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Managing Human Wildlife Interactions: Snakes

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Many people openly question the value of snakes, a perception that reflects the personal fear many folks have of snakes and the way our culture historically has viewed these animals. A vast amount of misinformation, myths, and folklore has been spread about snakes and, unfortunately, much of this helps to maintain the negative image people have of snakes in general. Although venomous snakes occasionally may pose a risk to one's personal health and safety, the vast majority of species do not present an imminent danger or threat to us. Yet they have suffered significant losses — primarily due to people's lack of familiarity with and unfounded fear of snakes.

Biology and Behavior

Snakes are members of the class Reptilia, commonly known as the reptiles. This class is comprised of four orders:

1. Squamata (lizards and snakes)
2. Crocodylia (alligators, crocodiles, and caimans)
3. Testudines (turtles, tortoises, and terrapins)
4. Rhynchocephalia (tuataras)

A common trait shared among snakes is a body covered by a scaly skin that is shed periodically. The frequency with which snakes shed their outer layer of skin is determined in part by age, physical condition, and amount of food intake. Actively growing younger snakes generally shed the outer skin once every two to three months, whereas mature adults may shed only once or twice a year.

Another characteristic of snakes is that they are ***ectothermic***, which means they are unable to internally regulate or maintain their body temperature and thus are influenced strongly by the temperature of the environment in which they exist. In other words, on cool or cold days, snakes may seek warm shelter to increase their body temperature, whereas on warm or hot days, they must find cool areas to avoid overheating. Hence, their behavior and movements often are dictated by the need to adjust body temperature in response to prevailing environmental conditions, an adaptation referred to as ***behavioral thermoregulation***. This explains why you often see snakes basking in the sunshine on cool mornings as they attempt to warm up, or resting in the shade of landscape plants or hiding in a cool basement or spring house during the heat of the day.

Figure 1. Copperhead (*Agkistrodon contortrix*).
Photograph courtesy of Harold Jerrell, Lee County, Va.

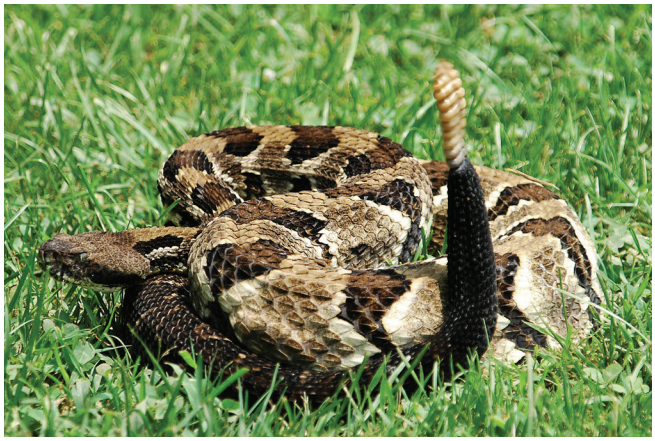

Figure 2. Timber rattlesnake (*Crotalus horridus*).
Photograph courtesy of Harold Jerrell, Lee County, Va.

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Geographical Distribution

Virginia is home to 32 species of naturally occurring snakes. Of these, only three species are classified as being venomous:

1. Copperhead (*Agkistrodon contortrix*), figure 1, which has statewide distribution.
2. Timber rattlesnake (*Crotalus horridus*), figure 2, which is restricted to the western one-third of the state and a very small portion of extreme southeastern Virginia (as the canebrake rattlesnake, a subspecies of the timber rattlesnake).
3. Cottonmouth (*Agkistrodon piscivorus*), which is restricted to the lower southeastern Coastal Plain only.

Of the 32 native species, less than 10 occur statewide; many species are relatively uncommon or have restricted ranges. As a general rule of thumb, a greater number of species occurs in the southeastern Coastal Plain than anywhere else in the commonwealth. Useful information about the distribution of snakes within Virginia, including range maps, can be obtained from the website of the Virginia Herpetological Society (*http://www.virginiaherpetologicalsociety.com)* and from the Virginia Department of Game and Inland Fisheries' brochure, "A Guide to the Snakes and Lizards of Virginia" (see Recommended Reading).

Egg-Laying vs. Live-Bearing

Snakes display different approaches to producing their young: those that lay eggs (***oviparous***) and those that bear live offspring (***viviparous***).

Among the species that lay eggs, egg-laying generally occurs during late spring or early summer, and the new hatchlings emerge anywhere from mid-summer to early fall. The female produces eggs that are somewhat leathery and flexible and have a well-developed yolk sac that provides nourishment to the embryo. The female deposits her eggs (anywhere from 2 to 50 per nest, depending on the species; the mudsnake (*Farancia abacura*)may produce up to 100) in a mulch pile, under decomposing leaves, or beneath logs or other organic debris where warmth is generated as the material rots. Once the eggs are laid, there is no further contact between parent and offspring. Ratsnakes, green snakes, and milk snakes are examples of species that deposit eggs.

However, not all snakes deposit eggs in the environment. In many species, the female retains the developing young within her body until the fully developed young snakes are ready to exit. There are differences among species regarding the internal physiology associated with livebearers and the degree to which nutritional support is provided maternally (i.e., across the placenta).

Some researchers recognize a distinction between full-placental provision, or ***viviparity***, and incomplete or partial placental provisioning, or ***voviviparity***. For simplicity, it is much easier to treat all the species in this group as simply livebearers. The three prominent venomous snakes in Virginia — copperhead, cottonmouth, and timber rattlesnake — all produce live young, as do all watersnakes, the Eastern gartersnake (*Thamnophis sirtalis*), and the common ribbonsnake (*Thamnophis sauritus*). Similar to egg-laying species, parental care is not provided by the adults in live-bearing species after the young emerge; they are entirely on their own from birth.

Given the distinctly different reproductive strategies that snakes display, a common myth about snakes — that a venomous and a nonvenomous snake can interbreed to produce venomous offspring that resemble the nonvenomous snake — cannot be true. In addition to being completely different species, their differing reproductive physiologies prevent venomous and nonvenomous species like the Eastern ratsnake (*Pantherophis alleghaniensis*) (figure 3) from producing viable offspring.

Figure 3. Eastern ratsnake, formerly black ratsnake (*Pantherophis alleghaniensis*).
Photograph courtesy of Harold Jerrell, Lee County, Va.

Senses

Snakes use all the senses they possess to engage with their environment, but they rely most heavily upon their senses of smell and touch (i.e., their ability to detect vibration through the body). Although some snakes do

see well, that capability is restricted mostly to short distances, especially when they are about to shed their skin. At that time, the normally clear skin that cover the snake's eyes cloud over and make seeing more difficult.

Snakes lack the physical structures (no inner ear chamber or ear drum) that would enable them to hear in the way that humans and most other animals do; however, "hearing" still plays an important role in how snakes gather information about their environment. Because a large proportion of a snake's body is in direct contact with the ground or other surfaces, vibrations transmitted through those substrates pass directly to the snake, alerting it to the approach of potential prey or danger.

Regarding smell, snakes do not sniff the air with their nose, as other animals do. Instead, they extend and wave their forked tongue to collect chemical "air samples," which then are deposited in special cavities located on the roof of the mouth, called ***Jacobson's Organ***. The chemical scents collected from the air are interpreted or decoded by receptors in the Jacobson's Organ.

In addition to using touch and smell, pit vipers (i.e., cottonmouth, copperhead, and rattlesnake) possess special heat-sensing organs known as ***loreal pits*** (figure 4), located on each side of the head just forward of the eyes, that help them detect and track potential prey.

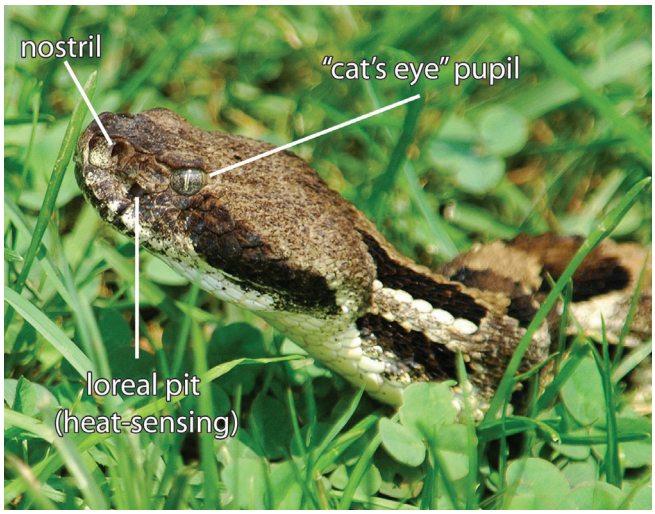

Figure 4. Sense organs of a typical venomous snake.
Photograph courtesy of Harold Jarrell, Lee County, Va.

Movement

For an animal with no legs, one might suspect that moving from one spot to another would be challenging for a snake. However, if you have ever witnessed how fast snakes can move, you realize that snakes have successfully adopted other means of movement that do not require legs.

Snakes use one of three methods to propel themselves on land: (1) arching the body into an open "S"-shape and using the lateral muscles to push off against vegetation or irregularities on the ground, (2) coiling the body into a series of tight curves and pushing off or springing forward against its own body mass, or (3) sequentially raising and lowering the scales on its belly in an undulating fashion to push forward using the traction gained by the scales gripping the ground. They use the same undulating "S"-shaped movement to swim.

If you corner a snake and provide it with few options of escape, the snake very likely will coil up into a tight mass and prepare to defend itself, often by striking out at the entity that approaches too closely. In such a situation, a frequently asked question is, "How far can a snake actually lunge if it was to attempt to strike out at me?" The answer will vary depending on the age and size of the snake, and, to some extent, on the species involved. A relative rule of thumb is that most snakes are capable of lunging a distance equal to about one-third to one-half of their total length. However, estimating the length of a snake is difficult when the snake is coiled, so always exercise caution around a coiled snake and try to avoid cornering a snake.

Economic Importance

Larger species of snakes provide an important service by helping to manage rodent populations (e.g., rats, mice, and voles) that can cause serious economic problems for homeowners, farmers, and businesses. In fact, farmers used to pay local kids a small "reward" to go out and collect ratsnakes to release around the barn and farmyard as a way to keep rodents in check. Many of the smaller snakes feed on insects and other invertebrate pests common to gardens and landscape plantings.

Although some species of snakes will prey on small songbirds or consume the birds' eggs where that opportunity exists, many snakes serve as a food resource for other predators, such as raccoons, opossums, skunks, birds of prey, and even other snakes. Thus, snakes are important players in the food web and are a key component of healthy ecosystems.

Management Strategies

Snakes in a Residence, Business Setting, or Other Occupied Space

There may be nothing more startling or unsettling to some folks than finding a snake crawling along the baseboard of a room in one's home or finding a shed snake skin in the cellar, bedroom closet, or attic — a clear indicator that a snake has been in the building. Not knowing where the snake is currently or whether it has left the site is enough to drive some people out of the building until they can be assured it is "all clear." To many folks, this is a violation of their personal living or working space.

Snakes enter a building for several primary reasons. In many cases, they simply were following and hunting their preferred food item (mice), which also happened to be sharing our living space. In other cases, snakes may be seeking a secure location to lay eggs. Snakes sometimes enter a building seeking conditions that will help them shed their old skin (small openings or sharp angles provide useful wedges to help peel off the old skin). Finally, a snake may seek temporary shelter from a predator or to help regulate body temperature.

Regardless of why a snake may have entered a residence or work area, most people just want to know how to remove it. However, people confronted with a snake must understand that under existing wildlife regulations, **it is illegal to kill any species of snake in Virginia** unless it presents an imminent threat to one's personal health and safety.

Snakes are classified as nongame species and therefore are afforded full protection under existing nongame regulations, similar to all other species in this category. In the case of the canebrake rattlesnake, which is one of Virginia's state-listed endangered species, neither the animal nor its habitat can be destroyed.

Thus, **trying to kill any snake found in the home is not an appropriate solution**. Instead, homeowners should concentrate on eliminating the attraction that brought the snake to the home in the first place and closing all points of access that allowed the animal to enter. The following serve as useful steps for homeowners to consider:

1. Eliminate the prey population that snakes are looking for by removing or cleaning up food resources in the home that attract and support rodents. This would include things like spilled bird seed, accessible pet food stores, open containers of dry goods, and similar potential food items. Transfer all stored dry goods to metal or glass containers that can be tightly sealed and cannot be chewed by rodents.

2. Repair, seal, or close off any openings 1/4 inch or larger that provide animals with access to the interior of the building. Most rodents need an opening of only 1/2 inch in size, or access to an opening that they can enlarge by gnawing, to get into buildings. Places to concentrate your initial search efforts would be where utility services (e.g., water, sewer, electric, telephone, cable) enters the home; where the clothes dryer vent exits the building; around doors, windows, and bulkheads to the basement or garage (including the gap under a large garage door); and where the house sits on its foundation (the sill area). Remember, if a rodent can get in, so can a snake — often by using the very same openings.

3. Thin or reduce the amount of landscape plantings that exist immediately against the foundation of the home. Thick, lush gardens and layers of growth located against the home provide perfect cover and protection to both snakes and their prey. Further, thick plantings provide these animals with time under protective cover to look for new ways to get in without having to worry about being exposed or vulnerable.

If you should find a snake in the home, removal can be accomplished most easily by using long-handled implements, such as a flat-bladed shovel, scoop, or broom, to pick up the animal or sweep it into a deep container that has been laid on its side. It is possible to scoop up some snakes with a large-bladed shovel and physically carry them outdoors.

Individuals who have experience in handling snakes may be able to catch a nonvenomous snake by grabbing it immediately behind the head and carrying it outside. Wear gloves and a long-sleeved garment to reduce the likelihood of sustaining a bite. If there is any uncertainty about the identity of the snake, do not attempt to catch or handle the snake.

If a snake is suspected to be present, but is not immediately evident — or has gone into hiding before capture was possible — several options exist for homeowners. Snakes often will seek cover where warmth and humidity exist, such as around large appliances (e.g., washers, dryers, freezers, hot water heaters, or furnaces) and

computers and display monitors. A loosely clumped bath towel that has been lightly dampened and placed near an appliance where a snake is suspected of hiding sometimes will entice the snake to crawl out and move under the towel. If you are ready with capture tools, you often can sweep up the unsuspecting animal as you quickly lift the towel.

A capture device known as a glue board or glue box is available commercially and sometimes can be used to lure a difficult-to-catch snake from the hiding spot. A glue box for snakes is a long, rectangular, cardboard box with an opening at each end and an interior floor that has been coated with a strong adhesive. A snake that enters the box looking for cover becomes entangled in the glue and usually cannot remove itself. For especially large snakes, several rodent glue boards attached securely to a wooden plank and placed against an inner wall may be effective. Glue devices may provide an opportunity to capture and remove a difficult-to-catch animal using other means.

However, never throw a box or a modified glue board that contains a snake directly into the trash. **This is a tremendously inhumane act** that will result in a very slow death for the animal, and **it is illegal**.

Further, the people who process your trash might be exposed to potential danger should the animal's head remain free or it manages to free itself from the device while in the trash receptacle.

Once you have moved the container outside and away from the home, you can easily free the animal by pouring a very small amount of vegetable oil over the surface of the glue to neutralize its stickiness. The snake will be able to wriggle itself free.

Snakes in a Yard, Activity Area, or Public Space

The most effective way to minimize or prevent a chance encounter with a snake outdoors is to modify the habitat such that the snake no longer can fulfill its basic life needs easily. Basic life needs, in this case, refer to food, water, cover, and space. By manipulating the habitat around your home, you can make it difficult for a snake to survive there. Examples of actions that might be taken include:

1. Eliminate, remove, or relocate brush piles, refuse, stored building products, stacked firewood, or other materials that may provide useful cover and hiding spots for both snakes and the prey species they hunt.

2. Thin out or selectively remove weedy or overgrown patches of vegetation that may harbor small prey animals such as rodents and provide cover for hiding snakes.

3. In areas where small children or pets play, keep the grass well-mowed and maintain an expanse of well-cropped vegetation between the play area and the surrounding woods. Snakes usually do not like to be exposed in the open and away from cover.

4. To create a snake-free play area, encircle the area to be protected with a fine-meshed (1/8- to 1/4-inch) fence, about 36 inches in height, that has been dug into the ground so that no gaps exist (figure 5). The fence should be supported by stout posts driven into the ground on the inside of the protected area, but angled outward at about 30 degrees. Because of the outward slant of this design, any access gates incorporated in the fence must open inward. Some fenc-

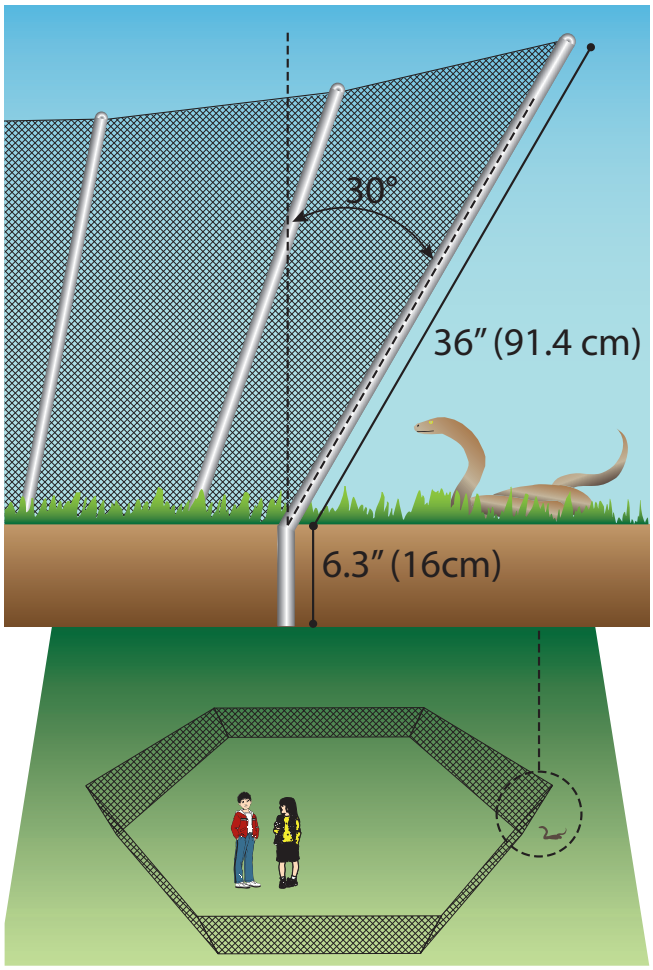

Figure 5. Perimeter fencing to restrict access by snakes.

ing experts recommend leaving extra fence material at the top of the device such that it can fold over to the outside of the fence and hang loosely at the top as an additional means of preventing the snake from getting over the top. Be sure that no vegetation comes in contact with or close to the fence as it may provide a means for access over the fence. Remember: snakes generally are skilled climbers.

Repellents

A number of commercially available products have been registered by the U.S. Environmental Protection Agency (EPA) for use as snake repellents. All of the currently registered products contain some combination of pulverized sulfur and naphthalene as active ingredients, and most are offered in a shakable powder or granular formulation. However, research conducted to investigate the effectiveness of these active ingredients has not demonstrated success in repelling snakes.

In its effort to eradicate the brown treesnake (*Boiga irregularis*), an especially troublesome exotic snake introduced into a number of Pacific Island ecosystems, the U.S. Department of Agriculture, Animal Plant and Health Inspection Service, Wildlife Services (USDA-APHIS-WS), investigated use of new snake repellents based on formulations containing mixtures of essential oils, including cinnamon, clove, and/or eugenol. Although hopes were high of discovering an effective repellent using these oils, field research proved otherwise (Kraus et al. 2015).

Recent research (Gallagher et al. 2017) examined the effectiveness of Milorganite, a reprocessed biosolid produced from municipal sewer sludge, as a snake repellent. Preliminary results from controlled field testing suggest that a repellent effect was detected on the species of snake used in testing (Eastern ratsnake), but further research was needed before this approach could be recommended.

Readers are reminded that use of any other ingredients or "home-brewed" snake repellents made from material for which an EPA product registration does not exist is a violation of federal law.

Toxicants

There are no chemicals or products registered or approved by the EPA to kill snakes. **Remember, it is illegal in Virginia to kill any species of snake**.

Assistance in Removing a Snake

If you are unable or unwilling to attempt the removal of a snake from your home or business, professional wildlife control operators may be available to assist you with this task. To determine who provides this service in your area, consult the list of certified wildlife control operators, listed by county, on the Virginia Department of Game and Inland Fisheries website: *www.dgif.virginia.gov/wildlife/nuisance/trappers/.*

Related Issue: Treatment of Snakebite

Recommendations on how best to treat someone who has sustained a snakebite have changed dramatically in recent years. Current recommendations for proper treatment, provided by health professionals at the National Institute of Health, can be obtained at *www.nlm.nih.gov/medlineplus/ency/article/000031.htm#First%20Aid*.

Acknowledgements

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