						
b	3'	2	1	5	0	0	0	/						
3 a	0'	0	0	0	0	0	0	/						
b	3'	0	0	0	0	0	0	/						
4 a	0'	1	0	0	0	0	1	/						
b	3'	0	0	0	0	0	0	/						
5 a	0'	4	2	0	0	0	0	/						
b	3'	3	2	0	0	0	0	/						
6 a	0'	0	0	0	0	0	0	/						
b	3'	0	0	0	0	0	0	/						

GEORGIA ADOPT-A-STREAM: Amphibian Monitoring Data Sheet

Ground Pipes and Coverboards

To be conducted quarterly

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

AAS group name: _____ County: _____
 Group ID number AAS-G Topo Map _____
 Site ID Number AAS-S Quadrant: _____
 Investigators: _____
 Stream/Wetland name _____
 Date MM/DD/YY: _____ Time: _____ Picture/Photo Documentation? yes / no
 Site/location Description: _____

Air Temperature (°C): _____

Rain in last 24 hours Present Conditions
 heavy rain steady rain heavy rain steady rain intermittent rain
 intermittent rain none overcast partly cloudy clear/sunny
 Amount of rain, if known? _____ Inches in last _____ hours/days

Water Temperature (°C): _____

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'						/						
4 a	0'						/						
b	3'						/						
5 a	0'						/						
b	3'						/						
6 a	0'						/						
b	3'						/						

Malformation datasheet: still to come!

Appendix **A**

Identification

- Key to the Identification of Treefrogs
- Key to the Identification of Salamanders

Key to the Identification of Georgia Treefrogs

Squirrel Treefrog, *Hyla squirella*

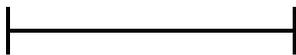
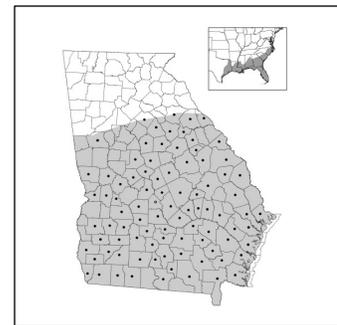
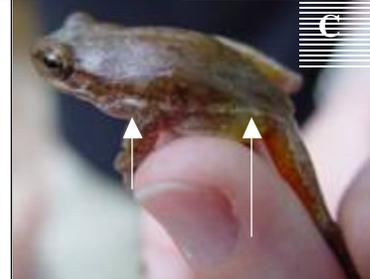
Appearance: Small, delicate, with smooth skin. Often referred to as a 'chameleon,' they are highly variable in coloration and pattern (A & B). They can be green or brown, or both, often (but not always) with a spot or dark bar between eyes. There also may be a light stripe (C) along the body, which may 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*

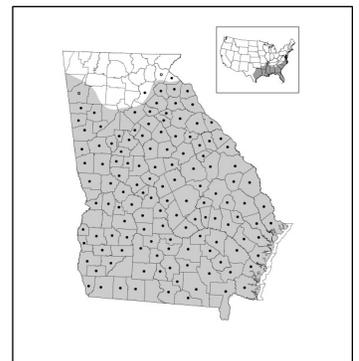
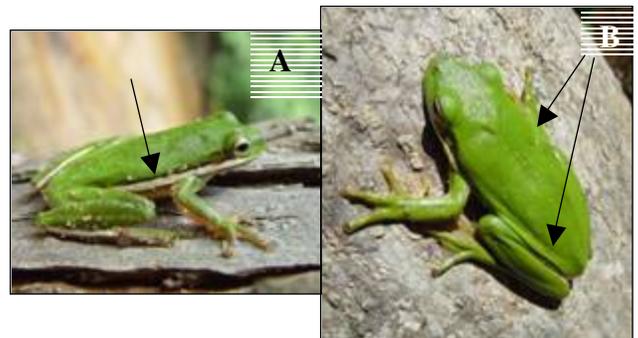
Appearance: One of the larger treefrogs. Very slender, smooth skin, bright green in color (some variation present), with a white or metallic yellow side stripe (A), pointed snout. Often with small gold or yellow spots on the back (B). The under surfaces are white or yellowish white. Color variations 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 chrysoscelis*

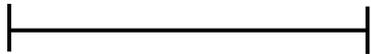
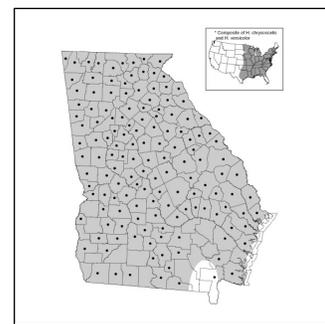
Appearance: Moderately large in comparison to other treefrogs. Head is broad and blunt, the body is fat and squat. Commonly gray in color although can vary through many shades of green and brown. Concealed surfaces of hind legs have bright orange (or golden yellow) spots on a mottled black background (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*

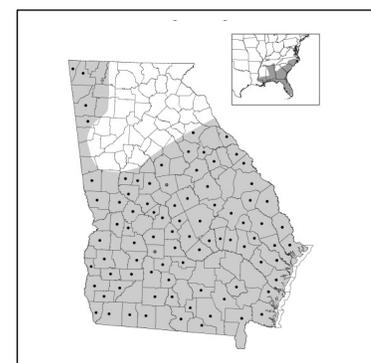
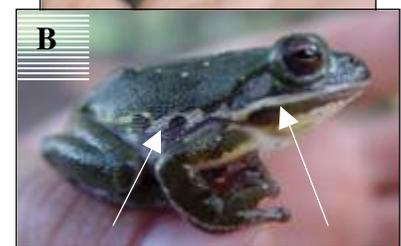
Appearance: Noted as the largest (and most spotted) of the native treefrogs. It is ashen gray, purplish, or green in color. The skin is thick and leathery, granulated over the whole upper surface as well as the lower. The back is evenly covered with elliptical or round spots darker than the general color 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*

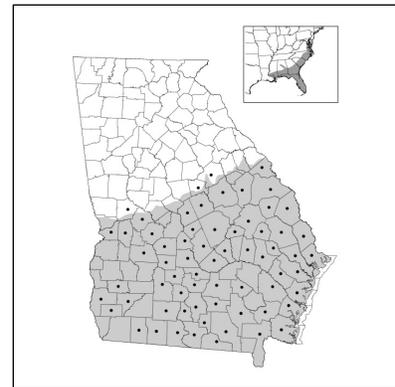
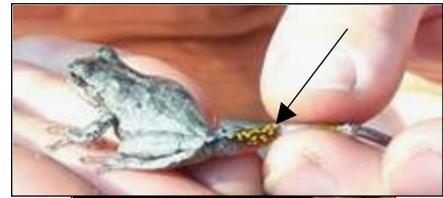
Appearance: A small treefrog that is commonly a deep reddish brown in color above, but may be gray or greenish gray. Dull white underneath, with a triangular dark spot between the eyes. There are distinct orange or grayish white spots on the rear of thighs (A), and although this frog resembles the Gray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

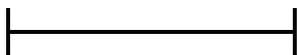
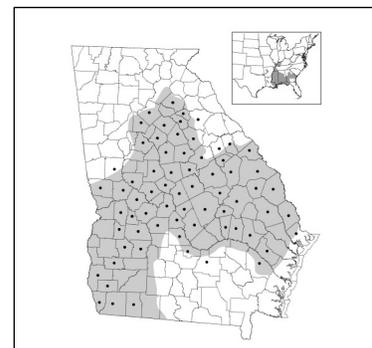
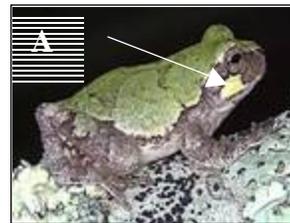
Appearance: Referred to as the smaller version of the Gray Treefrog, they are more slender, but are also gray, brown or green and have a light spot beneath the eye (A). However, the concealed portions of the hind legs in the Bird-voiced Treefrog are washed with pale yellowish green to greenish- or yellowish 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 3/4” (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



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)

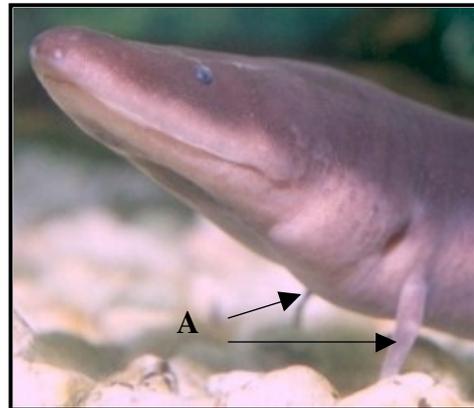
Appearance: Gray to black, eel-like bodies with four greatly reduced, non-functional legs (A).

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. pholeter*, may occur in extreme southwest Georgia, but has 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)

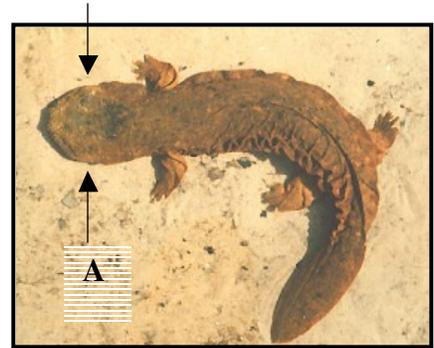
Appearance: Very large, wrinkled salamander with eyes positioned laterally (A). Brown-gray in color with darker splotches

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)

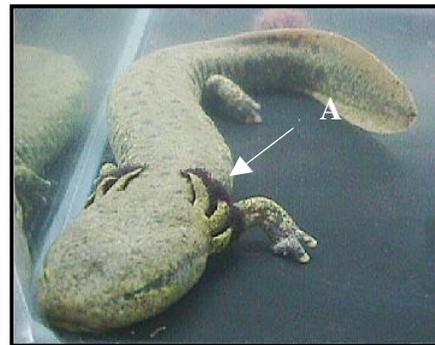
Appearance: Large aquatic salamanders with bushy external gills (A) and four stocky well-developed legs.

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. 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
- Jensen, J., C.D.Camp, W.Gibbons, and M.J. Elliott, eds. 2008. Amphibians and Reptiles of Georgia. University of Georgia Press. Athens, GA.
- 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 Tara K. Muenz and Lora L. Smith 2003

Appendix **B**

Websites, Links, Organizations, and Helpful References

Web Links

<http://allaboutfrogs.org/frogInd.shtml>
<http://cgee.hamline.edu/frogs/science/frogfact.html>
<http://www.mcnaair.ucdavis.edu/presentations/1998/ppt/yee/yee1/sld003.htm>
<http://encarta.msn.com>
<http://museum.nhm.uga.edu/gawildlife/amphibians/amphibians.html>
<http://www.amonline.net.au/webinabox/frogs/about/life.htm>
<http://herpcenter.ipfw.edu/> creation of ponds

Identification Guides

Amphibians and Reptiles of Georgia. J.J.Jensen, C.D. Camp, W.Gibbons, and M.J. Elliott editors. 2008. The University of Georgia Press, Athens, Georgia.

Frogs and Toads of the Southeast. M.Dorcas and W.Gibbons. 2008. The University of Georgia Press, Athens, Georgia.

Peterson Field Guides: Reptiles and Amphibians: Eastern/Central North America. 1998. R. Conant and J.T. Collins.

Salamanders of the United States and Canada. J.Petranka. 2010. To be released.

Tadpoles of the Southeastern United States Coastal Plain:

http://fl.biology.usgs.gov/armi/Guide_to_Tadpoles/guide_to_tadpoles.html

The Frogs and Toads of Georgia (images and calls):

<http://wwknapp.home.mindspring.com/GAFrog.Toad.html>

<http://jcmaerz.myweb.uga.edu/lab/GANAAMP/index.htm>

Other helpful Publications:

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.

Biology of Amphibians. Duellman, E. and Trueb, L. 1994. The Johns Hopkins University Press. 670pp

Extinction in our times: Global amphibian decline. J.P. Collins and M.L. Crump. 2009. Oxford University Press, Inc. New York.

Habitat Management Guidelines for amphibians and reptiles of the Southeastern United States. Technical publication HMG-2. Partners in Amphibian and Reptile Conservation.

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, by 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, by C. Kenneth Dodd, Jr. US Department of Interior, USGS, Circular 1258

Organizations and Contacts:

1. State Herpetologist, John Jensen, Georgia Department of Natural Resources, Wildlife Resources division, Nongame Section.

John.Jensen@dnr.state.ga.us

478-994-1438

2. Southeastern Partners in Amphibian and Reptile Conservation:

<http://www.parcplace.org/southeast.html>

3. The J.W. Jones Ecological Research Center at Ichauway:

www.jonesctr.org

4. Amphibian Research at the Atlanta Botanical Gardens:

<http://www.atlantabotanicalgarden.org/conservation/amphibian-research>

5. Amphibian Ark:

<http://www.amphibianark.org/>

6. United States Geological Survey: The North American Amphibian Monitoring Program:

<http://www.pwrc.usgs.gov/naamp/>

7. Savannah River Ecology Herpetology Program

<http://www.uga.edu/srelherp/>

8. Frogwatch USA:

<http://www.aza.org/frogwatch/>

9. International Union for the Conservation of Nature, Red List: Amphibians

<http://www.iucnredlist.org/initiatives/amphibians>

10. AmphiWeb:

<http://www.amphibiaweb.org/index.html>

11. The Center for North American Herpetology:

<http://www.cnah.org/nameslist.asp?id=3>

Appendix **C**

Glossary of Terms Counties of Georgia

Amphibian – Vertebrate animals of the class Amphibian.

Anuran - Any of an order (Anura) of amphibians comprising the frogs, toads, and tree frogs all of which lack a tail in the adult stage and have long hind limbs often suited to leaping and swimming.

Caecilians – Animals of the order Gymnophiona of amphibians that superficially resemble earthworms or snakes.

Caudata – An order of the class Amphibia, which includes the salamanders and newts.

Carnivorous - An organism that derives its energy and nutrient requirements from a diet consisting mainly or exclusively of animal tissue, whether through predation or scavenging.

Coverboard - A flat, untreated piece of wood (dimensions vary) used to attract salamanders.

DNR – Department of Natural Resources; a State entity charged with the conservation and management of Georgia’s natural resources.

Ecotone - A transition area between two adjacent but different plant communities, such as forest and grassland.

Embryo- An early stage of development, from the time of first cell division until birth, hatching, or germination.

EPD: The Environmental Protection Division; a branch of DNR charged to protect and restore Georgia’s environment.

Frog – An amphibian in the order Anura, characterized by a short body, webbed digits, protruding eyes and the absence of a tail.

Frogwatch USA - A volunteer frog call monitoring program run by the Association of Zoos and Aquariums.

Ground Pipe - A PVC pipe used to provide habitat/refugia for treefrogs.

Gymnophiona – An order of amphibians (see ‘Caecilian’).

Metamorphosis – A biological process by which an animal physically develops after birth or hatching, involving a conspicuous and relatively abrupt change in the animal's body structure through cell growth and differentiation.

NAAMP – The North American Amphibian Monitoring Program, run by the United States Geological Survey. A volunteer frog call monitoring program.

Pathogens - An infectious agent, or more commonly germ, is a biological agent that causes disease to its host.

Poikilothermic – A plant or animal whose internal temperature varies along with that of the ambient environmental temperature.

Refugia – A suitable habitat for an animal.

Salamander – An amphibian of the order Caudata. They are typically characterized by their slender bodies, short noses, and long tails.

Sod Staple – Galvanized or basic wire clips for holding/securing down coverboards into the ground.

Stations – A grouping of monitoring equipment that has a specific site designation/identification (i.e. one ground pipe and one coverboard called ‘1a’ and ‘1b’).

Treefrogs - Any frog that spends a major portion of its lifespan in trees; in the amphibian family Hylidae.



Counties of Georgia



"Froggin' By Ear"

Atlanta Area

Frog Species	Call Description	Other Notes
American Toad* <i>Bufo americanus</i>	Long musical trill	Usually has no more than one wart in each spot. Variable color. Larger than Fowler's Toad. Large paratoid gland doesn't touch cranial crest like it does in Fowler's. Breeds in winter & early spring in the northern half of Georgia.
Barking Treefrog <i>Hyla gratiosa</i>	Distant dog barking sound, like a pack of hunting hound dogs	Largest treefrog in GA. Changes colors & patterns. Granular, rough skin. Ragged white side stripe. Easily handled.
Bird-Voiced Treefrog* <i>Hyla avivoca</i>	Whistle, like calling a dog.	Looks like a Gray Treefrog, but has a green inner thigh rather than yellow.
Brimley's Chorus Frog <i>Pseudacris brimleyi</i>	Raspy, repeated trill	Fishless pools, puddles, ditches
Bullfrog* <i>Rana catesbeiana</i>	Jug-uh-rum	The largest frog in North America (8+ inches). Legs are commonly eaten.
Carpenter Frog <i>Rana virgatipes</i>	Hammer or galloping	In acidic bogs areas in South GA (e.g., Okefenokee)
Cope's Gray Treefrog* <i>Hyla chrysoscelis</i>	Harsh, quick, low- to medium-pitched trill	Breeds in fishless water, even in swimming pools (but eggs won't hatch out there). Yellow color in groin (vs. green color on Bird-Voiced Treefrog).
Eastern Narrowmouth Toad* <i>Gastrophyrine carolinensis</i>	Like a bleating lamb; More buzzy & nasally than Fowler's toad	Has smooth, moist skin. Short hind limbs, so it doesn't leap. No toe webbing. Folds of skin behind its eyes protects toad from ants & termites while eating.
Eastern Spadefoot Toad* <i>Scaphiopus holbrookii</i>	Belch-like, vomit-sounding call	Spends most of its life underground & only come out with 2-3" of rain. Explosive breeders in fishless, temporary pools when 55°F and warmer.
Fowler's Toad* <i>Bufo fowleri</i>	"Weeenk...." Sheep-like, long & nasally	Usually has 3 or more warts in each spot (vs. 1 wart per spot in American Toad).
Gopher Frog <i>Rana capito</i>	Rolling snore	Lives in sandy uplands and comes to water to breed.
Green Frog <i>Rana clamitans</i>	Untuned banjo string	Has dorso-lateral ridges down its back.
Green Treefrog* <i>Hyla cinerea</i>	Nasally duck-like call	Georgia's state amphibian. Large treefrog, generally green with a bold white stripe. Has smoother skin than Barking Treefrog.
Greenhouse Frog <i>Eleutherodactylus planirostris</i>	Insect-like chirps	Not native, accidental import along with tropical plants. Eggs hatch out directly to frogs (tadpoles develop inside eggs).
Little Grass Frog <i>Pseudacris ocularis</i>	High-pitched insect-like "tinkling" sound	A type of chorus frog. Smaller than a dime. Only found in South GA.
Mountain Chorus Frog <i>Pseudacris brachyphona</i>	Raspy, upslurred trill	Fishless pools, puddles, and ditches
Northern*/Southern Cricket Frog <i>Acris crepitans/gryllus</i>	2 marbles hitting each other ~ Northern is less rhythmic than Southern	About 1/2" long. Varies in color, but has a dark triangle between its eyes. Light line from eye to edge of mouth.
Oak Toad <i>Bufo quercicus</i>	Sounds like baby chickens	Smallest toad in North America. In GA, only found in southern part of the state. Has a white stripe down the middle of its back.
Ornate Chorus Frog <i>Pseudacris ornata</i>	Hammer hitting a metal chisel	Variable color (green, gray or brown), with a dark mask on face. Lives in South Georgia.
Pickerel Frog* <i>Rana palustris</i>	Rising, quick snore	Usually calls while submerged, in late winter and spring.
Pig Frog <i>Rana grylio</i>	Sounds like pigs grunting	A very aquatic species that lives in the southern half of GA, in swamps with alligators. Has extensive toe webbing. People commonly eat Pig Frog legs.
Pine Barrens Treefrog <i>Hyla andersonii</i>	Nasal, duck-like chirp	Rare species; may occur in Georgia (in surrounding states), but undetected so far. Breeds in small pools with calls in spring & summer.

River Frog <i>Rana hecksheri</i>	Scary, low-pitched growling call	Big frog that lives in South GA river swamps.
Southern Chorus Frog <i>Pseudacris nigrita</i>	Similar to Upland Chorus Frog, but at a much slower pace	Fishless ponds, pools, puddles, ditches
Southern Leopard Frog* <i>Rana Sphenocephala</i>	Variable call, like a finger rubbed across a balloon or a rapid chuckling	Normally call in winter and spring (early breeder). The most widespread species in GA. Similar in appearance to Pickerel Frog, but has a white dorso-lateral line and a white spot on the tympanum (eardrum).
Southern Toad <i>Bufo terrestris</i>	Fishless, temporary pools and ponds	Similar to the American, but not as long or musical
Spring Peeper* <i>Pseudacris crucifer</i>	High-pitched "peeps"	Occurs statewide. Breeds in the winter in GA but in the spring in the northern US. Wide range (up to Canada). Has an "X" mark on its back.
Squirrel Treefrog* <i>Hyla squirella</i>	Squirrel-like bark.	Responds to rain. Breeds in fishless temporary puddles and pools, often in ditches.
Upland Chorus Frog* <i>Pseudacris feriarum</i>	Sounds like running a finger across the teeth of a comb	Winter breeder. Very secretive, but may call all day long on warm winter days. Breeds in fishless puddles.
Wood Frog* <i>Rana sylvatica</i>	Quacking duck	Medium-sized frog, dark brown to black with a dark robber's mask.

General Frog Notes:

- Georgia is home to 31 species of frogs ~ ranks 3rd in the US for the state with the most frog species.
- Only males make breeding calls and have vocal pouches. Their throats are a different color than their bellies (usually darker). They also call when it rains, but biologists aren't sure why ~ perhaps they are getting territorial before night falls.
- Both males and females make "release" or alarm calls, usually as they are jumping away so as to notify others of predators in the area.
- A group of calling frogs is called a CHORUS.

To better learn Georgia's frog calls, you can find audio clips at
<http://jcmaerz.myweb.uga.edu/lab/GANAAMP/index.htm>.

OR

Purchase a "Calls of the Wild ~ Vocalizations of Georgia's Frogs" CD at
<http://wwwknapp.home.mindspring.com/docs/ga.frog.cd.html>.

To test your ability to identify frog calls,
visit www.pwrc.usgs.gov/frogquiz
and click the "Public Quiz" tab.

Frog Chorus Activity

Scientists studying rain forests, mountains, and wetlands have noticed an alarming decline in frog populations throughout the world. What would the night sound like without frogs? What effect would a decline in the frog population have on other animals? Many animals such as birds, fish, and snakes eat frogs. Frogs eat hundreds of insects, including mosquitoes. As frog populations decline, the web of life becomes unbalanced.

To help determine the size of a frog population, researchers go out during spring to listen to the frogs calling. Like birds, frog and toad species each have a distinctive mating call to attract females to breeding areas. (Refer to list of resources for the Frog Calls of Georgia CD from Georgia Department of Natural Resources.)

Procedures:

- 1 Divide students into groups
- 2 Assign each group a species of frog from the list below. If you are unable to supply them with an "instrument," they can vocally imitate various species by calling repeatedly.
- 3 Have each group practice their sound individually.
- 4 Conduct a frog chorus to combine sounds to simulate a pond at night.
- 5 What would the night sound like without frogs? What effect would a decline in the frog population have on other animals? How would you feel if frogs were extinct?
- 6 Critical thinking question: How can scientists determine the cause of the decline of frogs? More research projects need to be designed and implemented. Is acid rain in Georgia bringing pollutants into the water that is killing the frogs? Is there some sort of disease? Is this just a temporary natural decline?

Frog Calls Using "Instruments"

Green Frog	strum a rubber band
Bullfrog	blow across the rim of a soda bottle
Chorus Frog	run a finger over a comb's teeth
Spring Peeper	shake a package of small bells
Cricket Frog	tap two stones together

Frog Calls Using Vocals

Spring Peeper	peeeep, peeeep
Gray Tree Frog	barp, barp
Cricket Frog	click, click
Chorus Frog	cleek, cleek
Wood Frog	cluck, cluck
Bullfrog	jug-o'-rum, jug-o'-rum
American Toad	awwwwww, awwwww
Green Frog	boing, boing

Attracting Amphibians to Backyards



Frogs, toads and some salamanders can be easily attracted to backyard habitats by creating or improving adequate aquatic habitats, provided these aquatic habitats have some forested areas nearby.



Ponds made by digging shallow holes and lining with waterproof plastic are the easiest way to provide amphibians with the aquatic habitats they need for breeding and staying moist.



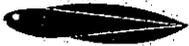
Few frog species such as bullfrogs, green frogs and Fowler's toads are able to survive well with fish present in shallow ponds. Most amphibian species including chorus frogs, treefrogs and most salamanders are unable to compete well with fish, with the exception of a few mosquitofish. Therefore, to attract a diversity of amphibians it is best to leave these ponds fishless.



Vegetation is also an important consideration when making or improving an aquatic habitat for amphibians. Aquatic plants like water lilies, *Sagittaria spp.*, bladderworts, sedges, rushes and others are important to provide structures for egg attachment as well as cover for larvae like tadpoles. You may wish to leave some "open" water so you can observe and enjoy your amphibians, but some vegetative cover is necessary elsewhere. In addition to aquatic plants, shrubs and other terrestrial vegetation is needed adjacent to some or all of the pond to provide cover and calling structures for treefrogs.



If there are wooded areas adjacent to or near the pond, it is important to leave logs, leaf litter, rocks and other cover to provide shelter for amphibians while they are away from the pond. Many amphibians spend more of their time on land than in water. Some amphibians only use aquatic habitats for brief breeding episodes.



Because the skin of amphibians is very porous and absorbent, pesticides should be used conservatively and prevented from entering the pond through runoff. Other than tadpoles (which eat algae and decaying vegetation), all amphibians eat insects and other invertebrates. Eliminating amphibians' prey could reduce or eliminate them indirectly. Successful attraction of a diversity of amphibians to your backyard will help control insect populations without the need for excessive pesticides.



Amphibians Likely to Use Backyard Habitats in Georgia

Species	Range in Georgia	Level of fish tolerance
American Toad	Northern half of state	Able to tolerate fish
Fowler's Toad	Throughout state	Able to tolerate fish
Southern Toad	Southern half of state	Able to tolerate fish
Cricket Frog	Statewide	Can only tolerate fish if there is abundant aquatic vegetation
Gray Treefrog	Statewide	Unable to tolerate fish
Green Treefrog	Southern two-thirds of state	Able to tolerate fish, though unlikely to breed in small pools
Squirrel Treefrog	Southern half of state	Unable to tolerate fish
Spring Peeper	Statewide	Unable to tolerate fish
Upland Chorus Frog	Northern two-thirds of state	Unable to tolerate fish
Southern Chorus Frog	Southern half of state	Unable to tolerate fish
Eastern Narrowmouth Toad	Statewide	Unable to tolerate fish
Bullfrog	Statewide	Able to tolerate fish
Green or Bronze Frog	Statewide	Able to tolerate fish
Southern Leopard Frog	Nearly statewide	Able to tolerate fish
Wood Frog	Northern third of state	Unable to tolerate fish
Spotted Salamander	Northern two-thirds of state	Unable to tolerate fish
Eastern Newt	Statewide	Can only tolerate fish if there is abundant aquatic vegetation

(For more information on how to construct shallow ponds in your backyard, contact the Georgia Wildlife Federation at (770) 787-7887 or www.gwf.org)

For more information, contact the Georgia Department of Natural Resources, Wildlife Resources Division, Nongame Wildlife/Natural Heritage Section, Nongame-Endangered Wildlife Program, 116 Rum Creek Drive, Forsyth, Georgia 31029
(478) 994-1438, www.georgiawildlife.com



Funding for this publication was provided by
The Environmental Resources Network, Inc. (T.E.R.N.),
Friends of the Nongame-Endangered Wildlife Program.

Must-Have Outdoor Teaching Kits

*Presented by Kim Bailey, EEinGeoriga.org
2010 Outdoor Classroom Symposium*

Make your own kit including these essential teaching tools and be ready to start teaching outdoors on Monday morning!

▪ Journal

Materials: blank paper, preprinted journal pages, or paper lunch bags; hole punch; cover such as cardboard, cardstock, etc.; fasteners such as twig and rubber band, string, ribbon, raffia, etc.

Directions: See

<http://handbookofnaturestudy.blogspot.com/2008/05/how-to-make-nature-journal.html> for how to make a journal bound together with a twig and rubber band plus over 50 “outdoor hour” activities to use with the journal, AND downloadable pre-printed journal pages!

See <http://scrapbooking.about.com/library/weekly/blpaperbagscrapbooks.htm> for directions on how to make a journal from paper lunch bags – hidden flaps and pockets for your treasures!



▪ First-aid Essentials

Materials: Latex, or other sterile gloves; cleansing towelettes to disinfect; antibiotic ointment to prevent infection; adhesive bandages in a variety of sizes; insect sting stick or wipes.

▪ Bug Box

Materials: clear plastic container with clear lid; string; permanent markers to decorate.

Directions: Poke holes in sides on container, attach string for handle and decorate as desired. Poke holes in container lid. Use to observe bugs and other critters in the outdoor classroom.

▪ Sit-upon



Materials: stack of newspapers; duct tape; permanent markers or paint pens; thick plastic bags, vinyl table cloth, tarp, or other waterproof material to make cover.

Directions: See

<http://basketmakers.org/topics/beginners/situpon2.htm> and http://www.makingfriends.com/scouts/scouts_girls_situpon.htm for many different ideas and ways to make sit-upons.

▪ Nature Bandanna

Materials: Plain bandana (available from a craft store) or make our own by tearing or cutting sheets or fabric into squares. Supplies for decorating – see ideas below.

Directions: Place flowers on bandana, cover with plastic wrap and use a hammer to pound “dye” out of the flower onto the bandana. Tye dye! Use acrylic or fabric paint to make leaf prints. Place leaves on a dark colored bandana and spray with bleach to make patterns (see directions at www.brightermindsmedia.com/parents/crafts/celebrate-fall-with-a-leaf-t-shirt.php) Use as a blindfold. Cover items collected from the outdoor classroom, uncover for 1 minute, cover again, then see how many of the items students can remember.

- **Plaster Track Casting Mini-Kit**

Materials: Plaster of Paris, small cup for water, paper clip, cardboard strip, zip-top plastic baggie

Directions: Using the small cup, place two cupfuls of Plaster of Paris in the baggie with the other materials, including the cup, and seal tight. Find a track (search near water sources.) Use the cardboard strip to build a wall around the track. Hold it in place with the paper clip. Be careful not to damage the track when you place this around it. Gently press the strip into the surrounding soil so the plaster will not run out from under it when poured. Measure a cupful of water (from stream or your water bottle), pour into the baggie of plaster, and mix well. Carefully pour the plaster in the mold letting it run into the track. After the plaster sets (about 30 minutes), pick it up by reaching underneath and lifting it. You may need to carefully dig out some of the mud or soil from beneath the cast before lifting. Allow it to dry for several days then hold it under running water to gently rub away any excess dirt.

- **Clipboard**

Materials: stiff cardboard, scrap wood, or foam core; rubber band or large binder clip

Directions: Cut cardboard or other material into a rectangle slightly larger than an 8.5 X 11” sheet of paper. Decorate if desired. Add a rubber band around the top or attach a larger binder clip to hold paper in place.

Also see these directions for making a field desk -

http://files.dnr.state.mn.us/education_safety/education/schoolforests/fieldDesk.pdf

- **Supplies for Outdoor Learning Activities**

Materials: pipe cleaners (3 of each color and at least 6 different colors); craft foam (one of each color and at least 6 different colors); nature magazines; construction paper or cardstock; 30 – 36’ length of rope; ball of string; glue stick; scissors.

Directions: Cut each pipe cleaner into four equal sections. Bend each section into a worm shape. Use pipe cleaner worms for the “*Birds and Worms*” learning activity (#25) available from the Project Learning Tree curriculum.

Cut the craft foam into about 1” squares. (A paper slicer works well for this too!) Cut rope into three 10’ or 12’ sections. Use the squares as food tokens for a number of activities found in the Project WILD curriculum guides and many other EE curricula. The ropes make good boundary markers. Ropes can also be used to play the Owls and the Crows game (a great outdoor review game for any subject area). See www.sharingnature.com/Awaken.html for directions.

Cut out photos of plants, animals, and fungi (don’t forget the fungi!) as well as nonliving parts of the environment – sun, soil, water, air, etc. Glue pictures on to squares of construction paper or cardstock. Laminate if at all possible! Use the cards to teach a variety of ecosystem activities such as “*Web of Life*” (#45) available from the Project Learning Tree curriculum (just add a ball of string). Here’s another activity that can be used to teach classification, questioning skills, etc: Who Am I? - Use masking tape or a clothes pin to attach a picture card to the back of each student. Students then ask each other questions to try figure out what is on their picture. The questions must be answered with a yes or a no. (Examples: Am I alive? Do I have a backbone? Do I fly?) Two students can take turns asking their own questions, or move on and ask questions of another student. Students will need to turn their backs to show the picture before asking a question. When a student figures out the picture, affix another picture on his/her back or allow him/her to assist others by answering questions.

OK, you’re set! Now all you need is an outdoor space and students (oh, and toss in some magnifying glasses too). Expand your kit as you learn additional outdoor learning activities.

Go on, get out there! There’s a reason it’s called the GREAT outdoors!

Creating the Perfect Home for Bluebirds

One of the easiest ways to assist bluebirds in your area is through the placement of nesting boxes. Bluebirds are not very finicky - they will nest in a wide variety of nesting boxes. The traditional 1 ½-inch entrance hole and sloping roof box is more widely used; however, studies have indicated that bluebirds often prefer the slot nesting box over traditionally-styled nesting structures. If you have had little success attracting bluebirds with traditional boxes, the slot box may work best for bluebirds in your area.



Construct boxes using untreated wood. Ideally, boards used in nest box construction should be ¾ inch thick. If smooth lumber is used in nest box construction, roughen the wood on the interior of the box just below the entrance hole. This makes it easier for young birds to climb out of the nesting box when ready to fledge. Assemble boxes using screws, aluminum nails or galvanized nails.

Entrance holes should be cut precisely 1 ½ inch in diameter. Larger holes permit European starlings to enter the box. These birds are exotic to the United States and will displace most cavity nesting birds during nesting season.

If you have a problem with flying squirrels increasing the size of the entrance holes to your boxes, install metal entrance hole shields around the 1 ½ inch hole. These shields can be obtained from stores specializing in bird-related items.

All boxes should be provided with drainage and vent spaces. Drainage holes can be created by cutting ¼ inch off each of the four corners of the bottom of the box, or by drilling four to five ¼-inch holes in the bottom panel. Drill holes at the top of the side panels or leave spaces between the top of the box and the sides to provide ventilation.

The outside of bluebird boxes should be painted a light color. Boxes painted light colors stay cooler than those painted dark colors.

Do not equip a bluebird nesting box with a perch. Bluebirds do not need perches; however, nest competitors such as house wrens and house sparrows will use perches to gain access to a box.

Measuring from the ground to the bottom of the box, mount your bluebird box at least four feet, but no more than 15 feet above the ground. Whenever possible, mount bluebird nesting boxes on poles made of metal or sunlight-resistant PVC pipes. Boxes placed on such structures are easier to protect from rat snakes, raccoons and other nest predators. A piece of ¾ inch electrical conduit makes an ideal nesting pole.

Boxes should be equipped with predator guards. One of the simplest ways to prevent predators from entering boxes is to smear automotive grease on the pole beneath the boxes. An alternative method is to place a sheet metal cone (36 inches in diameter) around the pole beneath the box.

If you must mount boxes on trees, leave at least a one-inch space between the nail or lag bolt and the box. This will allow the tree on which the box is mounted to grow without forcing the box off its trunk.

Boxes should be placed in open habitats with sparse trees and low vegetation. Many bluebirds' nest box efforts fail because boxes are erected directly in shrubby and forest conditions.

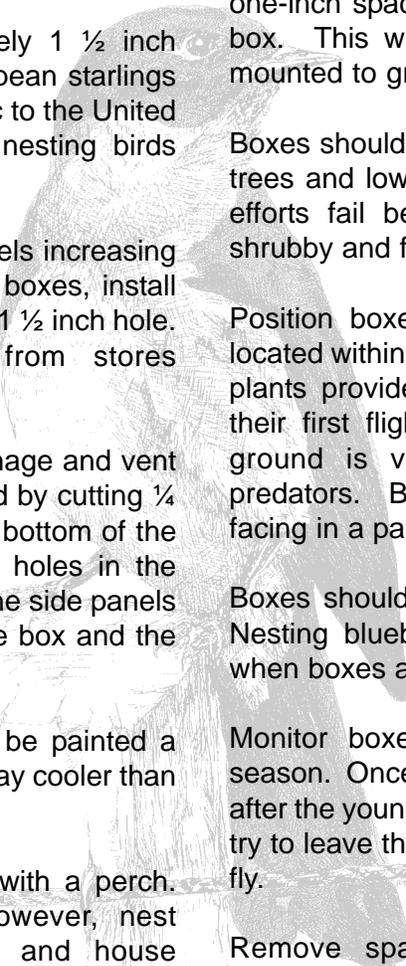
Position boxes so that they face a tree or shrub located within 25 to 100 feet of the box. These woody plants provide safe landing areas for fledglings on their first flight. A young bluebird landing on the ground is vulnerable to cats, dogs and other predators. Bluebirds do not seem to prefer boxes facing in a particular direction.

Boxes should be erected 100 yards or more apart. Nesting bluebirds will often fight with one another when boxes are placed close together.

Monitor boxes once a week during the nesting season. Once hatchlings appear, do not check boxes after the young are 12-14 days old as the young might try to leave their nesting box before they are ready to fly.

Remove sparrow nests as soon as they are discovered. While this procedure may have to be repeated several times, eventually the sparrows will nest elsewhere.

Do not take nesting boxes down in the winter season. Boxes make ideal roosting sites for bluebirds on cold winter nights.



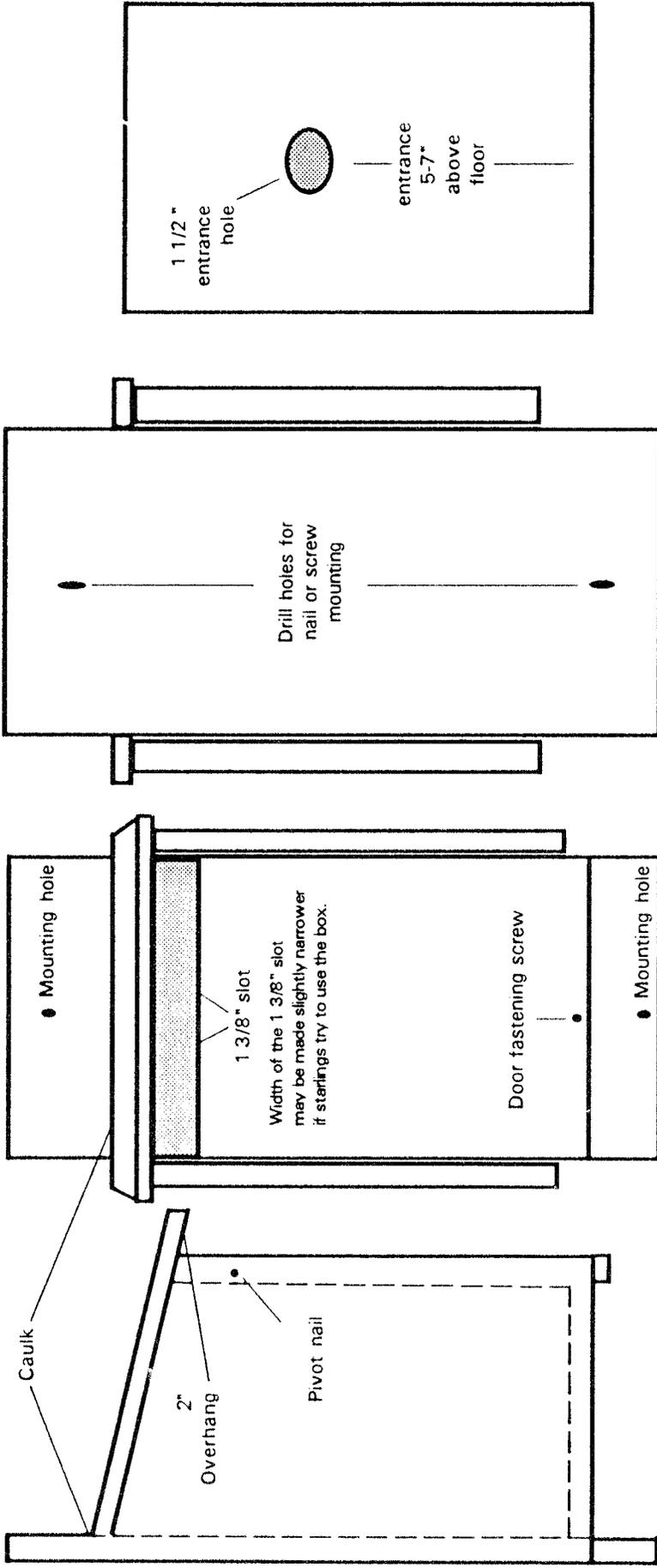
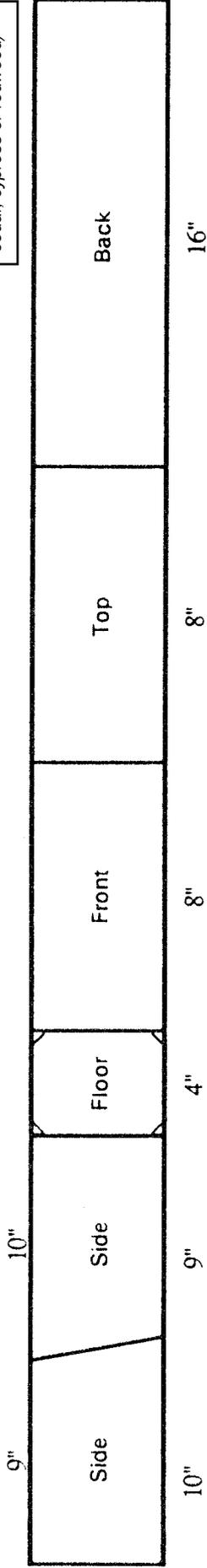
Bluebird Nesting Box Plans

Tools:

- Ruler
- Saw
- Hammer
- Drill and bits
- Screwdriver

Materials:

- 55" 1 X 6 lumber
- Galvanized 4d nails
- Adhesive caulk
- One 8 X 1 3/8" screw
- Light-colored paint
(Optional - not necessary with cedar, cypress or redwood)



Side View

Front View

Rear View

Alternate Front



For more information, contact the Georgia Department of Natural Resources, Wildlife Resources Division, Nongame Wildlife & Natural Heritage Section, 116 Rum Creek Drive, Forsyth, GA 31029, (478) 994-1438, www.georgiawildlife.com



This publication was funded by The Environmental Resources Network, Inc. (T.E.R.N.), the friends group for the Nongame Wildlife & Natural Heritage Section. www.TERNforwildlife.org



Bringing Wildlife Home

Nesting Boxes

Many species of birds require a natural cavity in a tree or branch where they can build their nest, lay eggs, and raise their young. Nesting boxes (or birdhouses) replicate these shelters for birds and create a safe and easy place for birds to live.



Nesting boxes come in many shapes and sizes to accommodate different varieties of birds.

Here are some helpful tips to guide you through the process of buying or building, installing, and maintaining your own nesting box. You can purchase nesting boxes at home improvement or birding specialty stores, through catalogs or via the internet.

- Install your birdhouse before the nesting season begins. Mid to late winter (late February) is best for most geographic areas.
- Each species of bird has different nesting box requirements. Visit the Cornell Lab of Ornithology’s Birdhouse Network at birds.cornell.edu/birdhouse/bhbasics/refrchart.html to get nest box plans for a variety of species.
- Boxes built of untreated wood are best.
- Your box should not have a perch. Perches are unnecessary and allow invaders such as house sparrows access to the box. House sparrows are known to sit on a nesting box perch and peck at other birds using the nesting box.
- You can score the inside walls of the box with a knife or nail, which will help baby birds in reaching the exit hole when they are ready to leave the nest.
- The box should have drainage holes in the bottom, ventilation holes toward the top (but not in the roof, or water will leak in), and a hinged side to allow easy access for cleaning and monitoring the birdhouse.

Nesting boxes or birdhouses replicate natural bird shelters such as cavities in trees or branches.



Nesting Boxes

- Hang your box from a pole with a predator guard. Nailing boxes in trees allows predators easier access and can harm the tree. There are different kinds of predator guards designed for different predators. For more information, visit www.birds.cornell.edu/birdhouse/resources/construct.
- Don't use insecticides and other pesticides on the nesting box. Birds rely on insects to feed their young and chemicals are harmful to the birds.
- You should monitor the nesting box on a regular basis. During the nesting season, beginning in March, examine the box every two weeks to see if it is being used. You can remove any nests that are no longer being used and check for any nuisance species. Clean the nesting box in September or October. The box should remain clean until the following spring.
- If you find a naked or down-covered baby bird without feathers it should be returned to the nest. Birds have a poor sense of smell and the parents will not reject the baby if you touch it.
- A baby bird with fully formed feathers that is out of the nest is called a fledgling and should be left alone. Fledglings often hop out of the nest before they've mastered flying and spend a few days on the ground while their parents continue to feed them.
- Keep your cat indoors. Domestic cats kill millions of birds every year.
- Try to identify invasive exotic birds, which may out-compete and even kill native birds. Remove their nests from your nesting box if you discover them. For more about undesirable birds visit www.birds.cornell.edu/AllAboutBirds/attracting/feeding/pests_birds.
- Participate in the Cornell Lab of Ornithology's NestWatch, a citizen science project gathering information about all of North America's nesting birds. For more information visit watch.birds.cornell.edu/nest/.



Visit www.nwf.org/gardenforwildlife for more information.

Photo Credits

Front: Gulf Fritillary, H. Cheek; Indian Paintbrush, iStockphoto.com; Rufous Hummingbird, iStockphoto.com/NaturesDisplay
Bullfrog, iStockphoto.com/Steve VanHorn; Tree, iStockphoto.com/Christine Balderas; Chipmunk, iStockphoto.com/
Jill Lang; Nesting box, Kim Winter.

Back: Bluebird, Corel

Steps for Building a Bluebird Nest Box

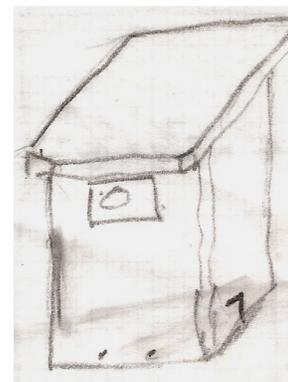
by Bill Baker (Charlie Elliott Wildlife Center Volunteer)

Materials List ~ 1 6"x9/16"x6' cedar fence board, cut into sections as follows:

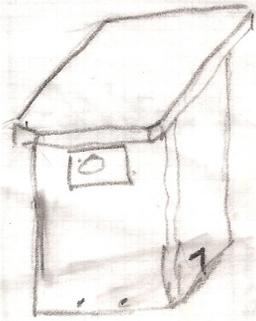
1 6"x6³/₈" section (top), 1 4"x4" section with each corner cut off 3/8" from the outside (bottom), 1 5¹/₈"x8" section with a 1¹/₂" hole drilled in the middle about 1" from the top (front), 1 plain 5¹/₈"x8" section (back), 1 4"x7³/₄" section with a 1/4"x1/4" notch cut out of the middle of the bottom side (left panel), and 1 plain 4"x7³/₄" section (right panel). Orient the wood grain vertically on each section.

Hammer, 14 1¹/₂"-long 4d galvanized finishing nails, 4 1/2"-long #6 carpet tacks, 1 10-gauge 1³/₄" square-bend screw hook (to keep side door closed), 1 2¹/₂"x2¹/₂" 32-gauge aluminum flashing with a 1¹/₂" hole cut out in the center (to prevent squirrels chewing on entry hole), and a small piece of sandpaper to smooth out the flashing around the entry hole if needed

1. Attach the aluminum flashing squirrel guard to the front section (around the 1¹/₂" entry hole), using the 4 carpet tacks. Use sandpaper to smooth the inside of hole if needed (to prevent birds from cutting themselves when entering & exiting).
2. Line up the right side panel (without the notch) to the front section, keeping it flush at the bottom. Hammer in 2 finishing nails.
3. Line up the back panel with the right side panel, and hammer in 2 finishing nails.
4. Take the 4x4" bottom panel, and screw the square-bend hook into the pre-drilled hole on the edge.
5. Slide the bottom section into place between the front and back, butting the right panel. Drive 2 nails into the bottom through both the front and the back sections, using the marked holes.
6. Put the left panel (with the notch at bottom) in place with the square-bend hook through the notch and with edges against the front and back. Drive 1 pivot nail through the top of both the front and back sections (so that the left side opens).
7. Put the top piece in place with its back edge flush with the back panel and equally-spaced, overlapping the sides. Drive 4 nails through the pre-drilled holes (2 on each side).

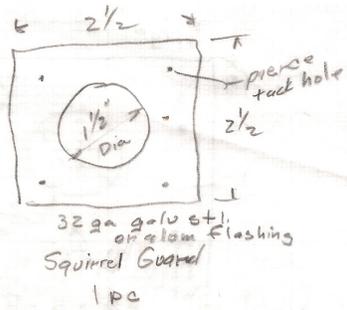
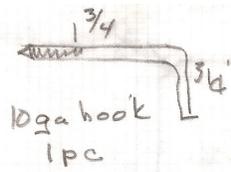


VOILA!
YOU HAVE A BLUEBIRD NEST BOX!

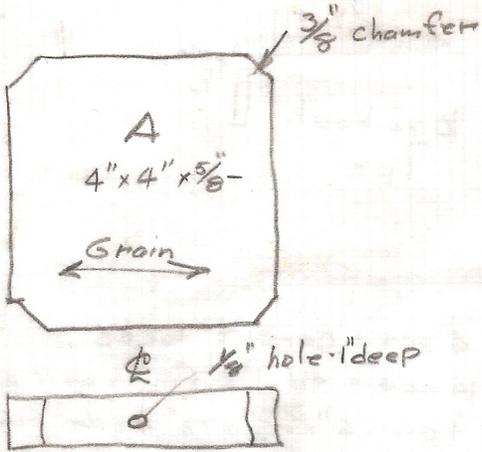


Notes:
 $\frac{3}{32}$ " nail holes

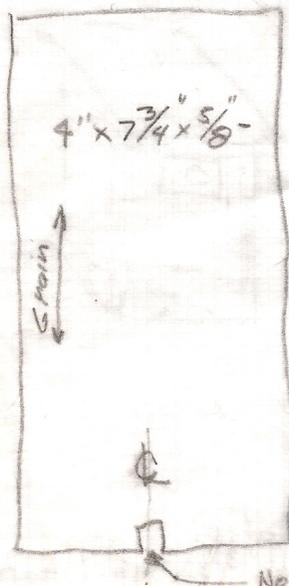
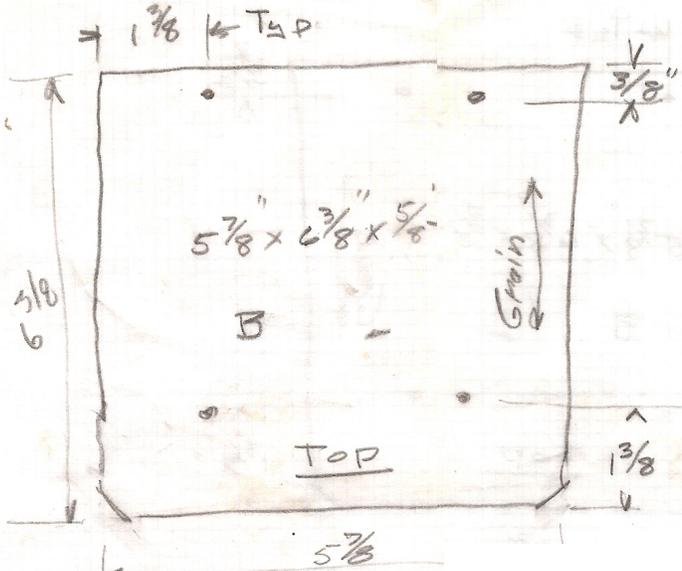
BLUE BIRD HOUSE
 4/9/00



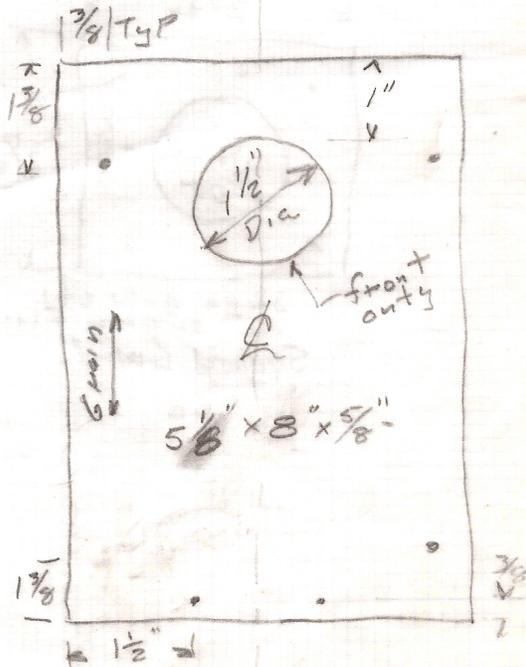
- 4 pcs - carpet tacks
- 14 pcs - 4d - 1 1/2" finish nail galv
- 1 pc - 6" x 3/16" x 72" cedar fence slat



Bottom 1pc



Notch, $\frac{1}{4} \times \frac{1}{4}$ " one side
 Side 2 pcs
 D



Front + Back
 1pc each
 C