

## Glass Frog Care and Information

**Everything you want to know about the glass frog.**

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Glass Frog by Bill Love. The family Centrolenidae refers to a group of small nocturnal and arboreal frogs that live along streams and moving water in the humid forests of the tropical Americas. There are currently more than a hundred species, and they are distributed from southern Mexico, through Central America, to South America, as far south as parts of northern Argentina, Paraguay and Bolivia.

With the recent increase of exploration in the forests of neotropical America, many species have only been described in the last 40 years. Glass frogs are difficult to find and collect, due not only to their small size and color, but also because of the extreme areas they sometimes inhabit. Glass frogs are often found along streams that are nearly impossible to walk along, let alone collect specimens. With new areas constantly being explored in tropical America, more species are sure to be discovered and described.

Glass frogs get their name from the semitransparent nature of their skin, and, in some species, the transparent ventral surface. Most of the specimens from this family are light green with small spots ranging from yellow, white, black and blue. The frogs typically range in size from 20 to 30 millimeters, but some species, like *Centrolene geckoideum* from the Pacific Andean slopes of Colombia and Ecuador, reach larger sizes.

### Centrolenidae Family and Genera

The Centrolenidae family of glass frogs was once composed of just two genera: *Centrolenella* (Noble, 1920) and *Centrolene* (Jimenez de la Espada, 1872). All of the smaller species were placed in the genus *Centrolenella*, and the one large species, *geckoideum* (Jimenez de la Espada, 1872), was placed in the genus *Centrolene*. Due to the recent work of Ruiz-Carranza and Lynch in 1991, the family has since been reclassified with respects to the genera. There are now three separate genera recognized in the family: *Hyalinobatrachium*, *Cochranella* and *Centrolene*.

The genus *Hyalinobatrachium* (Ruiz-Carrana and Lynch, 1991) contains the species that have white bones and a transparent parietal peritoneum (ventral surface) in live specimens. The transparent ventral surface allows one to view the viscera (internal organs), such as the heart, intestines and liver. Most of the species in this genus have a white visceral lining covering most of the digestive organs. This is in addition to the presence of a small bulb-shaped liver, which is different than the three-lobed liver that is present in many species of the other two genera. The name *Hyalinobatrachium* comes from Greek and means "glassy little frog."

The genus *Cochranella* (Ruiz-Carrana and Lynch, 1991) contains the species that, in life, have visible green bones, which are most noticeable in such areas as the arms and legs. Upon introduction to preservative, the green coloration in their bones typically fades after only a short time. The specimens from this genus also have a partially white-covered parietal peritoneum, which only allows for the viewing of the viscera in the lower abdominal area. The partial white parietal peritoneum looks like a white vest covering the upper area of the ventral surface. The specimens from this group have a colorless viscera and colorless walls of most the digestive organs.

The genus *Centrolene* (Jimenez de la Espada, 1872) refers to animals similar to those species from the genus *Cochranella*. Both genera have green bones in live specimens and a partial white parietal peritoneum, but the specimens from the genus *Centrolene* are set apart due to the presence of a humeral hook along the anterior surface of the humeral bone on the upper arm. This humeral hook is present on all male specimens, and a few females also have this structure. It is believed that this hook serves a purpose in breeding activities or in combat between territorial males.

### Habitat and Behavior

Glass frogs are nocturnal, arboreal and riparian (living along streams). Centrolenid specimens can most commonly be found, while active, in the night among the vegetation of many forest streams and moving water bodies in neotropical America. Glass frogs occupy a large range of altitudes, from sea level to near 3,800 meters (McDiarmid, 1983). During daytime, the species are typically sleeping in the vegetation and terrestrial substrate near streams, and are difficult to locate.

One species can be found guarding its egg masses even in the daylight hours. The reticulated glass frog, *Hyalinobatrachium valerioi* (Dunn, 1931), from central Costa Rica to Ecuador, is unusual because the male specimens will guard their eggs in the daytime. *Hyalinobatrachium valerioi* males will guard egg masses all day, apparently protecting the eggs from predatory insects and dehydration. The males of *H. valerioi* will often be found sleeping next to, or actually touching, the egg masses on the underside of the leaves during daylight hours (pers. obs. 1998, 1999). Other species of glass frogs show egg-attendance behaviors, but usually only for a couple hours following oviposition. The adults retreat to their sleeping sites during the light of day and only sometimes return to attend their eggs the following evening. In a study done in 1982 by Susan K. Jacobson, it was noted that males of *Hyalinobatrachium fleischmanni* (Boettger, 1893) often attend eggs on subsequent nights later in the evening hours, 71 percent of the observed instances happening after midnight (Jacobson, 1985). The probable advantage in waiting until later in the evening to attend eggs, when there are less females ready to breed, is that it decreases lost breeding opportunities for these males.

In 1998, while lowering a leaf to make a closer observation of male *H. valerioi* specimens on the underside of a banana leaf, I witnessed one male take a position that spread himself directly over one of his egg masses, apparently in a defensive manner. Male glass frogs can be found calling from leaves overhanging, or near, the stream's surfaces on most humid nights during the rainy season. One cloud forest species of glass frog, *Centrolene buckleyi* (Boulenger, 1882), is reported to use bromeliads to hide its eggs (Cannatella, 1997). Glass frogs have also been witnessed calling from vegetation above, or near, dried-up stream beds, apparently waiting for approaching rains to bring the water that is needed for the survival and development of the larvae.

Little is known about the females' non-breeding activities, but they are presumably present among the vegetation bordering the forest's streams during the night hours. In the absence of amplexus, the females have proven much harder to locate than the calling males. One method of identifying females in many species is the presence of eggs that are visible through the transparent dermal layer of the lower abdomen. Another female identification method in most specimens of the genus *Centrolene* is the absence of the humeral hook.

The feeding behavior of glass frogs typically takes place while they are active during the evening hours, but glass frogs may also be active and feeding during rain showers in the daylight hours as well. One phenomenon I have noticed in my field work with glass frogs is the tendency for individuals to be found further up the banks of the streams, in the lower vegetation, from the late hours of dusk to the early evening (1730 hours to 1900 hours). I feel this may be a "feeding period" for these frogs, during which they acquire nutritional support for their ritual evening breeding activities. In this lower thick vegetation, there are typically abundant supplies of small arthropods, and I have witnessed glass frog individuals feeding upon these abundant arthropod populations (pers. obs., 1998, 1999). More investigation of the frogs in regards to this idea of a feeding period need to be done in order to generate some stable data. Glass frogs typically feed on a variety of smaller arthropods that are present among the vegetation along the stream's banks.

#### Reproductive Behavior

The reproductive behavior of glass frog species is greatly dependent on the rainy season in most areas, except those that lack a defined dry season, and the species typically reproduce throughout the year. On most humid nights, especially after a rainstorm or even during a light shower, the male centrolenids can be heard making their mating calls along the stream's vegetation. One study done in 1982 by Mark Hayes, found that specimens of *H. fleischmanni* show a much higher activity and calling tendency in relative-humidity levels above 93 percent. The mating calls of male glass frogs are variable between species, but they can typically be described as single, rising whistles that have a duration of less than a second, high-pitched trills or a series of short, high-pitched peeps. Males will call from chosen sites along the stream that exhibit preferable characteristics for egg deposition directly above the stream water.

Male centrolenids are fairly territorial and typically do not tolerate the presence of other males in close vicinity to their particular chosen calling sites. It is not common to witness physical combat between two males over a calling site, but physical confrontation does occur. It usually takes place when an intruding male enters the vicinity (typically within 10 centimeters or the same leaf [pers. obs. with *H. fleischmanni* in 1998 and 1999]) of another calling male. When the original male observes an intruding male, he will then change his normal advertising call to a lower soft-pitched "preep," and orient himself toward the intruding male. Next, the defending original male will slowly approach the intruder and often jump on his back in a behavior similar to amplexus, but usually within a second or so, the intruding male will wiggle free from the original male's grasp and retreat to another site. The victorious male, if the original, will then resume the typical advertisement call within a minute or two after the confrontation. I have witnessed groups of several male *H. valerioi* sharing the same banana leaf overhanging a small stream. Evidence of obvious breeding and calling activity from all of these males comes from the presence of several egg masses distributed among the population of resident egg-guarding males.

The reproductive strategies of glass frogs differ among various species, but, in general, the males call from chosen sites,

and when an interested female comes close, usually within several centimeters, the male jumps onto her back and initiates amplexus. In some species, such as *H. fleischmanni*, the female often nudges the side of the calling male and crawls underneath him. The male next grasps the female and commences with amplexus behavior (Jacobson, 1985). Amplexus typically lasts for a couple hours or more, after which, if the pair are successful, they deposit typically between 20 to 30 eggs on an appropriate surface overhanging, or close to, stream water. The eggs typically take about two weeks to develop and hatch, often falling into the water below on rainy nights. One suggestion for larvae hatching on rainy nights, is the possible higher turbidity in the streams, due to the rain washing sediments from the land. In this turbid water, the chance for larvae survival from predatory fish is much higher due to reduced visibility (McDiarmid, 1983).

Little is known or reported about centrolenids natural larvae stages, but it is believed they burrow into the detritus that builds up in slower sections of streams and undergo development there.

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