



the gray-banded kingsnake:

A Herpetoculturist's Obsession

Gerold and Cindy Merker

Photos by G. & C. Merker except where noted

Betsy's grandmother died last summer. She was Betsy's maternal grandmother. Betsy's captive-bred mother and wild-caught father are a locality-matched breeding pair of Gray-banded Kingsnakes (*Lampropeltis alterna*) from West Langtry, Texas. What is significant is that Betsy hatched at all. Her grandmother was captured as an adult in 1987 and lived a long, healthy, captive existence. Not very long ago, the chances of a successful breeding of adult Gray-banded Kingsnakes, followed by a healthy clutch being incubated and neonates being hatched, would not have been very good. The knowledge herpetoculturists have gained and the rate at which that knowledge has been disseminated through the forums of magazines and books has been nothing short of remarkable. Rather than spending weeks or even years acquiring a locality-matched pair of adult Gray-banded Kingsnakes and then scratching one's head in dismay when they do not breed or do not produce a good clutch of eggs, hobbyists now can purchase healthy captive-bred animals. What is more, they can be raised to adulthood and bred successfully. We have come a long way in a short while. That can be only a good thing for animals such as the Gray-banded Kingsnake.

Description and Variation

Gray-banded Kingsnakes (*Lampropeltis alterna*) usually are found in desert regions of Texas, New Mexico, and Mexico (Walls, 1996). They do reach the higher mountainous elevations in Texas but more frequently are found in the drier regions of that state. The range extension into New Mexico only recently was confirmed (Degenhardt et al., 1996), and reputedly several more specimens have been found since that time

in that state. In New Mexico Gray-banded Kingsnakes have been found in the Chihuahuan Desert at the 3,770-foot (1160m) elevation in the Guadalupe Mountains of Eddy County (Degenhardt et al., 1996).

Gray-banded Kingsnakes are medium-sized colubrids. We have had females as small as 61 centimeters (24 inches) breed and produce viable eggs. Our largest animal is over one meter (39 inches) in length and has a mass of almost 300 grams. Conant and Collins (1991) noted that the largest individual of Gray-banded Kingsnakes measured 1.46 meters (57 inches) in length.

There are two general color phases, or morphs, of Gray-banded Kingsnakes recognized by both amateurs and scientists (Miller, 1979; Markel, 1990; Walls, 1996). The *alterna* morph is described as having as many as 22 main bands with little or no red coloration in them. Between the main bands are smaller alternate bands. The *blairi* morph has 11 to 20 bands with red or orange coloration. There are few, if any, alternate bands between the major bands. The range of variation in band count, ground color, and band color can be tremendous. In general the *alterna* morph is found in the western portion of the range of the Gray-banded Kingsnake and the *blairi* morph is found in the eastern part of the range. There are exceptions to this general rule. We have found true *alterna* morphs, in-between phase morphs, and *blairi* morphs all within one half mile of one another in the western part of the range.

above: Gray-banded Kingsnake habitat, Brewster County, Texas.

facing page: Female *blairi* morph Gray-banded Kingsnake from the Christmas Mountains region of Texas.





top: Habitat of the Gray-banded Kingsnake in the Big Hills Region of Texas, Presidio County.

center: One example of a Gray-band from Presidio County stock. The parents of this captive-bred individual are from River Road, one of several notable Gray-band localities.

bottom: Another snake from Presidio County. Notice the differences between these two animals. Gray-bands often exhibit great variation in color and pattern even at a single locality.

facing page: Breeders produce highly attractive Gray-bands, often mixing parents from different localities to combine desirable features. The parents of this snake come from Sanderson and River Road populations.



Gray-banded Kingsnakes have been noted for their nocturnal behavior (Miller, 1979; Tennant, 1984; Cranston, 1991; and Tennant, et al., 1998). Very little activity has been observed during daylight hours. In the evening we have seen specimens 15 minutes after sunset. We have observed animals moving on the surface as late as 4:15 A.M. Most often we observe these animals while walking along road cuts. On several occasions we have observed them when walking on private property, with owner permission, far from any cuts or roads. Gray-banded Kingsnakes are a rock-dwelling serpent thought to utilize the deep fissures in the limestone rock found through most of their habitat. In the wild, we have seen animals from late May into early July. Other sources have noticed activity as early as April into September and October (Miller, 1979; Tennant, et al., 1998).



In the wild, Gray-banded Kingsnakes are known to feed on lizards, rodents, and frogs (Tennant, et al., 1998; Miller, 1979). Lizards appear to be the most prevalent prey. Various species of lizards are eaten by Gray-banded Kingsnakes, including Crevice Spiny Lizards (*Sceloporus poinsetti*); Canyon Spiny Lizards (*Sceloporus merriami*); Eastern Fence Lizards (*Sceloporus undulatus*); and various whiptail lizards (*Cnemidophorus*) (Wright and Wright, 1957; Miller, 1979). Wild Gray-banded Kingsnakes also have been reported to feed upon pocket mice (*Perognathus* spp.) (Tennant, 1984), Canyon Tree Frogs (*Hyla arenicolor*) (Miller, 1979), whiptail lizard eggs (Miller, 1979), and perhaps snake eggs (Merker and Merker, in prep.). Salmon (pers. comm.) reports that as yet unidentified lizard eggs were passed from a Gray-banded Kingsnake from the Davis Mountains, Jeff Davis County, Texas.

Captive Care

Gray-banded Kingsnakes are easy to maintain in captivity, with the exception of the hatchlings. Currently, we keep our Gray-banded Kingsnake colony in either drawer-type modular cages or metal racks holding translucent plastic boxes. Our neonates are housed in ventilated shoe boxes in heated racks. We have used five- and ten-gallon aquariums in the past, but resorted to modular cages for more efficient use of space. We usually provide cages large enough so that the perimeter of the cage is at least twice the length of the snake being kept in it. Good cage design should incorporate the ability to maintain proper thermal gradients and exclude the possibility of a snake's escape. Also, the cage should provide a hide area that allows these shy creatures a place completely hidden from human view. We use either pine shavings, aspen bedding, or wood pulp as the cage substrate. All work well, but if you use pine shavings, make certain that they are as dust-free as possible. The substrate should be absorbent. Wood pulp is remarkably absorbent, so care must be used to ensure that the snake is





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not dehydrated. We always keep water in the cage with our animals to prevent any such mishaps.

The most important variable for the successful maintenance of any snake is to provide the captive access to correct temperatures. They are needed for the various life processes such as digestion, ecdysis, and reproduction. We always provide both a warm region and a cool region in the cage. The easiest way to create this is to place a cage heater under one side of the cage and maintain the other side of the cage at room temperature. Our colony has access to temperatures from approximately 70 F on the cool side to 85 F on the warm side. To safely ensure that the heater is producing the correct amount of heat, we connect a thermostat to the heater. As a fail-safe if the room approaches temperatures in excess of 80F, a room thermostat automatically shuts off the heaters. We provide hide areas over both the cool region and the warm region in an enclosure. This allows the snake to choose its desired temperature while remaining concealed.

Feeding adult Gray-banded Kingsnakes rarely presents problems. Most will accept appropriately-sized mice with little or no hesitation. However, as mentioned earlier the young may be substantially more difficult to feed. Indeed, the reluctance of neonate Gray-banded Kingsnakes to feed on domesticated pink mice often causes the would-be *alterna* breeder to discontinue working with this animal. Some keepers (Rodriguez, 1997) like to alternate pet store purchased lizards and domesticated mice for feeding their Gray-banded Kingsnakes.

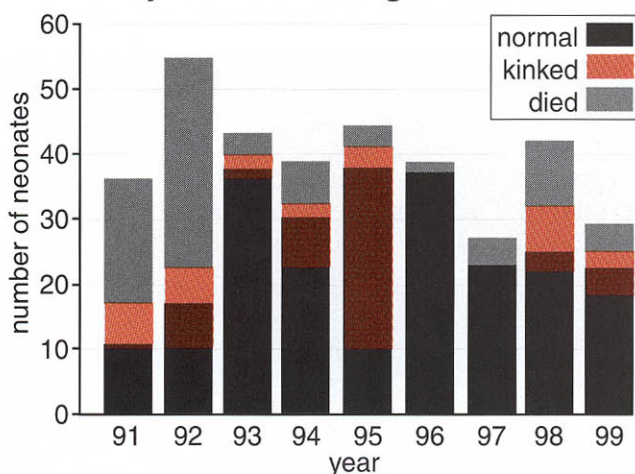
Photo by D. Johnson



The advantage is that lizards may provide the captive Gray-banded Kingsnake with some nutrients missing in a rodent diet; the disadvantage is the potential for introducing parasites into your Gray-banded Kingsnake's gastrointestinal tract.

To induce baby Gray-banded Kingsnakes to feed we have employed several strategies. One of the most successful techniques is offering the baby snake a lizard-scented pink mouse. We wash and dry the pinky, and then rub a lizard over the food. The pink mouse is then placed inside the container. Often, the kingsnake will eat it. We also have had success with placing pieces of shed skin from our captive Collared Lizards (*Crotaphytus collaris*) or captive Texas Banded Geckos (*Coleonyx brevis*) on the pink mouse and offering this to the baby snake. Another successful method has been simply to wait a few weeks after the post-hatch shed to feed the Gray-banded Kingsnake. The animal should have plenty of energy from its yolk sac to survive this period. Then we offer the snake a new-

Gray-banded Kingsnake Hatch



above: Number of neonate Gray-banded Kingsnakes (*Lampropeltis alterna*) hatched from fertile eggs during 1991-1999 in our collection. The addition of a calcium and vitamin supplement started during the fall of 1993 and continued until the spring of 1997. During the fall of 1997 and the spring of 1998, supplementation of the adult female diet with a calcium/vitamin additive stopped. During the fall of 1998 and the spring of 1999, supplementation was resumed.

left: Typical *alterna* morph Gray-band from Juno Road, Val Verde County. Notice the secondary bands between the major bands.

facing page: Two beautiful examples of captive-bred Gray-bands, one *alterna* morph and one *blairi* morph. Breeders tend to select for clean, sharply contrasting bands.



born pink mouse. A lot of hungry hatchlings have started feeding on pink mice using this latter trick. Another odd strategy is to offer the hatchling a previously frozen then thawed pink mouse. This sometimes works wonders with the reluctant feeder. We have also taken baby snakes placed in a small plastic container on a short car ride and upon returning home have them feed for the first time! As with anything, persistence is the key. With Gray-banded Kingsnakes and other kingsnakes with which we have worked, we have experienced problems in the past with litter mates feeding on one another. Because of these problems we typically maintain our hatchlings in separate containers once a clutch has undergone its first post-hatch shed.

Breeding

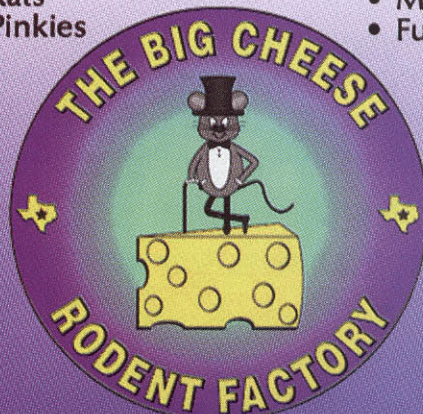
We provide our captive adult kingsnakes with a winter cooling or brumation period. This is accomplished most easily by allowing the animals access to heat with no further meals during the first two weeks of November. This allows them to void any food remnants before they are cooled. Failure to do this will result in food rotting in the gastrointestinal tract of the snake, creating a very unhealthy situation. Once this "clearing out" period is over, we simply turn off the cage heaters. The room temperature at this time of year is usually 50F to 55F (10C to 12C). Our animals remain at this temperature for about 12 weeks, or until mid-February. During the brumation period, our Gray-banded Kingsnakes occasionally drink wa-

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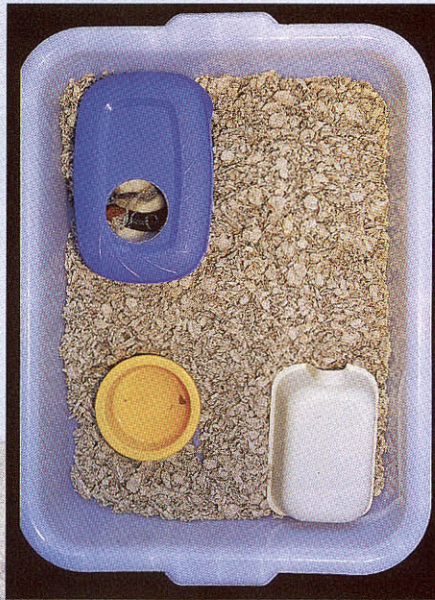
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ter and move about their enclosures, albeit much more slowly than during the warm part of the year. We feel that this cooling period is vital to the long-term survival of temperate colubrids. Gray-banded Kingsnakes are no exception. Their physiology seems to require this cooling period in order to synchronize their breeding readiness.

During mid-February, the heaters are turned on under the snake cages. Our Gray-banded Kingsnakes quickly return to their normal behaviors and begin feeding within 14 days of this spring warm-up. Within four to six weeks breeding behavior ensues in this species of kingsnake. We maintain our animals separately throughout the year and only place them together for breeding purposes. Murphy et al. (1978) discuss in detail the reproductive behaviors of Gray-banded Kingsnakes. Typically, the male will court the female once she is placed in his cage. He will rub his chin up and down the female's spine for as



long as 20 minutes. If the female is receptive, copulation soon occurs. We usually check a fluid sample from the female's cloaca once copulation is completed. If the male is producing sperm, these will be evident at 100 power under a microscope. If no sperm are detected, we immediately place the female in with another male for breeding. We usually place a female in with a male at least three times over the course of a two-week period.

When the female no longer breeds, she probably is gravid. Eggs form over the next four to six weeks within the female Gray-banded Kingsnake. Seven to 14 days before oviposition, the female always undergoes a pre-egg-laying shed. If eggs should happen to be laid prior to this, undoubtedly they will be infertile. After she sheds, we place a plastic container with a hole approximately twice the diameter of the female's body cut in the lid into the cage. Inside this container we place damp paper toweling. If the paper toweling is kept damp, the female usually oviposits in the container. After the eggs are deposited, they are incubated in a vermiculite and water mixture prepared in a 1:1 ratio by weight. The incubator is set at 26C (80F). At this temperature the eggs usually hatch in 60 to 80 days. The young are allowed to pip from the egg and emerge by themselves. They are set up in a heated shoe box rack with slightly dampened paper toweling. After ten days, most will have undergone their post-hatch shed. At this time they should be placed on dry paper toweling with a small water dish added to the box.

Importance of Supplements

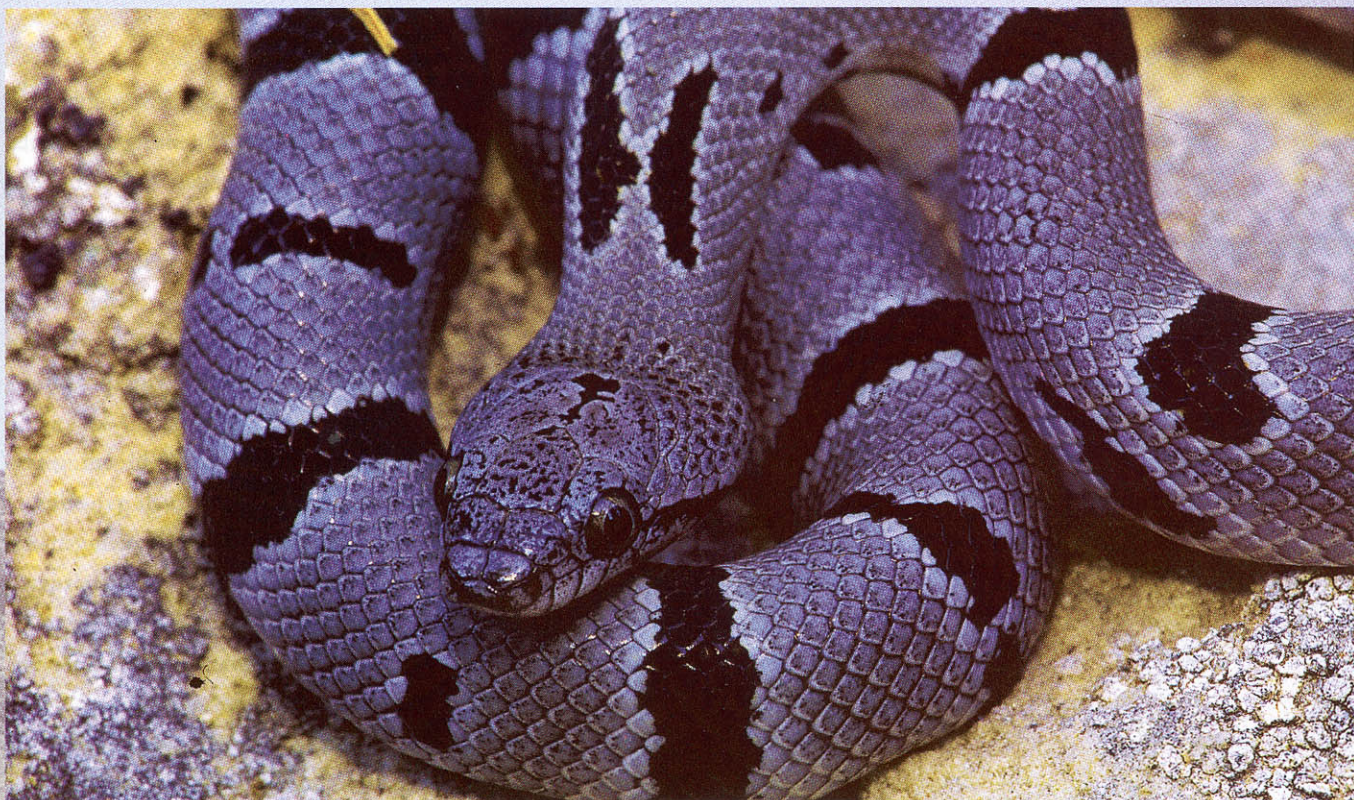
The above captive propagation protocol is followed with

top: Setup for a Gray-band. Two hide boxes are included, one at the warm end of the cage and one at the cool. Note that one hide box has a moistened paper towel substrate, used to facilitate egg-laying and shedding.

left: Gray-bands will thrive in the sweater box-type setups used by many breeders; there are a number of models available from different companies.

facing page: This captive-bred *alterna* morph may not be as flashy as some *blairi*, but the steel gray color and contrasting bands make for an attractive animal.





all our kingsnakes. Common Kingsnakes (*Lampropeltis getula*), Milk Snakes (*Lampropeltis triangulum*), and Sonoran Mountain Kingsnakes (*Lampropeltis pyromelana*) usually are captively propagated with minimal difficulties. However, we have experienced problems with our Gray-banded Kingsnakes. We have had numerous fertile eggs either produce severely kinked neonates or not hatch at all. We spoke with our veterinarian, Dr. Dale DeNardo. He suggested that we add a mineral supplement to the diet of our adult female Gray-banded Kingsnakes in an attempt to increase the numbers of fertile eggs hatching. He felt that the kinking was an indication that the females did not have enough reserve calcium to put into their eggs. The supplement we utilized had calcium, other minerals, and vitamins, including vitamin D-3.

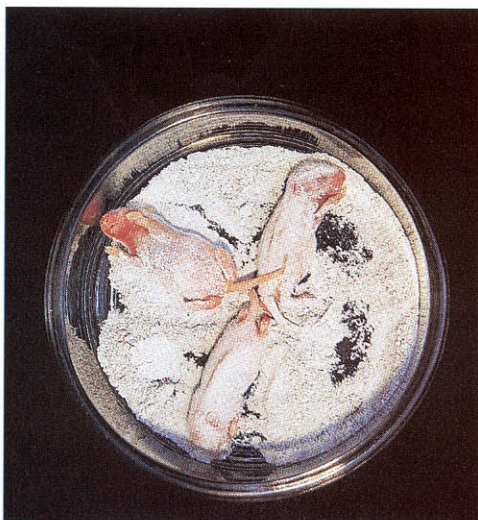
We should point out that if you are getting large numbers of fertile eggs that hatch with no problems, you *do not* need to supplement the diet of your Gray-banded Kingsnakes with vitamins and minerals. We have never experienced an increase in fertile egg production; rather, we have observed an increase in the percentage of fertile eggs going full term with a drastic reduction in spinal deformities of the Gray-banded Kingsnake offspring. Animals can get too much of some vitamins, such as vitamin D-3, which can be more detrimental than not having enough. More is not necessarily better. What is important is having enough, but not too much.

During the initial three years when we used a calcium/vitamin D-3 supplement, we would put a little of the substance on the mouse by dipping the hindquarters into the mineral and vitamin supplement. Placing the supplement on the hindquarters may allow the snake to recognize the scent of the food because the front of the animal smells like rodent, not supplement. For our adult females we used three- to four-week-old mice, or occasionally two-week-old mice. After we used this supplement for a summer and the following spring, we noticed a large increase in the number of fertile eggs going to full term and a decrease in the number of spinal deformities. We never determined whether it was the additional calcium or a vitamin, such as vitamin D-3, that was involved in the dramatic turnaround in the fertile eggs going full-term with fewer deformed neonates.

Because of these successes in the use of a calcium and vitamin supplement, we continued to supplement the females' diet for the next several years. In later years (1995 - 1997), we would only use the supplement twice monthly. During the summers of 1997 and 1998, we received a lot of correspondence that related to the potential dangers of a mineral/vitamin supplement. Because of this we decided not to use any additional supplement during the 1998 breeding season and to observe what happened to our fertile egg hatch rate. We have kept careful records of the outcome for our fertile Gray-banded Kingsnake

eggs over the course of the last nine years. These results are summarized below and in the graph.

The use of supplements dramatically increased the number of fertile eggs hatching in our collection. The use of supplements also dramatically decreased the number of kinked neonates hatching from fertile eggs. When we stopped using the supplements, we had an increase in the number of babies with spinal deformities and a decrease in the number of fertile eggs hatching. The supplement did not increase the number of fertile eggs produced by our females. Our females produced just as many infertile eggs during the supplementation years as they did during the years when they were not supplemented. During the past seven years, we have had a 40 percent turnover in adult females. Luckily, 60 percent of the females we had in 1991 were still with us in 1999. Although our younger females seemed to have more fertile eggs

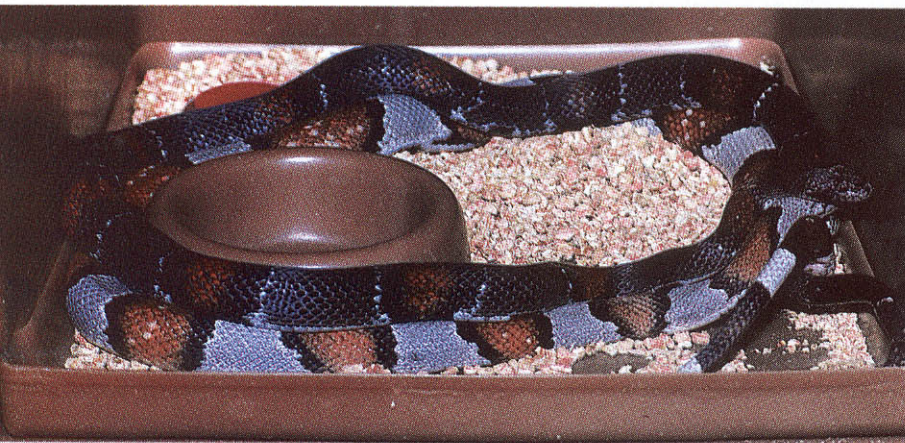


going to full term, this was enhanced further by supplementing their diets. Finally, if the breeder of Gray-banded Kingsnakes is getting fertile eggs that go to full-term and no kinked babies are being produced, probably it will not be useful to supplement the diet of the adult females with a calcium/vitamin D-3 mixture.

For the 1999-2000 breeding season we are supplementing the diet of our female Gray-banded Kingsnakes

with a calcium/vitamin D-3 mixture again. We may eventually use a calcium carbonate supplement without the addition of vitamins with our females to determine if calcium alone is the necessary factor in proper egg development in Gray-banded Kingsnakes. Such a supplement may be safer.

Keep in mind that the need for supplementation may be a factor of the age and nutritional status of the feeder mice utilized. We are experimenting also with different foods for our rodent colony to see



top: The authors saw lower incidence of spinal deformities and deceased embryos when they were supplementing the mice they fed their breeders.

left: Breeding pair of Gray-bands in the authors' collection. Gray-bands breed reliably when given a winter cooling, but successful hatching and raising of the young are not as common.

facing page: Christmas Mountain Gray-band laying eggs. Like other colubrids, Gray-bands prefer to lay their eggs in a small, moist enclosure.

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if we get any difference in fertile egg hatch rate for our Gray-banded Kingsnakes. We will report any significant results.

Health Problems

We have had a few Gray-banded Kingsnakes that have carried parasites and diseases. By far the greatest problems have been with the common snake mite. These insidious creatures can wreak havoc on any snake collection, and ours is no exception. The most common method for our collection to acquire the snake mite is carelessness on our part. If we acquire a breeding loan and are not careful in examining the incoming snake, we may get an unwelcome guest—the snake mite. Mites look like tiny black dots moving on the surface of the snake. The eyes of the snake will harbor easily seen mites. Therefore, eyes are an area that warrant careful examination. Thankfully, there are many products designed to rid your collection of these parasites. These products contain a substance, such as pyrethrin, that kills the mite. The product must be water-soluble so as not to harm the snake. The substrate in the cage should be thrown out in a trash can not located in the room in which your snake collection is housed. The cage itself should be sterilized with a soap and bleach solution. The entire process will need to be repeated in two weeks to kill any mites that hatched from eggs. Mader and Palazzolo (1993) is an excellent reference for several procedures to rid your pet of mites.

We also have had several snakes with bacterial diseases. This usually manifests itself as some kind of respiratory disease or a gastroenteritis. A veterinarian who has experience with exotic animals can be a life-saver for snakes with bacterial diseases. Take the time and the expense to seek out a good one who will work with you to save your animal. This may be the time also to examine the caging situation and to remedy problems such as extreme moisture condensation, overly dusty conditions, or improper thermal gradients. All may cause snakes to develop respiratory diseases and possibly an unhealthy appearance. Changing the setup with an eye toward what is most beneficial for the individual animal will pay off in the long run with fewer health problems for your snakes.

We have had a very few Gray-banded Kingsnakes harbor internal parasites such as nematode worms. If you suspect your animal may be afflicted with these parasites, have your veterinarian examine a stool sample. If parasitic infestation is discovered, then medication can be prescribed



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based on the weight of your snake in grams. If parasites are not the culprit, a thorough examination by your veterinarian may be required to determine the cause of the problems of an animal.

All reptiles have their good and not-so-good aspects. Gray-banded Kingsnake neonates may require some extra effort in the beginning, but they grow into beautiful, yet not-too-large, animals that feed well. Proper care usually ensures a long life for these animals. Their even temperament and nonaggressive attitude make them ideal for the person who may be a bit snake shy. That is where Betsy from the introduction comes in handy. She is a fairly typical *blairi* morph Gray-banded Kingsnake, but for some reason our youngest son "took a shine" to her in the summer of 1998. Before then, he wasn't too sure about holding a snake, but he is happy to hold Betsy and is unafraid to clean her cage and offer her water. We are sure others have become entranced by these beautiful animals as well, overcoming any initial apprehension in order to enjoy the distinct beauty and habits of the Gray-banded Kingsnake.

Acknowledgments

A lot of the information in this article has been gleaned from people who have had years of experience with these beautiful animals. These people include: Robert Assetto, Jeff Barringer, Ric

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top: Healthy Gray-band eggs incubating on vermiculite.

left: Severely deformed Gray-band hatchling. The authors currently are trying to determine if supplementing with calcium alone will help prevent this condition or if other vitamins and minerals play a role.

facing page: Gray-band hatching. Baby Gray-bands often need coaxing to take their first meal, especially if mice are offered. The hatchlings strongly prefer small lizards.



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Gerold and Cindy Merker are both instructors living in northern California. They have collaborated on numerous herp breeding projects and have produced three sons themselves.



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