

### Gopher Frog (*Rana* [*Lithobates*] *capito*)

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#### Introduction

The gopher frog (Figure 1) is a medium-sized terrestrial frog that inhabits the southeastern United States Coastal Plain. It is a very secretive species spending the majority of its life underground, emerging only to reproduce. Reproduction takes place in ephemeral wetlands in the fall and winter. The mating call of a gopher frog resembles the sound of a deep, nasally snore. As the name suggests, this frog is associated closely with the burrows of the gopher tortoise. The natural history of this species, destruction or conversion of habitat, and altered precipitation patterns possibly due to climate change have caused populations to drop to dangerously low levels prompting major research and investigation to determine whether or not federal protection as a threatened or endangered species is warranted.



**Figure 1.** Gopher Frog Adult

**Picture Credit:** <http://srelherp.uga.edu/anurans/rancap.htm>

#### Taxonomy

Order: Anuran

Family: Ranidae

Genus: *Rana* (*Lithobates*)

Species: *capito*

Taxonomically, the gopher frog was originally placed in the Order Anura which distinguishes frogs and toads from salamanders. The Ranidae family is known as the “true frogs”. Members have the generalized shape and body form of a frog. This family is very widespread globally containing approximately 630 species and 47 genera. Members are found on every continent except Antarctica. Individuals of this family vary greatly in size and habitat ranging from the African Goliath frog which inhabits hot climate river systems and can reach 12 inches long to the wood frog which is the only species of frog capable of living within the Arctic Circle reaching a maximum length of 2.5 inches. This family is distinguished from the Hylidae family (tree frogs) by the dorso-lateral ridges, webbed feet, and absence of toe pads. Tadpoles of this family also have eyes which are closer to the top of the head than Hylidae tadpoles (Figure 2). Nine members of the Ranidae family are found in Georgia.

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The gopher frog was originally thought to be the same species as the crawfish frog (*Rana areolata*). Recent authors have challenged the claim that lumped the gopher frog with the crawfish frog on the basis of biogeographical information. After further analysis, the gopher frog was recognized as distinct from the crawfish frog. In 2001, genetic data showed that the population of gopher frogs in Mississippi was distinctly different from the rest of the population leading to the separate designation of the Mississippi gopher frog (*R. c. sevosa*). In 2012, the US Fish and Wildlife Service published the final rule for critical habitat designation and recognized the name change from Mississippi gopher frog to the current dusky gopher frog (*R. sevosa*). Historically, there were two subspecies of gopher frogs: Carolina gopher frog (*R. c. capito*) and Florida gopher frog (*R. c. aesopus*). Recent data shows, however, that this claim is invalid and there is simply the gopher frog. The North American species in the family Ranidae have recently been proposed to be moved to the genus *Lithobates* which would change the name of the gopher frog once again.



**Figure 2.** Gopher Frog tadpole.

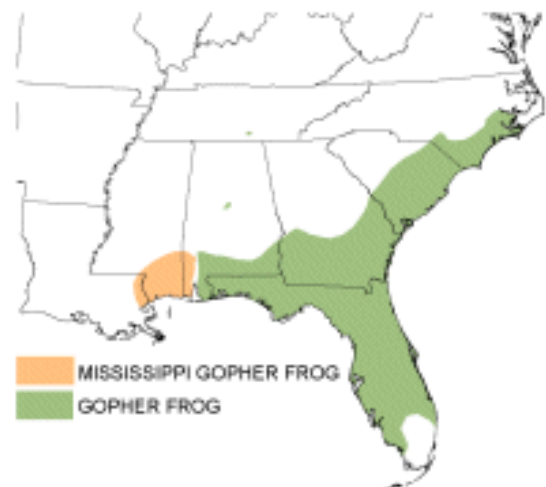
**Picture credit:** <http://www.arkive.org/gopher-frog/lithobates-capito/image-G103942.html>

## Description

The gopher frog is an average sized frog reaching lengths ranging from 2.5 to 4.5 inches. This species has shorter hind legs and a larger head than others in this family, giving it a peculiar squatting shape. It has many warts covering the skin surface coming together on both sides of the back to give the shape of a dorso-lateral ridge. The coloration and patterning of the gopher frog is a light brown to gray background coloration with dark brown to black irregular spots covering the legs, back, sides, and head. The dorso-lateral ridges are often tinted a slight brassy or yellow color. The belly is a cream color with some dark mottling and the underside of the hind limbs are usually washed with yellow. Males of the species have longer thumbs to aid in amplexus (grasping the female) when mating. Tadpoles are distinguished by an olive green color and fading irregular spots on the top side of the body and tail.

## Distribution

The gopher frog may be found throughout the southeastern Coastal Plain from Southern Alabama, to the tip of Florida, and into the middle portion of North Carolina. In Georgia, the gopher frog is found south of the Fall line where it inhabits very specific types of habitat. The longleaf pine-wiregrass ecosystem as well as the longleaf pine-turkey oak sand hill ecosystem are the major habitat types. As it is a more fossorial species it can only range into habitats that present suitable substrate for animals other than the gopher frog to excavate burrows. County records document gopher frog occurrence as far north as Richmond County and all the way down to Charlton County and into the panhandle of Florida. The range of the gopher frog extends throughout the state of Florida but excludes the Everglades in the southern part of the state.



**Figure 3.** Range of Gopher Frog

**Picture Credit:** <http://www.conservationsoutheast.com/infogf.htm>

## Conservation Status

The gopher frog has been listed as a “rare” species in the state of Georgia and is under review for listing under the Endangered Species Act. However, a western subspecies, the Mississippi gopher frog, is a federally listed endangered species due to population decline and limited habitat. This frog was historically known from nine counties of Mississippi, but has been reduced to a single site in Harrison County. The loss of the population has been attributed to several natural and human-induced factors. These same factors are the driving forces to the decline of Georgia populations as well. Factors include: loss of habitat due to destruction or conversion into agricultural land, development of land adjoining the breeding grounds of the frogs, climate change, and natural history of the frogs themselves.

These frogs breed in ephemeral wetlands which fill and dry up every year. They are triggered by heavy, warm rains to come out of hiding and breed immediately so that the eggs and tadpoles have ample time to metamorphose before the water dries up. However, with rain being less frequent in recent years and later in the season, reproductive output of populations has declined drastically. These frogs also have a tendency to have low survival rates even in good years. This low output coupled with the loss of breeding grounds has driven the gopher frog to drastic declines in numbers.

## Form and Function

The body shape and the patterning can lead to confusion between the gopher frog and other frogs. The southern leopard frog (*Lithobates sphenoccephalous*) is one of these species. Like the gopher frog, it has an olive background color with black spots and can even have the brassy or golden dorso-lateral ridges; however, it has smooth skin, a more slender body shape, and a pointed snout. The Fowlers toad (*Bufo fowleri*) can also be confused for the gopher frog, as it has a similar body shape and warty skin. It differs in the fact that it has paratoid glands behind the eyes and a grayish-tan body color.

## Reproduction

Gopher frogs are primarily a fossorial species but will emerge in the fall and winter with the arrival of heavy rains. These heavy rains will fill depressions and swampy areas creating ephemeral wetlands. Here the gopher frog will breed along with many other species of frogs, toads, and salamanders. Ephemeral wetlands provide a safe location for the eggs and the larvae since there are no major aquatic predators such as fish. However, with this luxury comes a fatal risk. If the water in the wetlands dry up before the tadpoles metamorphose, then the entire breeding season output will die. Regardless of the risk, gopher frogs will migrate to local ephemeral ponds in mass numbers. The males have a mating call that is similar to a low snore or growl in an attempt to impress a mate. They call from shallow water, usually among emergent vegetation.

When a female is attracted to a particular male, the male will attach himself to her back in a position known as amplexus. The female will then release a cluster of up to 2000 eggs and the males will fertilize them. The eggs are attached to the emergent vegetation. The male and female will then spilt and go off in search of another mate. Females may or may not lay multiple clutches. The males will usually stay around the pond longer than the female since he does not spend much energy making sperm. The eggs will hatch in about a week and the tadpoles will emerge to fend for themselves. The larval period for the gopher frogs in Georgia is reported to be around 155 days. Juveniles will metamorphose and emerge from the pond around May or June.

## Habits

Gopher frogs are very secretive animals that spend most of their life in underground burrows or refugia. These refugia are often burned out pine stumps. It has even been shown that they will wear a small spot into the ground from sitting in the same place over and over again near the entrance to an underground burrow. They can be aggressive sit-and-wait predators, eating any invertebrate small enough to fit in their mouth as well as other anurans. This is most likely due to the very small size of toads at metamorphosis making them easy prey. When threatened or handled, the gopher frog will assume a defensive posture of placing the fore limbs over the head and eyes. It is unknown why this posture is used, but it could be to try and blend with the background more by breaking up the natural shape of a frog.

## Habitat

Gopher frogs are found in the southeastern Coastal Plain, inhabiting particularly the longleaf pine-wiregrass ecosystem. These ecosystems contain the most vital component to the survival of the gopher frog: burrows. They will inhabit many kinds of underground burrows such as stump holes, crawfish burrows, pocket gopher homes, or other mammal holes; but, the most common home by far is the burrow of the gopher tortoise (*Gopherus polyphemus*).

These burrows are the reason why the gopher tortoise is considered a keystone species. There are over 350 reported species that will use these burrows, but the gopher frog is one of the most frequent tenants. The burrows provide safe shelter from the heat of ground fires and protection against bird or mammal predators that are unlikely to venture down the hole. Burrows can also be up to 6-8-feet deep and approximately 20 feet long which make it difficult for a passing snake to detect a frog at the bottom. The burrows also provide an almost constant temperature and humidity year-round which is necessary for the frog since it has semi-permeable skin and water is lost quickly. Many species of insects will also use the burrow or hang out around the mouth to provide quick escape from predation. This allows ample food for the frog when it emerges at night to feed near the burrow mouth.



**Figure 4.** *C. constrictor*-Black Racer is a predator of the Gopher Frog

**Picture Credit:**

[http://www.wildlife.state.nh.us/Wildlife/Nongame/snakes/profile\\_black\\_racer.htm](http://www.wildlife.state.nh.us/Wildlife/Nongame/snakes/profile_black_racer.htm)

Fire is an essential element to maintaining the habitat of the gopher frog. In this ecosystem frequent, low intensity fires are a natural rhythm of life. Fire eliminates woody plants which allows for an open canopy and promotes herbaceous vegetation, notably grasses which are also preferred conditions for gopher tortoises. An abundance of gopher tortoise burrows may have a positive effect on gopher frog populations. Fire also helps to maintain the structural integrity surrounding the edge of ephemeral ponds by burning off peat and encroaching vegetation. This allows for an open pond edge and greater breeding habitat for the frogs.



## Threats

Their small size and relatively slow speed makes the gopher frog food for a variety of predators. These include: black racers (*Coluber constrictor*), Eastern indigo snake (*Drymarchon couperi*), Eastern hognose snake (*Heterodon platyrhinos*), coachwhips (*Masticophis flagellum*), banded watersnakes (*Nerodia fasciata*), brown watersnakes (*N. taxispilota*), Florida softshell turtles (*Apolone ferox*), and Eastern mud turtles (*Kinosternon subrubrum*). The eggs are often predated upon by Eastern newts (*Notophthalmous viridescens*), striped newts (*No. perstriatus*), tiger salamanders (*Ambystoma tigrinum*), and aquatic insects.



**Figure 5.** *N. perstriatus*- Striped Newt- predator of Gopher Frog larvae

**Picture Credit:** <http://www.fws.gov/southeast/news/2010/r10-022.html>

Human threats impact the gopher frog most severely. Draining or filling of wetlands for agricultural use is a common practice in the coastal plain region. This absolutely decimates the population numbers by eliminating breeding areas and killing any larval frogs that resided there. Some wetland areas are also stocked with fish for recreational purposes and these will eliminate any tadpoles or eggs in the wetland. As long as fish can live there, no frogs will be successfully metamorphosed from that site. Development of the upland habitat into residential or agricultural areas reduces the habitat area and the population numbers. This also leads to fragmentation of the habitat which impacts the survival of adults and juveniles alike by adding barriers such as roads or buildings. Fire suppression also poses a threat to the population because it allows the growth of plant species that may shade out the growth of native plants. This canopy closure also leads to a reduction in the ephemeral ponds where these frogs breed. Other habitat threats include conversion to dense pine plantations, bedding pine plantations, changes in pond hydrology, and reduction in the longleaf pine - wiregrass ecosystem.

## Populations

The populations of the gopher frog seem to be declining steadily. Adult frogs will not stray far from the burrow in which they reside except to breed. This fossorial nature makes the population hard to assess. A recent study in Florida has however revealed some data on the survivability of gopher frogs. It was found that only 9.4% of newly metamorphosed frogs survive the first month in the terrestrial habitat. Predation pressure around the ponds attributed to the highest death rates with vehicular deaths following behind. It was shown however that the frogs that make it to a refugia site have a mortality rate that is a mere 4% of what the mortality rate is outside the refugia. Survival can be high if the appropriate terrestrial conditions are provided.

Another study on Dusky Gopher frogs in Mississippi, shown a higher annual survival rate of adult frogs (65- 92%) with a very low rate of adults that manage to return to breeding ponds (16-22%). These two studies show that the population of gopher frogs has a very low recruitment of juveniles due to death and the percentage of adults that return to the ponds to breed is low as well. These two factors have impacted the population numbers as a whole. Data on the sex ratio of populations is not available due to the difficulty of sampling and sexing.

## **Disease**

There are two diseases that are spreading throughout the world and affecting amphibian species in the United States as well: Frog Virus-3 and Chytrid Fungus (*Batrachochytrium dendrobatidis*). Frog Virus-3 is a strain belonging to the *Ranavirus* genus and specifically affects amphibians. It is also known as the “Red-legged disease” as infected individuals who die will have swollen red hind limbs due to severe hemorrhaging. The severity of the impact also depends on the life stage of the frog. The larval (tadpole) stage is the most susceptible; which is a major concern because the main method of spread is by contact through the water. On the other hand, the egg stage is the least susceptible to the disease which is why several institutions have started captive rearing of Gopher frog eggs and releasing juveniles. This pathogen has caused amphibian die-offs on five continents, and most greatly impacting Europe and North America. Out of the tested species in North America, the Gopher frog and the Wood Frog (*Lithobates sylvatica*) were the most susceptible to the disease. Other species such as the Bullfrog (*Lithobates catesbiana*) have been shown to be carriers of the disease which can pose a major problem controlling the spread of the virus. Biologists are constantly monitoring the remaining populations of Gopher frogs and watching for signs of the virus, such as red blotches on the legs or underside of tadpoles.

Chytrid is a fungal infection that will get in the cells of the outer skin layers and cause it to become very thick which is a big problem for amphibians who draw in water and salts through their skin. Chytrid is also spread by contact with infected animals or through objects that have come in contact with infected water. People will often spread the disease by not cleansing their field equipment between locations. Chytrid has killed off 10 amphibian species along the eastern seaboard, midwest and Pacific states. With the rapid spread of the infection, it is believed that this has a role in the population declines of both the gopher frog and flatwoods salamander here in the Southeast. When combined with the Ranavirus, infected sites suffer more than 90% mortality rates. Chytrid has been detected in gopher frogs but has not caused a severe die-off of entire populations. As with the Frog Virus-3, biologists are constantly monitoring for the spread and presence of Chytrid to try and avoid a population die-off and possible species extirpation/extinction.

## **Economic Value**

There is no known economic value associated with this species.

## **Medicinal Value**

There is no known medicinal value of the Gopher Frog.

## **Damage**

This species causes no damage to the environment in which they live. They also cannot live outside very specific habitat and therefore pose no threat of becoming invasive in other locations.

## **Legal Aspects**

The Gopher frog is listed in the state of Georgia as a rare species. Conservation efforts to restore the populations of this frog are ongoing in every state in their range. The main focus of these projects is

to restore the natural habitat of the longleaf pine-wiregrass system. Gopher frogs are not listed under the Endangered Species Act. They are ranked as G3 by NaturServe, which means that they are globally vulnerable. The International Union for Conservation of Nature (IUCN) ranks the species as “near threatened”.

## Management to Enhance

Gopher frog habitat is drastically declining and is a mere fraction of the historical range. This habitat is home to other species, such as the Eastern indigo snake, that are federally endangered. Major efforts are being undertaken to restore and conserve what is left of this ecosystem and protect endangered species. This also aids the gopher frog.

As a land owner efforts should be made to preserve as much natural habitat as possible, especially the wetland areas. This entails the use of prescribed fires to maintain the natural habitat and vegetation. If development has to be made to the habitat, be sure to ensure a large buffer area around wetland areas, since the frogs will travel up to a mile away from breeding sites. Be sure not to stock fish into the wetland areas. If you have a breeding population of gopher frogs on your property, it is best to monitor them from year to year. This may be as simple as getting in touch with the Department of Natural Resources and letting them monitor for you. The more natural habitat that can be conserved the better the chances of this species survival.

Some zoos, such as the Henry Doorly Zoo in Omaha and the Memphis Zoo, have been conducting captive breeding projects for reintroduction of frogs to restored habitat. Although the frogs prove difficult to breed successfully, *in vitro* fertilization has proven effective for the Mississippi (or dusky) gopher frog (*Rana sevosia*). This success will be the groundwork in the future if gopher frog populations in Georgia are reduced to critical levels.

## Human Uses

There are no known human uses of this species.

## Further Informational Sources

2001 Federal Register, 66 FR 62993; Centralized Library: U.S. Fish & Wildlife Service. 2001 Federal Register, 66 FR 62993; Centralized Library: U.S. Fish & Wildlife Service. 26 Nov. 2001. <http://www.fws.gov/policy/library/2001/01fr62993.html> Accessed 31 May 2012.

Amphibian Ark. Keeping Threatened Amphibian Species Afloat. Chytrid Fungus - Amphibian Ark. <http://www.amphibianark.org/the-crisis/chytrid-fungus/>. Accessed 31 May 2012

Florida Natural Areas Inventory. 2012. Gopher Frog. [http://www.fnai.org/FieldGuide/pdf/Rana\\_capito.PDF](http://www.fnai.org/FieldGuide/pdf/Rana_capito.PDF). Accessed 31 May 2012.

Green, D. E., K. A. Converse, and A. K. Schrader. Epizootiology of Sixty-Four Amphibian Morbidity and Mortality Events in the USA, 1996-2001. *Annals of the New York Academy of Sciences* 969.1 (2002): 323-39. Print.

Jensen, J. B., C. D. Camp, W. Gibbons, and M. J. Elliott. *Amphibians and Reptiles of Georgia*. Athens: University of Georgia, 2008.

- McLean, R. "Amphibian Diseases." *USGS*. N.p., Apr. 2001. Web. 13 Sept. 2012.  
<[http://www.nwhc.usgs.gov/publications/fact\\_sheets/pdfs/fact\\_amphdis.pdf](http://www.nwhc.usgs.gov/publications/fact_sheets/pdfs/fact_amphdis.pdf)>.
- Miller, D., M. Grey, and A. Storfer. Ecopathology of Ranaviruses Infecting Amphibians. *Viruses* 3 (2011): 2351-373. Accessed 13 Sept. 2012. <<http://www.mdpi.com/1999-4915/3/11/2351>>.
- Palis, J. G., and R. A. Fischer. 1997. Species profile: Gopher frog (*Rana capito*) on military installations in the southeastern United States. Technical Report SERDP-97-5, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS. <http://el.erdc.usace.army.mil/tes/pdfs/serdp97-5.pdf>
- Richter, S. C., and R. A. Siegel. 2002. Annual variation in the population ecology of the endangered gopher frog, *Rana sevosia* Goin and Netting. *Copeia* 202(4): 962-972. *American Society of Ichthyologists and Herpetologists*. Web. 13 Sept. 2012.  
<http://www.asihcopeiaonline.org/doi/abs/10.1643/0045-8511%282002%29002%5B0962%3AAVITPE%5D2.0.CO%3B2>.
- Roznik, E. A., and S. A. Johnson. 2009. Gopher frogs, burrows, and fire: Interactions in the Longleaf Pine Ecosystem. EDIS. University of Florida IFAS Extension, <http://edis.ifas.ufl.edu/uw295>. February 2009.
- Roznik, E. A. "2007. Terrestrial ecology of juvenile and adult gopher frogs (*Rana capito*). Thesis. University of Florida, 2007. Web Access. 13 Sept. 2012. [http://ufwildlife.ifas.ufl.edu/pdfs/Roznik\\_thesis.pdf](http://ufwildlife.ifas.ufl.edu/pdfs/Roznik_thesis.pdf).

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