

## Snakes of Narrow Habitats

by Andrew M. Durso



*Thermophis baileyi*, one of two species of Tibetan Hot-springs Snake, the highest snake in the world, a native of the Tibetan Plateau. Photo by Kai Wang.

Many snake species are habitat generalists, such as the familiar North American ratsnakes, Australian tiger snakes, and European grass snakes. However, some snakes are so specialized, it's hard to believe. Here, I'll profile a few of the most specialized snakes (in terms of habitat) on Earth.

### Hot-spring Snakes

Everyone likes a good soak in a hot spring now and again, but imagine

spending your whole life in one! Now imagine being the size of a pencil and unable to regulate your own body temperature, and you're doing a pretty good approximation of a Tibetan Hot-spring Snake (*Thermophis*). These tiny snakes reach only 2.5 feet (76 cm) in length and are found at elevations above 14,000 feet (4267 m) on the Tibetan plateau in south-central China, higher than any other snake

known! Known to the native people of Tibet for centuries, hot-spring snakes were first discovered in 1907 by Lieutenant F. Bailey, after whom one of the two species was named. In 2008 a second species of *Thermophis* was discovered and named *Thermophis zhaoermii* for preeminent Chinese herpetologist Zhao Ermi.

One reason we know only a little about *Thermophis* is its high mountain habitat. Most of the mountain ranges in China run east-west, but the Hengduan Mountains, where Hot-spring Snakes are found, stretch north-south (the name "Hengduan" means "to transect" and "cut downward" in Chinese). Parallel north-south sub-ranges of the Hengduans are separated by deep river valleys through which flow the famous Three Parallel Rivers: the Nujiang (Salween), Lantsang (Mekong), and Jinshajiang

*continued on p. 4*

Three Parallel Rivers of Yunnan Protected Areas (red circle), in the region of the Hengduan Mountains, where Tibetan Hot-springs snakes live. Map from Wikipedia, created by Alan Mak.



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# Get Your June Photo Contest Calendar



Even if you live in the Southwest, odds are you've never seen this month's calendar beauty, the **Long-nosed Snake** (*Rhinocheilus lecontei*), as it hides out under rocks or in burrows during the day. Photographer **Rob Lovich** coaxed this one out long enough to pose for him. Our runner-up is easier to spot, but you wouldn't want to stand too close! Download your free June calendar at <http://parcplace.org/images/stories/YOS/YearoftheSnakeCalendarJune.pdf>.

## Call for Photos for the 2013 Year of the Snake Calendar Photo Contest

We are seeking close-up, digital photos of snakes, preferably in their natural habitats or within an educational or conservation context. One winner will be selected each month to be the featured photo as part of the Year of the Snake online calendar. Runner-up photos will also be included in the calendar. Additionally, all submitted images will be considered for use in the Year of the Snake monthly newsletter and website as well as other Year of the Snake-related conservation, outreach, and educational efforts. Give us your best shot! For more information and for entry details, please visit [http://parcplace.org/images/stories/YOS/YOS\\_Photo\\_Contest.pdf](http://parcplace.org/images/stories/YOS/YOS_Photo_Contest.pdf).

Year of the Snake outreach posters:  
Available at [www.yearofthesnake.org](http://www.yearofthesnake.org)!

### Have a Question? Ask the Experts!

Submit your snake questions via email ([parcyearofthesnake@gmail.com](mailto:parcyearofthesnake@gmail.com)) to our panel of snake experts, and we will select questions to answer in upcoming newsletters. Please include your name and location in your email message.

## More Year of the Snake Stamps



This month's featured Year of the Snake stamps are from the Philippines (left) and the tiny European nation of Liechtenstein (right).



# Year of the Snake Collaborating Partners



## The Association of Reptilian & Amphibian Veterinarians (ARAV)

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ARAV is advancing reptilian and amphibian medicine, surgery and conservation worldwide. The ARAV is an international professional organization with the goal of improving reptilian and amphibian husbandry and veterinary care through education and research. The ARAV promotes conservation and humane treatment of all reptilian and amphibian species through education, captive breeding, and habitat preservation.

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The Copperhead Institute is governed by Directors and a Scientific Advisory Panel. The mission of The Copperhead Institute is to develop and conduct original field- and laboratory based scientific research on the ecology and evolutionary biology of snakes; to disseminate our findings to the scientific community through peer-reviewed publications (e.g., journals, book chapters) and presentations at scientific meetings; to promote the public conservation of snakes through publication of popular articles and educational materials, and through informal and formal educational presentations; and to support the intellectual growth and research goals of graduate and undergraduate students in pursuing a research career.



## North Carolina Partners in Amphibian and Reptile Conservation (NCPARC)

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The Mission of NCPARC is to conserve amphibians, reptiles and their habitats as integral parts of North Carolina's ecosystems and culture through proactive and coordinated public/private partnerships.

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TWH is dedicated to providing news, facts, and educational information about amphibians and reptiles. TWH believes in conservation through education. Our goal is to dispel misplaced fears and myths about amphibians and reptiles and to encourage people to learn more about these fascinating organisms.



Our growing list of Collaborating Partners will be featured in future newsletter issues.

If you are interested in contributing to the Year of the Snake efforts, please send an email to [parcyearofthesnake@gmail.com](mailto:parcyearofthesnake@gmail.com) with a brief description of your organization and its efforts. Our full list of partners can be found at: <http://www.parcplace.org/news-a-events/2013-year-of-the-snake/271.html>.

### Are You an Educator or Interpretive Naturalist?

We are working to create resources for teachers and naturalists! If you are willing to share, please send your unit materials, educational program information, or PowerPoint presentations to [parcyearofthesnake@gmail.com](mailto:parcyearofthesnake@gmail.com). Please include your name, the name of your school/nature center or organization, and location. If you did not create the materials, please be sure to tell us where you found the materials.

**Snakes of Narrow Habitats**, *continued from p. 1*

(Upper Changjiang or Yangtze). *Thermophis baileyi* is distributed west of the Salween, whereas *T. zhaovermii* is distributed east of the Changjiang. Geologic uplift of the intervening region of southern Tibet began about 20 million years ago, about the same time as the divergence between the two extant species of *Thermophis*.

Although the advantages of living around hot springs at high altitudes, where the temperature is relatively stable, seem pretty obvious for a reptile, recent surveys by Ding-qi Rao found that Hot-spring Snakes also live in fields and other areas far from hot springs, suggesting that the species' ecological niche is wider than previously thought. This is fortunate, because global climate change will likely continue to cause mountaintop habitats around the world to shrink, necessitating a shift upward in elevation by high-altitude species in order to follow their habitat. This problem has been documented for pikas and for birds and will likely affect Hot-spring Snakes too. Because the ability of mountaintop species to disperse to higher mountain ranges is limited, many may go extinct. Will we one day see the top of Mount Everest as the last foothold for Hot-spring Snakes? Let's hope not.

Read more about hot-spring snakes online [here](#).



Fea's Pitviper (*Azemiops feae*). Photo by Patrick Prevost.

### Fea's Pitless Pitvipers

Late one spring night in 1887 in the Kakhyen Hills of Burma, 35-year-old Italian explorer Leonardo Fea found a snake of indescribable beauty. It was shiny, dark purplish-black and marked with thin, widely-spaced neon-orange bands so bright they almost looked white. The head bore a striking symmetrical pattern of orange, gold, and black. It appeared to be a harmless colubrid, and luckily for Fea, he wasn't bitten, so he had no opportunity to find out that it wasn't.

Note the shape of the head. Fea's Viper photo by Patrick Prevost.



The enigmatic "pitless pitviper," Fea's Viper (*Azemiops feae*) looks almost nothing like other vipers, with its elliptical head, enlarged head scales, and smooth dorsal scales. In fact, it is so unusual that at times it has been classified as an elapid or a colubrid instead, of which its enlarged head scales in particular are reminiscent. Morphological and molecular evidence point to an ancient relationship between Fea's Viper and other Old World vipers ("viperines"), which last shared a common ancestor over 56 million years ago. Rather, Fea's Viper is more closely related to the crotaline vipers, or "pit vipers", a predominantly New World clade that includes rattlesnakes, copperheads, and bushmasters (although even from these it is distinct, having diverged over 32 million years ago). Although there are a few other Asian crotalines, such as *Hypnale* and *Trimeresurus*, even these are more closely related to their New World counterparts than they are to Fea's Viper, all sharing an infrared-sensitive facial pit. Indeed, Fea's Viper occupies a lonely branch of the snake family tree.

We know a little of the natural history of Fea's Viper. It is found primarily in karst systems in the tropical uplands of northern Burma, northern Vietnam, and south-central China. Adults are active predominantly during cool, rainy summer nights, when they move slowly through deep leaf-litter in bamboo and tree-fern thickets interspersed with well-lit clearings. They spend much of their lives in the holes and crevices of karst outcrops and in open and underground streams. Juveniles are most active on cool, wet fall nights. Like other vipers, Fea's Viper hibernates in winter, so presumably they are fairly predictable in space and time when entering and leaving their hibernacula. Only a few prey items have been recorded, all of which have been rodents and shrews abundant in karst outcrops associated with swift mountain streams, although these snakes will also eat geckos in captivity.

Fea's Vipers are rare and difficult to keep in captivity.

In keeping with their specialized microhabitat preferences, observations of captive individuals indicate that these snakes do not tolerate dry conditions. Many develop skin problems when maintained at less than 100% humidity. Ideal temperatures are between 60 and 68°F, surprisingly cool for a reptile. In the words of one reptile keeper, they are “so boring & difficult to keep” that he sent his off to a zoo. If widely held, this sentiment may actually bode well for Fea’s Vipers if it renders them unlikely to become overcollected for the pet trade.



*Azemiops* habitat in southeast Asia. Photo by Kevin Messenger.

How dangerous are Fea’s Vipers? Few bites have been reported, but these are described as “mild”, causing few serious consequences. There are similarities between Fea’s Viper venom and that of viperines, especially Wagler’s Temple Viper, except that *Azemiops* venom has no blood clotting, hemorrhagic, or muscle-destroying activity. The venom gland itself is similar in morphology to a viperine’s, but Fea’s Viper fangs possess a ridge at the tip and a blade on the back seen only in some opisthoglyphous and atractaspid snakes. One venom component, dubbed azemiopsin, has been identified as a potential model in neurotransmitter research, adding to the pharmacopoeia of medicinally-useful compounds found in snake venom. Although discovered 125 years ago, Fea’s Viper has much still to teach us about evolution, neurology, and much else. Let us hope we can learn from it.

Read more about Fea’s Viper online [here](#).

## Round Island Splitjaw Snakes

Round Island is a herpetologically interesting volcanic islet, just over half a square mile in size, located approximately 14 miles (22.5 km) NNE of Mauritius, in the Indian Ocean east of Madagascar. Round Island and Mauritius are part of the Mascarene archipelago, which formed between 35 and 2 million years ago as a result of

the Réunion seafloor hotspot. Before the 16th century, no humans inhabited the islands, which were covered in unique tropical moist broadleaf forest. All Mascarene flora and fauna arrived by oversea dispersal, possibly using prehistoric islands of the Mascarene plateau, now submerged by the sea, as ‘stepping stones’. Round Island is home to an endemic skink (*Leiopisma telfairii*) and an endemic day gecko (*Phelsuma guentheri*), both food for an unusual and highly specialized snake, the Round Island Keel-scaled Boa, *Casarea dussumeri*.

Not to be confused with the unfortunate Round Island Burrowing Boa (*Bolyeria multocarinata*), which was last seen in 1975, the Round Island Keel-scaled Boa is still with us, just barely. In 1996, less than 250 adult individuals remained alive, although recent captive breeding efforts have raised that number to about 1000 in spite of the difficulty of coercing these snakes to eat anything other than the endangered skink and gecko they have evolved a taste for. Together, *Casarea* and *Bolyeria* made up the strange and intriguing family of snakes named the Bolyeriidae. Although they’re sometimes called ‘boas’, they are distinct from the Boidae, or true boas, in not having any vestiges of a pelvic girdle. In fact, they are probably more closely related to the advanced snakes (Caenophidia) than to the true boas, although their phylogenetic relationships to other snakes are not quite certain. Some have advocated calling them ‘splitjaw snakes’ instead of boas, a name that describes their uniquely hinged upper jaw morphology. Due to their remote range and the extirpations they have suffered, few herpetologists have been lucky enough to see a living specimen, especially a wild one.

Both species of splitjaw snakes used to be found on Mauritius and other nearby islets, from which they were first extirpated. Their specialized microhabitats



Round Island Keel-scaled Boa, *Casarea dussumeri*. Photo by JJ Argoud.

included underneath fallen palm fronds and in the burrows of nesting pelagic birds such as shearwaters and petrels. Round Island Keel-scaled Boas reach 1 to 1.5 m in length. As with many snakes, their color changes with age, from orange to brown, but unusually it can also change from light at night to dark during the day, reminiscent of another island-living boa, the

Hog Island race of *Boa constrictor* from Cayos Cochinos in Honduras. We may hope that this interesting phenomenon, and other aspects of the natural history, ecology, and evolution of this unique snake, can be studied by generations of future snake biologists.

Read more online about splitjaw snakes [here](#).

## The San Francisco Gartersnake

by Tammy Lim



The brilliant colored San Francisco Gartersnake, *Thamnophis sirtalis tetrataenia*. Photo by Holly Berger.

The Common Gartersnake (*Thamnophis sirtalis*) is a widely distributed species that occurs across much of the temperate regions in North America. Taxonomists currently recognize 12 subspecies of the common gartersnake, identified mostly by color and geography (Rossman et al. 1996). One of these subspecies, the San Francisco Gartersnake (*Thamnophis sirtalis tetrataenia*), is famously described as “one of the most beautiful serpents in North America” (Stebbins 2003). These snakes feature a striking combination of red and black dorsal striping, red head, and turquoise venter (Stebbins 2003). These colors are bright and contrasting, yet on a snake retreating through grass and heavy vegetation, they all but disappear. The exact mechanism for and the evolutionary advantage the coloration provides is unknown. The distribution of this color morphology, however, is highly restricted.

The San Francisco Gartersnake’s entire range is limited to coastal marshes, wetlands, and reservoirs found on the San Francisco Peninsula in Northern California. The common name is somewhat of a misnomer; these snakes have never been confirmed to occur in the city of San Francisco proper, rather occurring from just south of

the San Francisco County line throughout San Mateo County to northern Santa Cruz County (Fox 1951). Though there are no significant geographic barriers to the south, San Francisco Gartersnakes are restricted to the peninsula.

The subspecies’ nearest conspecific is the California Red-sided Gartersnake (*T. s. infernalis*) which borders the San Francisco Gartersnakes’ range on all sides. Another subspecies, the Valley Gartersnake (*T. s. fitchii*), occurs in the Central Valley to the east. The California Red-sided Gartersnake is distinguished from the striped San Francisco garter snake by a checkered pattern. Common Gartersnakes are known to be a wide-ranging species, capable of moving long distances. How such a distinctive color morphology formed and persists in the absence of a geographic barrier to the south seems implausible, given the species’ ability and propensity to travel and disperse.

San Francisco Gartersnakes’ high level of endemism may, in part, be explained by the distribution and isolation of their preferred habitats. San Francisco Gartersnakes evolved in a series of sag ponds along the San Andreas Fault (Barry 1994). In geologic time, the lives of these freshwater pools—whose formation is tied to fault lines—were probably rather brief. Seismic activity would create sag ponds, which would gradually fill with sediment and vegetation, eventually returning to a meadow. As these ponds were formed and filled, San Francisco Gartersnakes would presumably wander, colonizing suitable habitat where available.

San Francisco Gartersnakes are habitat specialists: they require ponds, drainages or pools with a thick cover of vegetation that they can retreat to; associated upland habitats with rodent burrows to serve as winter hibernacula; and a prey base comprising primarily frogs. During the winter, these snakes retreat to hibernacula, spending the cool, temperate winters largely

underground. When they emerge in spring, they feed on larval and metamorphosed frogs. Adults feed and mate during the spring and females give birth to live young in late summer and early fall.

Large populations of the subspecies once inhabited a series of sag ponds south of the city of San Francisco. Mid-century, Wade Fox, a UC Berkeley herpetologist, described large numbers of San Francisco Gartersnakes in these ponds, often foraging on the also abundant California Red-legged Frog (*Rana draytonii*). He collected hundreds of San Francisco Gartersnakes and documented their behaviors and habitat specificity.

The next few decades were marked by rapid urban expansion along the San Francisco peninsula. In the 1960s, a new highway and housing developments were built where the sag ponds once lay. The loss of these populations was significant, and these factors, in conjunction with habitat fragmentation and degradation, and an increasing interest and illegal collecting for the pet trade, imperiled the San Francisco Gartersnake across its range. Robert C. Stebbins, another UC Berkeley herpetologist suggested that San Francisco Gartersnakes be added to newly minted Endangered Species Act (ESA; Barry 1994). In 1971, the snake was listed as endangered, one of the first subspecies and the first snake to secure protection under the ESA.

Today, the San Francisco Gartersnake is protected under both federal and state Endangered Species Acts. Its primary prey species, the California Red-legged Frog, is itself listed as federally threatened. The extensive loss of wetland habitats contributed greatly to the decline of both species. Though illegal collecting of snakes for reptile collectors is suspected to still be an issue, many of the known populations of San Francisco Gartersnakes are protected, monitored, and managed. There have been times when the management of their habitat has resulted in heated debate and controversy, but at the end of the day, this debate is indicative of the fact that people care enough to argue.

Some of these populations occur in relatively pristine and remote, protected lands owned by land trusts. Others occur on state and federal park lands with



Basking San Francisco Gartersnake. Photo by Tammy Lim.

recreational access. One population is bordered by a public golf course, a residential area, and a federal park. Another, and in fact, one of the largest populations, occurs in an area surrounded by an extensive urban matrix. At this site, the wetland habitats are hemmed in on all sides by a freeway, an airport, and homes. Beneath this habitat is a criss-cross of gas lines, sewer lines, electrical systems and above, a raised rail line extends public transportation to the airport. Yet amid all this, the snakes persist.

Some may see this as a loss—that wild animals should be in wilderness. But the story of the San Francisco Gartersnake, though not a romantic one, is one of hope and reality. Through the efforts of academics, land managers, water department regulators, city airports, agency representatives, biological consultants, and zoos, the San Francisco Gartersnake has been able to carve out an existence in one of the largest metropolitan areas in the county.

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# Snakes in the Sky Islands of Sonora

by Thomas R. Van Devender, Sky Island Alliance, Tucson, AZ



Brown Vine Snake (*Oxybelis aeneus*), Sierra Aconchi, September 2012. Photo T.R. Van Devender.

Since the 1960s, herpetologists have trekked to southeastern Arizona mountains following the lure of Mexican rattlesnakes. The Madrean Archipelago is the region of Sky Island mountain ranges crowned by oak woodland and pine-oak forest between the Sierra Madre Occidental in Sonora and Chihuahua and the Mogollon Rim in central Arizona. Wondrous diversity reflects the convergence of five biotic provinces: the cold temperate Rocky Mountains-Colorado Plateaus forests to the north, the grasslands and Chihuahuan desertscrub to the east, Sonoran desertscrub to the west, and New World tropical vegetation and tropical temperate forests of the Sierra Madre Occidental to the south. The transition between the New World tropics and the northern temperate zone is at about 29°N in east-central Sonora, and foothills thornscrub reaches 30°30'N in the Ríos Bavispe and Sonora valleys. Quite a few thornscrub species, such as Brown Vine Snake (*Oxybelis aeneus*), Green Ratsnake (*Senticolis triaspis*), and Thornscrub Hook-nosed Snake (*Gyalopion quadrangulare*), cross the border into southern Arizona in desert grassland-oak woodland ecotone.

Chihuahuan Ridge-nosed Rattlesnake (*Crotalus willardi silus*), Sierra Aconchi, September 2012. Photo T.R. Van Devender.



In 2009, the Madrean Archipelago Biodiversity Assessment (MABA) program was initiated by Sky Island Alliance to document animals and plants in Sonora for conservation, research, and education. Observations and images are available on line in the MABA database ([madrean.org](http://madrean.org)). New observations were made on MABA Expeditions to the Sierra San Luis, Sierra el Tigre, Sierra la Madera, Ciénega de Saracachi-Sierra San Antonio, Sierra Bacadéhuachi, and the Sierra Aconchi.

There are 46 species of snakes in the Madrean Archipelago, with 41 species in Arizona and New Mexico and 39 species in Sonora, but fewer species in individual Sky Islands. In the Yécora area in the Sierra Madre Occidental there are 39 species, with a total of 59 species in the Sky Islands and the Sierra combined. Species turn over from north to south as desert grassland merges into thornscrub, and diversity increases in tropical southern Sonora and in the Sierra Madre Occidental.

Noteworthy snakes encountered on MABA Expeditions include the small, secretive Chihuahuan Black-headed Snake (*Tantilla wilcoxi*) in the Sierra



Tarahumara Mountain Kingsnake (*Lampropeltis pyromelana knoblochi*), Sierra Bacadéhuachi, September 2011. Photo T.R. Van Devender.



Chihuahuan Earth Snake (*Geophis dugesi aquilonaris*), Sierra Bacadéhuachi, September 2011. Photo T.R. Van Devender.



Bacadéhuachi, the Southwestern Black-headed Snake (*T. hobartsmithi*) in the Sierra la Madera, and the Yaqui Black-headed Snake (*T. yaquia*) in the Sierras Aconchi and El Tigre, and the Patagonia Mountains, Arizona. Widespread Madrean snakes such as Ridgenosed Rattlesnake (*Crotalus willardi*) and Sonoran Mountain Kingsnake (*Lampropeltis pyromelana*) have been encountered in several ranges. The Chihuahuan Earth Snake (*Geophis dugesi*) in the Sierra Bacadéhuachi was a 165-km northern range extension of a rare montane Madrean species. File-tailed Ground Snake (*Sonora aemula*) in the Sierra la Madera was a northern range extension of 150 kilometers for a lowland tropical species. Boa Constrictor (*Boa constrictor*) in the Magdalena Palm Canyon was only 95 km south of the Arizona border. Tropical Whipsnake (*Coluber mentovarius*) in the Sierra Azul is only 57 km south of the Arizona border. Prairie Rattlesnake (*Crotalus viridis*) in the Animas Valley at the base of the Sierra San Luis was the first Sonoran record for a northern species. The MABA observations are important and exciting, but snakes are so secretive and seasonal that lots of fieldwork is needed to further document the snake fauna of the Madrean Archipelago.



Tropical Whipsnake (*Coluber mentovarius*), near Álamos, September 2007. Photo by S.A. Meyers.



Boa Constrictor (*Boa constrictor*), west of Río Yaqui, November 1997. Photo T.R. Van Devender.



File-tailed Ground Snake (*Sonora aemula*), Sierra Agua Verde, January 2012. Photo E.F. Enderson.

### Submit Your Citizen Science Projects

A compilation of snake citizen science (volunteer) inventory and monitoring projects has begun. These will be featured in our monthly newsletters. Send any information on these types of projects to [parcyearofthesnake@gmail.com](mailto:parcyearofthesnake@gmail.com).

### Submit Your Snake Art, Stories, and Poetry

Submit photos of your snake art (jpg, tiff, or pdf files) and copies of your stories and poems via email to [parcyearofthesnake@gmail.com](mailto:parcyearofthesnake@gmail.com). Please include your name, location, and any comments about the submission in your email message. We will select submissions to include in upcoming newsletters.

# *Ophidiomyces ophiodiicoli* (formerly *Chrysosporium*) infection in Eastern Massasaugas

by Matt Allender, DVM, MS, PhD, Diplomate American College of Zoological Medicine

Facial disfiguration syndrome was first observed in massasaugas (*Sistrurus catenatus*) from Illinois in 2006, and has been seen in several individuals since from the same population. Lesions appear on the face (Figure 1) and rarely along the back. To date, the mortality rate of infected individuals has been 100% in this species. Infections with fungal organisms are not uncommon in wildlife populations, as we have seen during outbreaks of chytridiomycosis in amphibians and white-nose syndrome in bats (caused by the fungi *Batrachochytrium dendrobatidis* and *Geomyces destructans*, respectively). Similar to outbreaks in those species, population sustainability in snakes may be threatened. However, the impact of this pathogen(s) and risk to healthy populations requires further research.

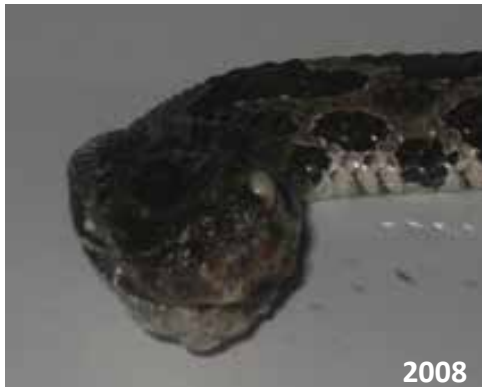


Figure 1. Eastern Massasaugas from Carlyle, IL, infected with *Ophidiomyces* (formerly *Chrysosporium*).

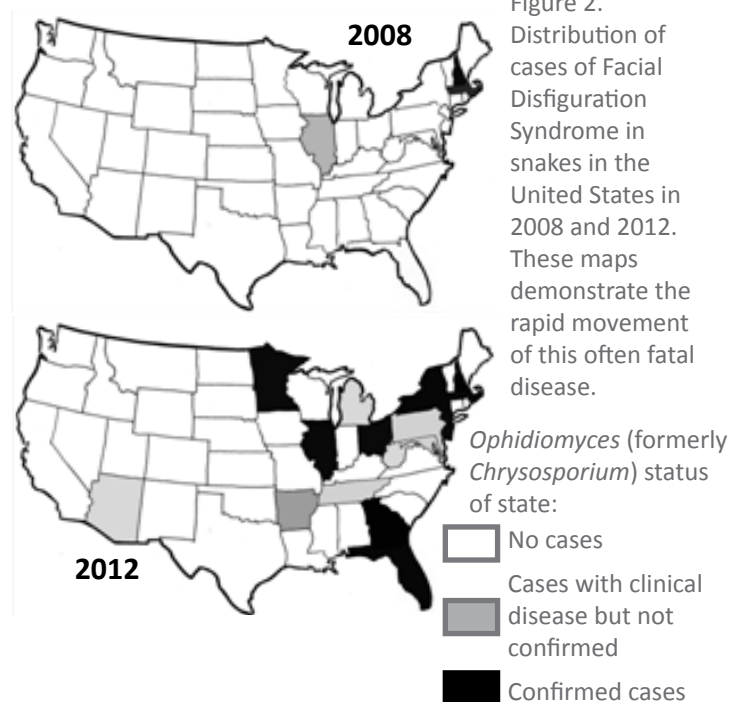


Figure 2. Distribution of cases of Facial Disfiguration Syndrome in snakes in the United States in 2008 and 2012. These maps demonstrate the rapid movement of this often fatal disease.

*Ophidiomyces* (formerly *Chrysosporium*) status of state:

- No cases
- Cases with clinical disease but not confirmed
- Confirmed cases

To date, clinical signs consistent with facial disfiguration syndrome have been observed in nine species from thirteen states. Reports have increased in the last two years, but it is unclear whether this reflects an increase in disease or just the increase in recognition of disease (Figure 2).

One of the keys to determining infection is to develop accurate diagnostic methods, which would enable population health monitoring and provide early diagnosis of disease. However, these methods are lacking at present, partly due to the fact that more than one pathogen may be playing a role in disease. Current methods of diagnosis rely on biopsy collection as the only mechanism to confidently identify the disease. And even in these cases, the results are only reported as present or absent. Other methods to assess presence of disease include swabs, flushes, fungal culture, PCR, hematology, and plasma biochemistries: none of these methods have so far been helpful or reliable in detection of the pathogen.

Treatment has not been successful in massasaugas, but supportive care under the direction of a veterinarian has been successful in several Timber Rattlesnakes (*Crotalus horridus*) cases. If suspected cases are observed, consultation with a wildlife disease specialist or wildlife veterinarian familiar with this disease is recommended.

## Behavior Unknown

by Vince Cobb and Eric Nordberg, Middle Tennessee State University, Murfreesboro, TN



Figure 1. Facial swelling of a *Crotalus horridus* infected with *Chryso sporium*. Photograph by Vince Cobb.

Monitoring wildlife disease can often be a difficult task for researchers because only a small subset of the population may be exposed or exhibiting signs of infection. For many animal species, it may be difficult enough just to obtain an appropriate sample size to monitor normal behavior, let alone separate treatment groups of sick or diseased individuals. Recently, the discovery of a snake fungal infection, suspectedly caused by *Chryso sporium* spp., has been documented in certain populations of pit vipers and colubrids across the midwestern and northeastern United States. *Chryso sporium* appears to spread in the subcutaneous tissue and causes facial swelling and lesions on the skin of infected snakes. This infection can progress rapidly and is associated with a high mortality rate in some snake species (i.e., Massasauga, *Sistrurus* spp.). However, other species appear to be able to survive, at least for a while. It's these infected survivors that may provide useful information on how this disease is leading to their detriment or possibly how individuals are able to fight off the infection. Discussions of this emerging disease have led to speculation that infected snakes may be behaving differently, such as altering their thermoregulatory behavior. Just as disease monitoring may be difficult, so is the interpretation of "normal" behavior amid all the individual variability.

We have been monitoring the behavioral ecology of a small population of Timber Rattlesnakes (*Crotalus horridus*) in Middle Tennessee. In November 2012 one of our telemetered snakes showed facial anomalies

(Figure 1) and tested positive for *Chryso sporium*. We monitored the body temperature of this and other *C. horridus* through the winter. The infected snake survived the winter and is being monitored this year as well; it tested positive again this spring. While we cannot make any conclusions with one individual, we did notice more mid-winter activity by this animal than by the other snakes. From continuous body temperature records, we know this snake emerged from underground 18 times on warm days throughout winter and traveled over 166 meters around the hibernaculum area. Other *C. horridus* averaged about 4 (primarily subterranean) movements and 25 meters. During one aboveground event, the infected snake was observed basking 1.5 m off the ground in a small Eastern Redcedar (Figure 2).

Although arboreal behavior and mid winter basking in *C. horridus* are less common behaviors, we don't know if it is associated with any illness. It is not known to what extent this fungal infection influences snake thermoregulatory behaviors, but if you omit the winter basking, this snake selected body temperatures similar to the other hibernating snakes. To avoid anecdotal cause and effect association, we hope other researchers may be able to monitor infected individuals so that any "real" trends can be identified. As of the writing of this article, we have another telemetered rattlesnake that we suspect will test positive as it is now exhibiting the characteristic facial anomalies. In conjunction with the Tennessee Wildlife Resources Agency, we plan to continue to monitor the behavior and health of this population.



Figure 2. *Crotalus horridus* infected with *Chryso sporium* basking in an Eastern Redcedar in late January in Middle Tennessee. Photograph by Eric Nordberg.

## Disease Management at OCIC

by Courtney Torregrosa,  
the Orianne Society



The OCIC Health Care Center in Lake County, Florida. Photo by Courtney Torregrosa.

The Orianne Center for Indigo Conservation is a carefully managed captive-breeding facility for The Orianne Society. The staff who work here all have backgrounds in professional, captive, reptile husbandry. We follow the guidelines of the American Zoo and Aquarium Association (AZA) for quarantine and husbandry. An important part of keeping a large collection of snakes is disease control, and we have a unique concern among captive breeders in knowing that the indigos produced here will, potentially, become wild. This means we want them to be as fit and healthy as possible.

The OCIC staff follows the AZA quarantine protocol; every animal that comes to us is held in a quarantined building for about four months before being moved to live with the rest of our collection. During that time they are monitored and tested for intestinal parasites, viral and bacterial diseases, skin fungi, and any other odd or unusual symptoms that may indicate a disease that could be vectored to our other animals. Monitoring includes a base-line blood draw, fecal testing, and physical exam. If anything presents itself, the veterinarians from the University of Florida Zoo Med program guide us as to what medications to offer or any special care an animal may need. Animals that are collected from the wild are of particular concern, as they have more potential to be carriers for disease. They also need to be monitored behaviorally to be sure they make a smooth adjustment to captive life. Most do well and clear quarantine in time. There are a few stragglers that have needed some extra attention due to slow feeding, slow growth, or continued parasite loads. These individuals stay in their quarantine and continue

to receive special attention until they are deemed clear. Animals in the main collection that become ill are moved and monitored until they are healthy enough to return. When the quarantine period is over, for most animals, they are moved to the Herpeterium or to the outdoor enclosures as part of our main animal collection.



Above: One of the racks housing young captive Eastern Indigo Snake specimens at the OCIC. Below: A close-up of an open rack with a young Eastern Indigo Snake coiled in it, showing how calm the captive specimens are in the racks. Photos by Courtney Torregrosa.



Most of OCIC's snake collection live in well-managed racks. These racks are specially designed to hold the most snakes in a compact space. Don't worry, they have plenty of room to move and behave normally. However, it's kind of like living in a college dorm, everyone is sharing air and in some cases, surfaces with the others in the unit. What would happen if a vector was introduced to that rack? Well, in any captive setting, but especially with a valuable collection like the one we have at OCIC, it could be disastrous. Animals housed at OCIC are



Venomous enclosures housing Eastern Diamondback Rattlesnakes and Timber Rattlesnakes at the OCIC. Photo by Courtney Torregrosa.

checked on daily, including the venomous snakes. Most of the time it is as simple as opening an enclosure, looking at the snake, cleaning the tub and/or water bowl, and replacing it; but it can be as complicated as removing the animal, treating for any ailments, or looking for signs of a gravid female. Daily care is a great way to spread unseen vectors, so simple hygiene is often the best preventative. Knowing the animals and being able to notice if one is behaving differently, holding his body in an unusual position, producing any unusual fluids, sounds, or has changes in the skin, eyes or membranes is absolutely key. Luckily for snake keepers, most only eat once or twice a week—in some species, once a month! Indigos have proven to have a higher metabolism than most other colubrids, and are quick to pass what they eat. A great way to maintain care is to monitor not only what they take in but also what they put out! If any problem should arise, the individual can be moved back to quarantine until they are done with treatments. The enclosure they inhabited is cleaned with Roccal (mild but effective disinfectant) and bleached. Usually that particular enclosure is left dry for a while before either the animal is healthy enough to move back, or it is sufficiently disinfected a second time and a new animal can move in. This is true for the enclosure itself as well as any props (logs, branches, hide-boxes) or water bowls, and substrate is thrown away and completely replaced.

We have twelve state-of-the-art Indigo enclosures that are open to the elements, including spiders, anoles, tree frogs, and bird droppings. These are all a veterinarian's nightmare. Exposing wild animals to a collection not only potentially infects the animals being held, but also could possibly vector captive diseases to the wild population. Daily water changes prevent anything

funky from growing in the bowl, and weekly water-bowl bleaching keeps bacterial, fungal, and viral vectors at bay. The substrate is not changed completely, but spot cleaning and regular raking prevents growth that would easily breed unwanted pests. Also any droppings that are left behind by unexpected guests are cleaned out regularly. One of the treats of these outdoor spaces is the opportunity to watch how the Indigos behave in a relatively large outdoor setting. We have observed climbers, diggers, aggressive displays, courtship, and daily basking and hiding. Again, watching and keeping track of these behaviors is often the first way to notice if a disease is starting to develop, but it also is showing us how the changing of the seasons changes the way each animal behaves. For example, spending more time in their hibernacula, or 'bunker' as we call them, in the fall and winter is nothing to be concerned about. But that same behavior in the warmer months could mean they are getting ready to shed their skins.



The inside of one of the outdoor enclosures housing an Eastern Indigo Snake at the OCIC. The outdoor enclosures allow these specimens to receive all of the environmental stimuli they would receive naturally in the wild. Photo by Courtney Torregrosa.

OCIC takes pride in having a fit and healthy group of snakes that will be around for a long time. These animals represent The Orianna Society's mission to conserve many different species, including the Eastern Indigo Snake. Health management is and will continue to be a part of our daily routine. Most importantly, keeping healthy animals produces healthy animals that can help supplement the wild population.

# An Interview with Robert Weaver

By Dede Olson  
US Forest Service



Robert Weaver (a.k.a. Dr. Nightsnake) of Central Washington University, Ellensburg, Washington, is pointing at a Gopher Snake while talking to his Herpetology class. Photographer unknown (CWU student photographer).

In the US Pacific Northwest and western Canada, if you mention snakes, Dr. Robert Weaver comes immediately to mind. Dr. Weaver is a member of the faculty in the Department of Biological Sciences, Central Washington University, Ellensburg, WA. He's become our go-to guy for snake information, inventory and monitoring approaches, and conservation issues. In particular, his expertise focuses on the 'east-side' fauna, meaning east of the Cascade Range in the Columbia River Basin. He works on the behavioral ecology of many snake species, but is especially renowned for his expertise with cryptic species such as the Sharp-tailed Snake, *Contia tenuis*, and the Desert Nightsnake, *Hypsiglena chlorophaea*. His favorite group of snakes is the Nightsnake group, inclusive of the Cat-eyed Snakes (the genera *Leptodeira*, *Cryophis* and *Tantalophis*). At last year's World Congress of Herpetology, located here in the northwest, he was "Dr. Nightsnake"!

Dr. Nightsnake with his "name-snake" during an evening of road cruising in eastern Washington. Photographed by Ed Meyers.



When I asked him how he became interested in snakes, his eyes lit up as he recalled his first encounter. "I was 5 years old living near Tri-Cities [Kennewick, Pasco, and Richland, Washington]. I saw what appeared to my young eyes as a monstrous 10-foot long Gopher Snake. I grabbed it and it started biting me. My mom was so scared of snakes; I knew that I was onto something! Between ages 5 and 8, everything took off. We moved from Tri-Cities to Yakima [Washington]. I would bring home duffel bags of gartersnakes from around the fish hatchery there. I'm pretty sure I colonized our neighborhood, and to this day, gartersnakes are there because of me. I caught my first rattlesnake when I was about 10 or 11 years old. We were at Moses Lake, and my brother wouldn't let me approach it, but I caught it with a make-shift snake hook and a Folgers coffee can." Such childhood exposure and immersion in herpetofauna are often the defining moments of passions that last a lifetime. These stories have been echoed many times among today's specialists.

Robert Weaver showing off a Gopher Snake in eastern Washington. Photographed by Kendra Weaver.



Robert was quick to respond when I asked him about the value of snakes. He said that there are two ways to define that. First, we can consider their economic value: "There is no better rodent trap." I wondered if anyone had ever done an economic estimator for snakes, and he recalled an estimate from about the 1930s for Gopher Snakes: \$35/snake in terms of loss of agricultural resources. That would likely translate to hundreds of dollars today, if not thousands. Second, Robert explained the value of snakes as an organism. "The evolutionary biology of a snake is exquisite," he

said. They are unique in how they move, and how they swallow. And although they share their limblessness with a few other taxonomic groups, as a large group, their lack of legs has proven to be a world-wide adaptive strategy.

Our conversation turned to conservation. “Like any other species, habitat loss and degradation are the biggest threats to snakes,” he said. The public can help with snake conservation in several ways, he thought, with education being a top priority. Since snakes are secretive, if the public knew more about them and what to do with them upon encountering them, then they could contribute to their conservation more effectively. They could help add to our knowledge of their distribution by adding localities to our databases and atlases. Education is especially needed to reduce fear of snakes. He advises interested people to just “jump in” and learn about snakes, find information about them online, read books, and then find them in the field, try to understand their natural history and try to learn more about them by observing them in nature. Robert says that he has been making special efforts in conservation education by working with PARC and doing outreach to raise awareness for snakes. But to make great advances in conservation, institutional support is needed. “If funding sources would realize the importance of basic natural history information, then we could really make progress for snake conservation. We really don’t know much about snakes,” he said.



Robert Weaver providing an educational moment with a rattlesnake: “It was the calmest, “tamest” adult male [*Crotalus oregonus*] I have ever encountered.” Photographed by Ben Tomscheck.

As I glean his CV, I see that Robert has 20 journal articles on herpetofauna since 2007, with 10 papers since 2010! I can readily see a theme emerging. Robert is indeed Dr. Nightsnake, with 9 papers on this taxon in the last 7 years. Although Robert Weaver may be a new name for many readers here, he is an emerging northwest Super Star—making a difference through his scientific advances in snake life history, and his dedication to conservation and education.

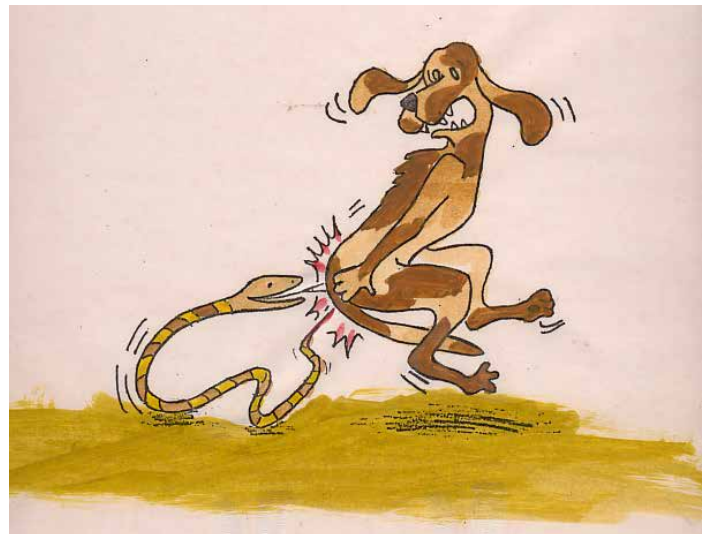
## Snake Myths

by Carrie Elvey,  
The Wilderness  
Center

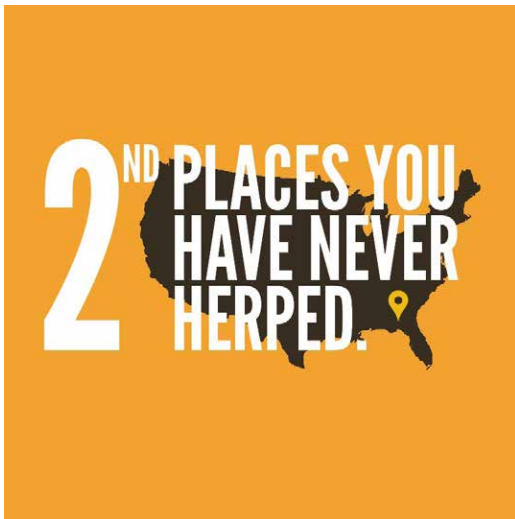
Because of their unique lifestyle, snakes are prone to being the subject of myth and legend. Some of these myths have a kernel of truth, others have no discernible origin. Read on to learn the truth about these myths.

### **Myth:** Snakes Sting Enemies with Forked Tongues and Pointed Tails

**Facts:** Snakes don’t have “stingers” on either end. The soft, flicking tongue is used in odor detection and the tail is just that—a tail. Some snakes (wormsnakes) do have hardened, pointed scales on their tails. However, these scales do not have venom and are not dangerous.



Artwork courtesy of The Wilderness Center



## Join the Orianne Society for the 2nd Places You Have Never Herped

**When:** June 15-16, 2013

**Where:** The North Georgia Mountains (rendezvous at Tallulah Gorge State Park)

Want to contribute to reptile and amphibian conservation and fulfill your competitive nature at the same time? Then come join us for the 2nd **Places You Have Never Herped** Event in beautiful north Georgia.

We are asking our herping friends to help us perform a bioblitz on a tract of land identified as a potential Priority Amphibian and Reptile Conservation Area (PARCA). Identifying priority conservation areas for biodiversity protection is an important strategy for conservation

planning, but efforts to identify these areas are lacking for herpetofauna. Recently we developed the first draft list of PARCAs for the southeastern United States, including Georgia. Now we need your help to validate our findings in the field.

Attendees will be broken into teams once the event is underway. Each team will be led out into the field by an Orianne Society staff member. For two days you and your team will search for herps and record your findings and location data. The winning team will be the one that identifies the most species (not individuals). Winning teams will receive bragging rights, some TOS gear, and a sense of achievement as they do their part for reptile and amphibian conservation!

We will rendezvous at **Tallulah Gorge State Park** in Rabun County, Georgia at 8:30 A.M. on June the 15th. This will be a two-day event so consider camping at the Park for lodging. If you plan to lodge at the Park, make your reservations soon as summer in the Georgia Mountains brings a lot of tourists. Lodging can also be found a short distance away in Clayton, Georgia. The event will conclude with the announcement of the winners at a BBQ at 2:30 pm the afternoon of June 16th.

This is a very large area we will need to cover—so tell your friends—the more the merrier!

For a map of the area, and to sign up, go to [www.oriannesociety.org/2nd-places-youve-never-herped-event](http://www.oriannesociety.org/2nd-places-youve-never-herped-event)

More detailed maps will be provided to those who sign up to attend. If you have any questions, contact Heidi Hall at [hhall@oriannesociety.org](mailto:hhall@oriannesociety.org). See you there!

### Upcoming Meetings & Events

**Sandy Creek Nature Center Snake Day**, June 1, Athens, GA. The Orianne Society will be participating in this event.

**Orianne Society at Endangered Species Day**, June 8, Atlanta Botanical Gardens, Atlanta, GA.

**Sabino Canyon Lizard Walk**, June 8, Sabino Canyon Rec. Area, Tucson, AZ. Meet at 8 am at the visitors' center.

**8th Annual Great Basin Kingsnake Survey**, June 12-15, Great Basin National Park, Baker, NV. See [link](#).

**Venomous Animal Safety & Husbandry Training Seminar**, June 13-16, Catocin Wildlife Preserve & Zoo, Thurmont, MD, and Frederick Community College, Frederick, MD. <http://cwpzoo.com/2nd-venomous-animal-safety-and-husbandry-training-seminar/>

**Herps of the Palmer Divide**, Colorado PARC field trip, June 15, Castlewood Canyon State Park, CO. See [link](#).

**2nd Places You Have Never Herped**, June 15-16, Tallulah Gorge State Park, Rabun Co., GA. See above for details.

**Sabino Canyon Lizard Walk**, July 13, Sabino Canyon Rec. Area, Tucson, AZ. Meet at 8 am at the visitors' center.

**Spotted Frog Survey**, July 8-12, Indian Valley, NV.

**Southwest PARC Annual Meeting**, July 8-10, University of New Mexico, Albuquerque, NM.

**Joint Meeting of Herpetologists and Ichthyologists**, July 10-15. Hosted by University of New Mexico Museum of Southwestern Biology, Albuquerque Convention Center, Albuquerque, NM. See [link](#).

**World Snake Day! July 16**

**Sabino Canyon Lizard Walk**, August 10, Sabino Canyon Rec. Area, Tucson, AZ. Meet at 8 am at the visitors' center.