

## Companion Animal Hospital Exotic Animal Care



Kingsnakes and milksnakes are members of the genus *Lampropeltis*, a beautiful and diverse group of snakes with about 15 species and over 60 subspecies. *Lampropeltis* means “shiny shields,” a reference to their shiny scales. Many species and subspecies are commonly kept as pets (see below for a list). They are relatively long-lived and may easily surpass 20 years of age with proper care, so one must be prepared to take care of their pet for several decades. Like with all reptiles, good husbandry and preventative health care are important for a long and healthy life.

*Lampropeltis* is a wide-ranging group, with species found from southern Canada to South America. While they inhabit a wide range of habitats, we can make some generalities about their care as most species have similar habits.

There are many captive bred kingsnakes and milksnakes available in the pet trade, and we strongly recommend captive bred animals over wild caught individuals for several reasons. Wild caught animals tend to make poor companion animals, as they are generally quite stressed by captivity and may be aggressive towards people.

### 1. Environment: Enclosure

There are many suitable reptile terrariums available on the market today. Most are made of glass with screen paneling for ventilation, but an aquarium with a securely-fastened screen lid is also a suitable enclosure. These snakes are “escape artists,” so the enclosure must be secure! While these snakes are primarily terrestrial (live on the ground), in the wild they are often found climbing in trees and offering climbing opportunities in captivity helps maintain a healthy snake.

These snakes, like most reptiles, do best when housed alone because of their solitary nature, and kingsnakes are named as such because they are known to eat other snakes! Snakes must have an enclosure large enough to stretch their entire body in a straight line in captivity (this may be achieved on a diagonal axis in the enclosure), so the minimum enclosure size will depend on the adult size of the species. Most members of this group can be housed in an enclosure at least 1 m long by 0.5 m wide by 0.5 m tall (or 3 ft long by 1.5 ft wide by 1.5 ft tall), or a “standard” 151 L (40 gallon) aquarium. The larger the enclosure, the better, as these snakes are very curious and active.

## **2. Environment: Heating**

Reptiles are ectothermic: They rely on external heat to maintain their bodies at a preferred temperature. All reptiles need an external heat source so that they may thermoregulate by shuttling within a heat gradient in their enclosure. Basically, when a reptile is too cool he will move to somewhere warm, and when he is too warm he will move somewhere cooler. Reptiles will move around in the gradient throughout the day to try to stay at a target body temperature.

To create a thermal gradient in the enclosure, a primary heating device should be placed on one end. In some homes, a secondary heating device may be necessary to maintain temperatures warm enough. The primary heating device can be a heat lamp left on during the day. Heating pads make excellent secondary heating devices if needed at night. Ceramic heat emitters and radiant heat panels may also be used for nighttime heating as they do not produce light. Red coloured incandescent bulbs, sometimes called “infrared” bulbs, should not be used for nighttime heat as reptiles certainly see the red light, contrary to what they often advertise.

The preferred temperature range for most species of kingsnake and milksnake is 18-30 °C (64-86 °F) during the day, and no cooler than 15 °C (59 °F) at night and the cage environment should reflect this. Two thermometres are required for monitoring temperatures: One to monitor the warm end of the gradient to ensure that it is warm enough, and one to ensure that the cool end is cool enough to allow for thermoregulation.

Monitoring the thermal gradient is critical: Use a thermometre both at the animal’s basking spot as well as at the cool end of the enclosure. It is not only important to ensure that your pet can get warm enough based on the species’ preferred body temperature, but also that the cool end allows for proper cooling when needed. Hyperthermia, or an excessively high body temperature, can kill a reptile or amphibian within minutes, and ensuring that your thermal gradient is appropriate at both ends is critical. We recommend the usage of either a digital thermometre with a probe that may be placed at the appropriate spot, or a noncontact infrared temperature “gun” that can be pointed at any location in the enclosure. Note that some thermometres are not very accurate and may be misleading when monitoring temperatures. “Stick-on” LCD and dial thermometres are generally quite inaccurate and we do not recommend their use.

Many species of kingsnake and milksnake are from temperate regions that experience seasonal cooling during fall and winter. While these temperature drops and even brumation (the ectothermic term for “hibernation”) are necessary to stimulate breeding behaviour, for most pets seasonal cooling may not be necessary. There is a lack of long-term data to indicate whether offering seasonal temperature changes has an impact on the animal’s health, and cooling snakes that may not be in optimal health actually poses health risks.

### **3. Environment: Lighting**

In the past decade, there is more and more research indicating that snakes can benefit from broad-spectrum lighting. While in the past it has been demonstrated that rodent-eating snakes can be raised and bred without lighting that offers UV-A or UV-B radiation, new research has shown that they can benefit from it. We recommend broad-spectrum lighting with all reptiles; please refer to our handout on lighting for reptiles for more information.

Reptiles require a regular photoperiod (“daylight” period) in captivity. Twelve hours of daylight to 12 hours of darkness is often accepted. Please use an electric timer to keep the photoperiod regular for your snake.

### **4. Environment: Substrate and cage furnishings**

Substrate is the medium covering the floor of the enclosure. For newly acquired snakes, we strongly recommend using an easy-to-clean material like unprinted newspaper or paper towels so that the animal’s stools and urates can be monitored (and a sample easily collected for parasite screening).

Once the animal is given a clean bill of health, the substrate should mimic what is found in their natural habitat to allow for burrowing and moisture gradients in the enclosure. A mix of wood chips, moss, sand, and soil creates a forest floor-like substrate, and the ratio of components can be changed depending on the species’ natural habitat (some live in more humid forests, some prefer drier, more desert-like habitats). See the species notes below for more details.

Wood shavings such as aspen are easy-to-clean and allow for burrowing, but do not allow for a moisture gradient to be created in the substrate. If you are using wood shavings, please be sure to provide one or more humid hides (see below) so that the snake has a humid retreat. Please note that aromatic woods like cedar and pine produce fumes that are toxic and these woods should never be used.

Burrowing provides enrichment and adds places for hiding for the snake, but these animals need hiding spots so that they may hide to feel secure. There are many commercially-available caves and other hides made out of resin that are easy to clean and disinfect, but simple hides can be made out of plastic food containers or plant saucers. Hiding spots should be just large enough for the snake to enter and coil up snugly, as larger hides do not offer the same sense of security.

A moist or humid hide is essential so that the snake can retreat to a refuge with higher humidity, important for hydration and shedding. If you are using a naturalistic forest floor-like substrate mix, the substrate under or inside one or more hides can be dampened regularly to create a moisture gradient. If you are using a dry substrate like aspen shavings that do not allow for a moisture gradient, you can use any hide filled with moist paper towels or sphagnum moss

to allow for a humid retreat. Any humid hide should be cleaned and moist substrate changed regularly to avoid mold growth.

The minimum number of hides is three: One “dry” hide in both the warm and cool ends of the enclosure, and at least one humid hide. This allows the snake to hide in both ends of the gradient for thermoregulation. Other cage furnishings such as rocks, branches, and fake plants add behavioural enrichment and aesthetic value to the enclosure. Kingsnakes and Milksnakes will climb branches if given the opportunity, and this is a great way to provide exercise.

## 5. Nutrition

Kingsnakes and milksnakes are carnivores, and eat many different prey species in the wild. In fact, kingsnakes are named as such because they are known to eat other snakes, even venomous species. As companion animals, they may be maintained on a diet of rodents such as suitably-sized mice or rats.

Please see our handout on feeding rodent-eating snakes for more information.

We do not recommend feeding other prey like amphibians (frogs, toads, salamanders, etc.), birds, or other reptiles (lizards or snakes), as this may be a source of parasites for your pet. Many parasites have life cycles that involve a “food chain” of these species. Kingsnakes and milksnakes can be kept very healthy and happy on a diet of captive-bred rodents.

Fresh water should be available in a dish at all times.

## 6. Health

Good husbandry helps prevent most health problems in reptiles. As ectotherms, their immune system function is directly affected by both stress and their ability to thermoregulate, so proper environmental temperatures are critical. There are some other common health problems that you can avoid with the right precautions.

Parasites are unfortunately very common in captive reptiles due to overcrowded, stressful conditions and poor hygiene in pet stores and some breeding operations. Many parasites that affect kingsnakes and milksnakes have a direct life cycle, meaning that they require no other species to help transmit them. Parasites like this tend to accumulate in captive reptiles and cause disease. Fecal testing is required to determine what kind of parasites your snake may have so that the appropriate medication can be prescribed.

Contrary to popular belief, captive-bred rodents are not a common source of parasites in snakes. While rodents have their own species of parasites (such as the rat pinworm, *Syphacia muris*) that will sometimes be found on snake fecal exams, these act as “pseudoparasites” since the rodent parasite does not mature in or infect the snake. It is important to have fecal exams

performed by a qualified veterinary team that can identify pseudoparasites, so that you do not treat a snake for no reason!

## 7. Notes on species in genus *Lampropeltis*

As mentioned above, there are about 15 species and over 60 subspecies in the genus that includes kingsnakes and milksnakes. Here is a list of some commonly kept pet species:

- Common Kingsnake, *Lampropeltis getula*: The Common Kingsnake has many subspecies found in captivity with a wide range of appearances, but their captive care is similar across these subspecies.
  - California Kingsnake, *Lampropeltis getula californiae*
  - Desert Kingsnake, *Lampropeltis getula splendida*
  - Eastern or Chain Kingsnake, *Lampropeltis getula getula*
  - Florida Kingsnake, *Lampropeltis getula floridana*
  - Mexican Black Kingsnake, *Lampropeltis getula nigra*
- Mexican Kingsnake, *Lampropeltis mexicana*: The care of these subspecies is similar to the Common Kingsnake.
  - Gray-banded Kingsnake, *Lampropeltis mexicana alterna*
  - Variable Kingsnake, *Lampropeltis mexicana thayeri*
- Milksnake, *Lampropeltis triangulum*: There are 24 subspecies of Milksnake, and their care is similar to other members of *Lampropeltis*. The following are commonly seen in the pet trade.
  - Eastern Milksnake, *Lampropeltis triangulum triangulum*
  - Mexican Milksnake, *Lampropeltis triangulum annulata*
  - Sinaloan Milksnake, *Lampropeltis triangulum sinaloae*
  - Honduran Milksnake, *Lampropeltis triangulum hondurensis*
  - Pueblan Milksnake, *Lampropeltis triangulum campbelli*
  - Nelson's Milksnake, *Lampropeltis triangulum nelsoni*
- Scarlet Kingsnake, *Lampropeltis elapsoides*: This species was once thought to be a subspecies of milksnake, but is now recognized as a distinct species. This species is a specialist predator on lizards, and may be difficult to train to eat rodents in captivity (our knowledge of lizard-eating snake is generally lacking, and transitioning these species to eat rodents may not be healthy). It is considered a difficult species to maintain in captivity.

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### Lighting for Reptiles and Amphibians

Some reptiles and amphibians require broad spectrum lighting that includes ultraviolet A and ultraviolet B radiation (wavelengths found in natural sunlight). Providing this special lighting in captivity is critical for the health of many common companion species.

#### 1. What is ultraviolet light?

Ultraviolet light is invisible to the human eye, but important to many members of the animal kingdom. There are three classifications of ultraviolet light:

- **Ultraviolet A:** UVA is also called long wave or "black light" ultraviolet radiation. This class of UV is important in regulating natural cycles in some reptiles, such as brumation ("hibernation") and reproduction.

Many species of reptile (Fleishman et al. 1993), insects (Salcedo et al. 2003) and birds (Cuthill et al. 2000) can see UVA light. It is important in helping to see members of the same species or even prey. It has been demonstrated that reptiles provided with UVA light generally do better in captivity, with increased levels of natural activities, greater reproductive success, and better appetites (Klaphake et al. 2004).

UVA is produced by the sun, by broad spectrum fluorescent bulbs and black lights (Gehrmann 2006).

UVA is definitely beneficial to diurnal species (species active during daylight hours). It may be most important in visually-oriented species, like members of the iguana (Iguanidae), agama or dragon (Agamidae) and true chameleon (Chamaeleonidae) families of lizards, as well as in turtle and tortoise species.

- **Ultraviolet B:** UVB is also called medium wave ultraviolet radiation, and is essential in vitamin D<sub>3</sub> production (the "sunshine vitamin"). Vitamin D<sub>3</sub> allows the body to use calcium from the diet. Some species can use vitamin D<sub>3</sub> from dietary sources (animal matter), but many species either cannot absorb dietary D<sub>3</sub> or do not encounter vitamin D<sub>3</sub> in their natural diet.

It is uncertain whether reptiles can see or detect UVB. It is produced by the sun, and by some broad spectrum artificial lighting (Gehrmann 2006).

UVB is important to provide for most diurnal lizards, chelonians and some amphibians. Herbivorous (plant-eating) animals absolutely need UVB lighting as they cannot use dietary vitamin D<sub>3</sub>. Without UVB lighting, calcium deficiency occurs and manifests as many health

problems, including the metabolic bone diseases (a group of pathologies related to calcium metabolism).

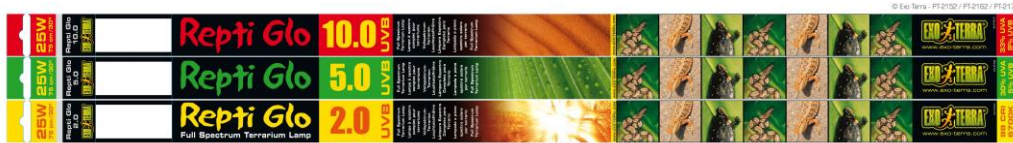
There is a growing amount of research suggesting that species that we have not traditionally recommended UV-B lighting for can benefit from exposure. For example, some studies (Acierno et al 2008, Hedley and Eatwell 2013) have demonstrated that snakes can certainly use UV-B lighting. More investigation is needed to determine the health benefits of providing broad spectrum lighting to these species, however in the meantime it may be safest to allow for lighting that is as natural as possible for these captive snakes.

- **Ultraviolet C:** UVC, or short wave ultraviolet radiation, is produced by the sun but filtered by our atmosphere. Some lights will produce UVC radiation very close to the bulb surface. It is germicidal and used in air and water disinfection systems. Exposure to UVC radiation is harmful to the skin and eyes, and does not need to be provided to reptiles or amphibians in captivity.

## 2. Types of broad-spectrum lights

There are several types of commercial bulb available to provide your companion animal with broad spectrum lighting. Select a bulb according to the animal you have, and the type of enclosure you are using.

- Linear fluorescents are suitable for enclosures with a lot of floor space, as well as for long animals that have a large body area that needs UV exposure. Examples of brands include: **Exo Terra Repti Glo** by Hagen, **Iguana Light** and **Reptisun** by Zoo Med, **Desert Series 50** and **Tropical Series 25** by Zilla.



- Compact fluorescents are limited in their "spread" (place them horizontally towards the basking area, to increase surface area exposed) but have a greater relative irradiance closer to the bulb, so they are more suitable for small enclosures.

Examples of brands include:

**Exo Terra Repti Glo** by Hagen, **Reptisun** by Zoo Med, **Desert Series 50** and **Tropical Series 25** by Zilla.



- Mercury vapour lamps are only suitable for very large enclosures. They produce a large amount of heat as well as visible light, UVA and UVB (Baines et al. 2006). Users must be very careful to avoid thermal burns, always test the environmental temperatures before introducing your pet to the enclosure when using a mercury vapour lamp.

Examples of brands include:

**PowerSun UV** by Zoo Med, **Exo Terra Solar Glo** by Hagen.



### 3. Using broad-spectrum lighting

Keep the following points in consideration when lighting reptile or amphibian enclosure:

- Always research recent current care information about what kind of lighting your species needs. Reptile and amphibian care and medicine is a field that is constantly evolving.
- Never allow a glass or plastic barrier to occlude your broad spectrum light. Glass and plastic filter 99-100% of UVB radiation, even if visible light may pass through (Baines et al. 2006).
- The amount of UV produced decreases with distance from the bulb. Most bulbs are effective at a distance of less than 30 cm (12") from the basking spot (but read the manufacturer's recommendations). However, because bulbs may also produce small amounts of harmful UVC radiation near the bulb's surface, keep a minimum distance of 10



cm (4") (Baines et al. 2006).

- Screen or mesh covers or enclosures will physically block some UV from reaching the animal (Baines et al. 2006). If you have mesh or screen between your broad spectrum bulb and the animal, ensure that your pet can get relatively close to the bulb, or add a reflector to increase how much UV is projected to the basking spot.
- Reptiles and amphibians are never in direct sunlight for the entire day. Always ensure that your pet can choose a location as a shelter from UV light exposure.
- Replace the light every 6-12 months, or according to the manufacturer's recommendations. The UV output of a bulb decreases over time, even if the light is still producing visible light (Klaphake et al. 2003).
- Consider using "high output" bulbs (with an 8.0 or 10.0 rating) with species that would be exposed to a lot of UV light (like desert animals) or in large enclosures, and mid-range output bulbs (5.0) with other species or in smaller enclosures. Low output bulbs (2.0) are probably useless in terms of UVB output.

Thank you for your trust in taking care of your reptile companion. If you have any questions or concerns about his or her care at home, please call the hospital to speak with our staff.

#### 4. Sources and further reading

- Acierno, MJ, MA Mitchell, TT Zachariah, MK Roundtree, MS Kirchgessner, D Sanchez-Migallon Guzman. 2008. Effects of ultraviolet radiation on plasma 25-hydroxyvitamin D3 concentrations in corn snakes (*Elaphe guttata*). *American Journal of Veterinary Research*, 69(2):294-297.
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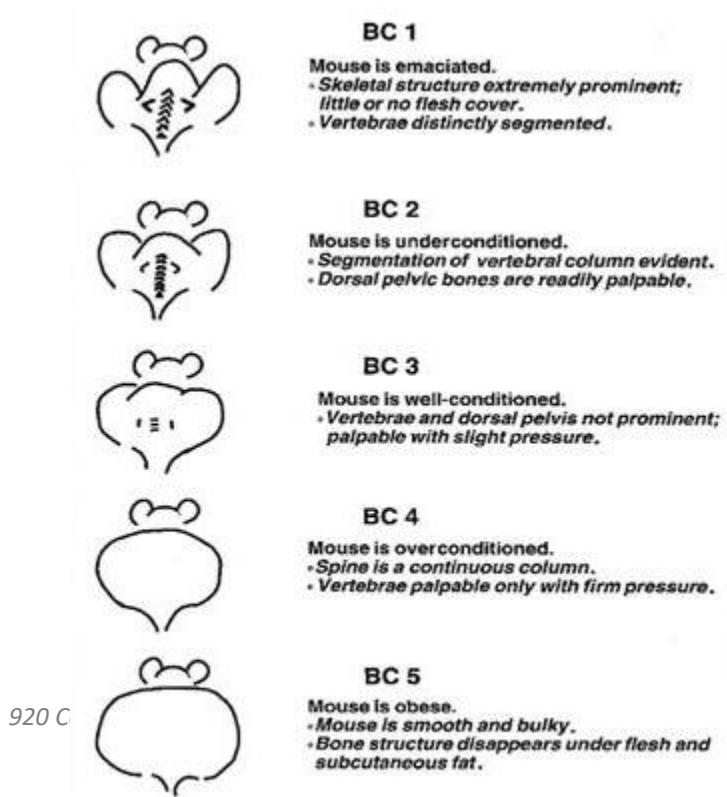
Rodentivores are a subset of carnivores that specialize in eating rodents. Many companion reptiles, including most commonly kept snakes, are rodentivores or are best maintained on a rodent diet in captivity.

8. Selecting healthy prey

Healthy prey leads to a healthy predator! Rodents that are fed to your reptile should be healthy. Their fur should be clean, they should not have a foul odour, and their eyes and ears should be clear of any discharge.

Rodents should be of a good body condition score. Feeding underweight or malnourished rodents may lead to nutritional deficiencies in your reptile, just as feeding overweight or obese prey will lead to an obese predator and other nutritional deficiencies. Supplementation with calcium or multivitamins is not necessary as long as the prey is healthy, with the exception of feeding neonatal (“pinkie”) mice and rats. “Pinkies” are naturally lower in calcium, so a calcium supplement is necessary on these meals to ensure that no deficiency in calcium occurs. It is a commonly propagated myth that pinkies that have just nursed are higher in calcium (and as such, have a stomach full of milk which is visible through their translucent skin): This is not true, they still require calcium supplementation.

Please use the following diagram to assess rodent body condition (Foltz 1999):



920 C

A "+" or a "-" can be added to the body condition score if additional increments are necessary (i.e. ...2+, 2, 2-...)

## **9. Safety practices**

Rodents should be offered during the reptile's activity period, so nocturnal snakes should be fed at night, and diurnal snakes should be fed during the day. This is to avoid leaving a deceased rodent spoil in the cage, which is unsanitary and if eaten may cause some digestive upset.

Always wash your hands thoroughly after handling rodents. Snakes sometimes get excited about the scent of prey and will bite a human hand that smells like prey before waiting to see if it is actually a meal. Rodents that are being offered to a snake should always be held in a tool such as tongs, forceps, or hemostats to avoid biting accidents.

We strongly recommend feeding your snake outside of the enclosure, in a separate feeding bin. This can be a plastic storage container with a tight-fitting or locking lid. The snake may be placed in the food container, and the rodent then offered with a pair of tongs, forceps, or hemostats. The snake is then allowed to eat its prey, and can be moved back to its enclosure after it has finished. There are a number of reasons why this feeding method is advantageous:

- The snake will not learn the association that the enclosure opening means that food is coming: A common complaint among people who keep snakes is that they are attacked as soon as the enclosure is opened. Often, this is a habit formed by feeding the snake in the enclosure—snakes will quickly learn where food comes from, and if they're hungry, they may not wait to see if it is your hand or a rodent coming into the enclosure.
- Accidental ingestion of substrate is avoided: If you are using a "loose" or particulate substrate (sand, moss, wood shavings, etc.), pieces of substrate may get stuck to the rodent and be eaten accidentally. Problems such as gastrointestinal impaction, gastrointestinal perforation, or even stomatitis (oral infection) can occur from pieces of substrate getting stuck in the wrong place.
- Nervous or shy snakes that do not eat in the enclosure may be more inclined to eat when confined to a feeding container with their prey. The reason for this is not known, although a common theory is that this simulates the snake entering a rodent burrow, where their meal can be found.

Frozen rodents should be stored in an airtight container, such as a zipper lock freezer bag, and for no more than 3-6 months to preserve freshness. Some snakes will not accept rodents that have been "freezer-burned."

The safest method for thawing frozen rodents is to leave them in the fridge overnight, as this has been demonstrated to reduce bacterial growth. Prior to feeding, soak the rodent in a warm-water bath to make the prey more appealing (many snake species rely on detecting body heat as well as the smell of the prey to identify it). Please ensure that the water is comfortable to the touch and not hot enough to burn, as this may cause serious burns in the oral cavity and esophagus of the snake.

Prey that is uneaten is ideally discarded and should not be “recycled,” either by giving it to another animal in the home (this can contribute to parasite transmission between enclosures), or by re-freezing it (to reduce the chance of the meal spoiling).

## **10. Live or pre-killed?**

This is a popular debate among reptile-keepers: Do you feed live prey that provides a “hunting” experience, or pre-killed prey? In truth, pre-killed prey is much safer, and it does not deny the reptile environmental enrichment contrary to popular belief. While nobody is pre-killing prey for wild snakes, these animals are in our care and not in the wild. Like with all aspects of caring for pet reptiles, we want to reduce incidence of health problems and allow them to live long, healthy lives.

In the wild (and in captivity), snakes are predominantly ambush predators: As they lack arms and legs, they rely on stealthy camouflage and the element of surprise when stalking prey. Placing a live, fearful rodent into a small and restricted enclosure may result in serious injury. Rodents can be quite vicious when defending themselves, and a hyperactive, frightened mouse or rat bouncing around a reptile enclosure may actually scare a snake into not wanting to eat.

Rodents are capable of causing serious damage to a snake that does not want to eat, whatever the reason for inappetence may be. Rodents tend to gnaw along the head and back of snakes, and damage to eyes and the spine are not uncommon. Bites to the spine may commonly develop meningitis. When a snake is attacked by a predator (or its prey-turned-predator), their first defense is often to freeze and hope that whatever is attacking them leaves them alone. Snakes prefer to flee rather than fight, and if there is no opportunity to get away from the attacking rodent then the consequences are often serious. If you choose to feed live prey to your snake, never leave the live rodent unattended with your pet snake to help avoid these complications.

Another concern is that allowing the rodent to be “stalked” in a restricted enclosure by a predator can be considered inhumane. As reptile-keepers often do not have public opinion on their side, this is an important aspect to consider for the public image of the hobby. Feeding humanely euthanized rodents is more ethical than allowing a frightened animal to be stalked and slowly killed by its predator.

## **11. Transitioning to pre-killed prey**

Most snakes that are eating live prey can be transitioned easily to pre-killed prey. There are a number of steps to try:

- Often, using a feeding container alone will convince snakes to eat pre-killed prey.
- Ensure that the pre-killed rodent has been warmed. Soaking the rodent in a warm-water bath is very effective, but ensure that the water is comfortable to the touch and not hot

enough to burn (this may cause serious burns in the oral cavity and esophagus of the snake).

- Offering the rodent on tongs and “jiggling” it will often attract a snake’s attention. Hold the rodent around the hips and not the tail to give it a more natural movement.
- Making a small tear in the rodent’s skin to expose blood or organs can stimulate some snakes into feeding.

We do not recommend “force-feeding” rodents to snakes or restricting access to water to stimulate feeding without veterinary supervision. While these techniques are commonly recommended on the Internet, in an anorectic snake serious complications such as skin tears and dehydration can occur.