

# GENERAL HUSBANDRY OF TERRESTRIAL (FOSSORIAL) CAECILIANS IN CAPTIVITY

Dennis Parmley, Georgia College & State University, Biology Department,  
Milledgeville GA 31061 (dennis.parmley@gcsu.edu)

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## INTRODUCTION

Caecilians are a rather strange group of limbless, worm-like, and annulated amphibians of the Order Gymnophiona. They have no external ear openings (a stapes is present in some, but not others; Wever and Gans, 1976; Exbrayat, 2006), and their eyes are tiny and covered by skin and/or bone (Duellman and Trueb 1986; Wake 1994). While some caecilians are aquatic (e.g., *Typhlonectes*), the majority of the approximately 34 genera and ca. 165-200 species (Jenkins and Walsh, 1993; Duellman and Trueb 1986; Wilkinson et al., 2011) are terrestrial spending most of their lives underground burrowing in soil or plant litter. In fact, the skeletal and muscular anatomy of fossorial caecilians has been fine tuned for such an underground life by millions of years of evolution (e.g., Estes and Wake, 1972; Jenkins and Walsh, 1993). Living caecilians are primarily pantropical in distribution, occurring for the most part from southern Mexico to Argentina, most of tropical Africa, India, Sri Lanka, and from south China to the Philippines (e.g., Duellman and Trueb, 1986), but they do not occur in Madagascar or Australasia (= southeast of Wallace's line; Exbrayat, 2006).

Over the past several years imported wild caught terrestrial caecilians of a few genera have trickled into the United States pet trade and have been of interest to some herpetoculturists and academicians (personal observation; Gower and Wilkinson, 2005). Caecilian husbandry is, however, still poorly understood and certainly a work in progress (e.g., Wake 1994; O'Reilly 1996). After keeping terrestrial caecilians in my live animal lab for several years, I have developed a general husbandry protocol that may prove useful to others. Keep in mind that the information presented here is what has worked for me over the years, and to be honest, is the result of trial-and-error and information gained from corresponding with other "caecilian keepers" in the academic and hobby arenas. I have especially benefited from caecilian husbandry advice from Danté Fenolio and David Gower (Natural History Museum of London). While certain species may require modifications to the general husbandry techniques I purpose here, these methods and products have worked well for me over the years. The proper enclosure, substrate, temperature and moisture regime, and food are the most important needs that must be met to promote good health and long term maintenance of caecilians in captivity. These issues are discussed below.

## HOUSING

**Cages:** I use plastic storage containers to house caecilians (Fig. 1). I do not recommend using the less expensive, thin-walled varieties that are available in most all

discount stores, but rather buy thicker-walled ones with lids that close tightly. Even the best containers available are not expensive. There are several advantages to these types of cages, including (1) they are, as mentioned, relatively inexpensive and readily available; (2) there are a wide variety of sizes available to meet the size requirements of most any caecilian; (3) they are easy to modify for ventilation; (4) they are easy to clean and disinfect; and (5) they hold moisture well.

The size of the container is determined by the size of the animal. For example, I am currently using the following (see Figs. 1, 2, 3):

A. Large caecilians (e.g., *Dermophis mexicanus*): 96 quart containers.

B. Medium size Caecilians (e.g., *Herpele*, *Geotrypetes* and *Ichthyophis*): 40 quart containers.

C. Small caecilians: 6 quart containers.

**Ventilation:** Along a horizontal line, I drill 6-8 approximately 8-10 mm holes on each side of the containers approximately 2-2.5 inches below the top lip. The holes are then covered on the outside of each container with fine mesh plastic window screen (mesh size about 8x16 or 18x20 openings/inch) taped around the borders with duct tape (see Figs. 1, 2). The screen over the holes is not to prevent a caecilian from escaping as the holes are too small for such an escape, but rather to keep live food items in, especially worms. No holes are drilled in the lids.

**Substrate:** Various substrates have been suggested for captive caecilians. For example, O'Reilly (1996) recommended using pH-balanced commercial-grade potting soil. Wake (1994) suggested moist, friable organic soil. Fenolio (2004) discusses the pros and cons of using pH-neutral soil, paper products, and even acidic substrates (such as potting soil and peat moss) for some species. He noted that the West African species *Geotrypetes seraphini* in his care preferred an acidic substrate of peat moss mixed with sand (Fenolio 2004). Others have used sterilized topsoil for various species with good success (D. Gower, pers. comm. 2012).

I have experimented with various substrates for caecilians, including damp paper towels, organic mulches, potting soils, potting soils mixed with coconut husk, potting soils mixed with worm castings, and potting soils mixed with deciduous leaf litter, but I now exclusively use a paper product marketed as Carefresh Bedding® (a product of U.S.A./Absorption Corp in WA, [www.absorptioncorp.com](http://www.absorptioncorp.com)). I buy bags of 54.5 dry quarts in bulk on line as this is cheaper than buying it from pet stores. Carefresh Bedding® is a shredded paper product (see Figs. 4, 5) designed specifically for use as pet bedding. It is sold as pine and cedar oil free and as being pH neutral (or nearly so), safe and I believe, digestible (or at least able to pass through the gut). It retains moisture well, is easily rehydrated as needed, and I have had no serious fungal or mold problems with it. Moreover, caecilians easily burrow through it and worms can thrive in it (discussed under the feeding section).

Basically, I give each caecilian approximately 8-12 inches (adult *Herpele*-size) to 10-15 inches (adult *Dermophis*-size) of damp bedding to burrow in. Small caecilian are

provided a few inches of substrate. I keep the bedding damp, but not so wet that you can grab a fistful and squeeze water out of it. You don't want pools of standing water on the bottom of the container. I have no "magic bullet" or predetermined ratio of water to bedding to suggest, but rather you will have to determine what works best for you. My goal is to keep the bedding damp but not soaking wet, which is easily done with this product. Moreover, the dampness of the bedding is easily maintained by misting and occasionally turning over the substrate as needed from time to time. I also provide the caecilians with at least some degree of a moisture gradient in the cage (discussed under the Temperature regime section).

There is very little information on the type of water that should be used to moisten the substrate. In reference to larval and aquatic species, O'Reilly (1996) mentions using chlorine and chloramine-free tap water, or even distilled water with added salts. Fenolio (pers. comm.) moistens the substrate for terrestrial species with bottled drinking water. Some of the caecilian keepers I have corresponded with use only rain water to wet their substrate. I use well water, mainly because I have easy access to it and I have been using it for several years now with no problems. I will note, however, that others have successfully used unaltered tap water with no problems (Dr. Gower, pers. comm. 2012). Nonetheless, my advice is that unless you are maintaining large numbers of caecilians, simply buy bottled spring water. A few gallons will go a long way and is relatively inexpensive.

I routinely replace the substrate in the larger cages about every 4-5 months (or sooner if needed, but it rarely does). I change the substrate of the small 6-qt. cages more often, but again, on an as-needed basis. In addition to maintaining a clean environment for the caecilians, this gives me a chance to perform a visual inspection to assess the overall health and appearance of each individual.

**Surface objects:** It is a good idea to place a flat piece of wood on the surface of the substrate, noting that some species like to take near-surface refuge between the wood and the substrate (D. Gower, pers. comm. 2012). Moreover, it is an easy way to check specimens without digging them up. I place an approximately 4x6 inch piece of sterilized (via 12 minutes in a microwave) hardwood bark in each of my caecilian containers (Fig. 6).

**Water:** I do not provide a bowl or pool of drinking water for my caecilians. While I have never seen any of my specimens actually drink water, condensation often beads up on their container walls, which would be available to them.

**Temperature regime:** Fenolio (2004) suggests maintaining caecilians between 70 to 75° F with temperature swings not exceeding 5 degrees. I keep my cages on a tiled floor in my animal room and on wooden shelves about 6 inches above the floor (Figs. 2, 3). Here the temperature remains relatively stable between ca. 72° at night and slowly warms to ca. 74° -75° F during the day. I also use Helix® control units to regulate Flexwatt Heat Tape® (see Figs. 2, 7). Cages are set on top of the heat tape (Fig. 2). For my larger cages, the heat tapes run the full length of one side, and for smaller cages, they run the length of one end of each cage. I set the tape temperature at 82-85° F. The heat tapes do dry out the paper substrate to some degree, but only in the general area where

the tape contacts the cage floor. Moreover, I believe this is a positive attribute as it offers some degree of a temperature and moisture gradient for the caecilians.

I have talked with several people who successfully keep their caecilians simply in cooler areas of their house with no specific control of temperature. Regardless of which option you choose, relatively quick and wide temperature fluctuations should be avoided as caecilians do not seem to do well under these conditions. The overall goal is to maintain some degree of thermal and moisture gradient that is not too warm, but also provides thermal stability for the caecilian.

**Escape proofing cages:** Although the containers I use come with either a snap on lid or a lid with a latching mechanism, I don't trust them. All it takes is one time to forget to properly close the lid, and if the caecilian can reach the top of the container, he likely will escape. Moreover, worms are notorious for climbing the container walls at night and squeezing under a lid and escaping. I simply place weights on top of the lids. In my case, I use books, as they evenly distribute pressure to the top (see Figs. 2, 3). While I do still have some worms escape, it is minimal, but most importantly, I have never had a caecilian escape.

**Light regime:** Given that terrestrial caecilians are fossorial, a precise light regime does not seem to be a requirement for captive care. My animals thrive well being kept in an animal room that mostly stays on a 10 hr or 14 hr light cycle.

**Number of specimens per cage:** Other than during breeding trials, I maintain one individual per cage. This eliminates any chance of intraspecific competition or aggression. Moreover, it makes it easier to monitor the growth and general health of each specimen. However, others have successfully housed caecilians in single-species but multi-individual communities, checking them occasionally for any evidence of aggression (D. Gower, personal communication, 2012). This indeed probably promotes a better chance of captive breeding success.

## **FEEDING**

**What and how often to feed:** Fossorial caecilians are capable of locating prey items in complete darkness using chemosensory cues picket up by tiny tentacles (Himstedt and Simon 1995). While a variety of mostly invertebrates have been suggested as food items for captive caecilians (crickets, small roaches, termites, but also chopped beef heart), earthworms are eaten by most all species of terrestrial caecilians (Wake 1994, O'Reilly 1996; Duellman and Trueb 1986; Fenolio 2004). I feed my caecilians almost exclusively earthworms. For example, I use earthworms commonly sold for fish bait in my area of the country as "Red Wigglers." They are small to medium size worms that meet the size requirements of most of my caecilians. For smaller caecilians, I cut the worms into appropriately sized pieces. If worms are not available in your area, various sizes of earthworms are readily available for sale by reliable companies on the internet. Moreover, if you are interested in raising your own worms, Red Wigglers are easy to culture and information on how to rear them is available on the internet.

One benefit of using earthworms coupled with Carefresh Bedding® as a substrate is that the worms can survive in the substrate for long periods of time. They do not die and decompose in the enclosures; I consider this a big advantage of using Carefresh. In general, I put 10-15 earthworms per cage about every 14 days. Also, I dig through the bedding of each cage at least once every 2 weeks to check for any excessive buildup in worm numbers. An excess of worms may be an indicator that you are overfeeding or that your caecilian is not feeding well and may need attention.

The only species I keep that has a varied diet are my specimens of *Dermophis*. While earth worms make up the bulk of their captive diet, once every 2-3 months I offer newborn mice (which they usually consume), and once a month I offer crickets (also usually consumed).

**Food supplementation with vitamins and minerals:** Fenolio (2004) noted that that the nutritional component of earthworms can be boosted by injecting them (via a tuberculi syringe) with a small amount of water and reptile vitamin/mineral powder (commonly sold in pet stores). He suggested this can be an “effective method for increasing the nutritional value “ of the worms. My protocol has been to once every two months simply add about a teaspoon of powdered calcium supplement and vitamin and mineral supplement (premixed in a 50:50 ratio) to the substrate that comes in the worm container. I do this about 4-6 days before I feed the worms to the caecilians. The idea is that the worms will ingest the minerals and vitamins (“gut load”), which in turn will be passed on to the caecilian when it eats. To be honest, I don’t know how successful of a delivery system this has been as I have no way to tell how quickly the worms are consumed, or even if the worms consumed a beneficial amount of vitamins and minerals, but I have raised *Herpele* from small wild imported individuals to large and robust adults exclusively on this earthworm diet and vitamin-mineral regime (Fig. 5).

**Confirmation of feeding:** I have caecilians that have been in my live-animal lab for several years now that I have never actually seen eat? What I do is when I first get a caecilian, I house it in a relatively small, worm-proof, plastic storage container. I count the worms I put in, and about every 3-4 days, I go through the substrate to see if any worms are remaining. I do this for about 30 days before transferring the specimen to a permanent cage. To be honest, as of yet I have never had a caecilian refuse to eat earth worms.

## GENERAL TROUBLE SHOOTING

**The caecilian will not stay burrowed:** If a caecilian does not spend most (about 95%) of its time burrowed in the substrate you provide for it, but rather spends a lot of time on the surface, then something is wrong. Consider whether the substrate is too damp, too dry, too cool, too warm, or chemically uncomfortable or intolerable. If you feel that the moisture content is not the problem, then change the substrate, and you may need to try a different water source to dampen the substrate. Either replace it with a fresh batch of what-ever has worked for you, or try a different substrate. Also make sure the temperature of the room you are keeping your caecilian in is not too warm or too cool. You may want to try moving the cage to a different area of the room, or a different

location altogether. Moreover, you may try placing a flat piece of wood on the surface of the substrate – perhaps the caecilian needs a secure “surface” place to hide.

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### Literature Cited

- Duellman, W. E., and L. Trueb. 1986. *Biology of Amphibians*. McGraw-Hill, Inc., New York, New York, 670 pp.
- Estes, R. and M. H. Wake. 1972. The first fossil record of caecilian amphibians. *Nature* 239: 228-231.
- Exbrayat, J-M. (editor). 2006. *Reproductive Biology and Phylogeny of Gymnophiona (Caecilians)*. Enfield: Science Publishers, 2006. 395 pp.
- Fenolio, D. 2004. Say Hello to the Caecilians. *Reptiles Magazine*, December: 38-42.
- Gower, D. J., and M. Wilkinson. 2005. Conservation biology of caecilian amphibians. *Conservation Biology* 19:45-55.
- Himstedt, W., and D. Simon. 1995. Sensory basis of foraging behavior in caecilians (Amphibia, gymnophiona). *Herpetology Journal* 5:266-270.
- Jenkins, F.A., and D. M. Walsh. 1993. An Early Jurassic caecilian with limbs. *Nature* 365:246.
- O'Reilly, J.C. 1996. Keeping Caecilians in captivity. *Advances in Herpetoculture*, pp. 39-45. International Herpetological Symposium, Inc.
- Wake, M. H. 1994. Caecilians (Amphibia: Gymnophiona) In Captivity: pages 223-228 in *Captive Management and Conservation of Amphibians and Reptiles* (eds. J.B. Murphy, K. Adler, and J.T. Collins). Society for the Study of Amphibians and Reptiles. Ithaca, New York, USA. 408 pp.
- Wever, E. G., and C. Gans. 1976. The caecilian ear: Further observations. *Proceedings of the National Academy of Science, USA*. 73:3744-3746.
- Wilkinson, M., San Mauro, D., Sherratt, E., and D. J. Gower,. (2011). A nine-family classification of caecilians (Amphibia: Gymnophiona). *Zootaxa* (2874): 41–64.



Figure 1. Large (96 qt.), medium (40 qt) and small (6qt) plastic containers used to house caecilians. Note ventilation holes in large and medium containers covered with fine mesh screen duct taped to the container to prevent worms from escaping.





Figure 2. Large cages set over Flexwatt Heat Tape<sup>®</sup> controlled by Helix<sup>®</sup> units.





Figure 3. Medium size cages housing caecilians.



Figure 4. Long-term captive *Geotrypetes* cf. *G. seraphini*.





Figure 5. Newly imported *Herpele squalostoma* from the equatorial African country of Cameroon (a); same individual two years later (b).



Figure 6. Bark on surface of substrate in caecilian cage that provides caecilian with a near-surface hiding area.





Figure 7. Helix<sup>®</sup> DBS 1000 temperature control unit used to control Flexwatt Heat Tape<sup>®</sup>.