

## Wintertime Observations on Five Species of Reptiles in the Tucson Area: Sheltersite Selections / Fidelity to Sheltersites / Notes on Behavior

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The best place to start anything is at the beginning.

The morning of February 16, 1991, found a troop of four people in a vehicle whistling southward out of Tucson, Arizona. To the left of our chariot, the awe-inspiring spectacle of the Santa Rita Mountains was nearly obliterated by low-lying cloud cover. To our right lay the moldering slag heaps indicative of open-pit mining.

The windshield wipers were doing their slowest sweeps, ridding the glass of the few specks of dank drizzle that assailed our viewing pleasure. A glance at the clouds spread from horizon to horizon, and knowledge of such things as low readings on thermometers, barometers, and their effect on ectothermic creatures, told me what I needed to know. Always one to speak my mind in the face of adversity, I felt compelled to pipe the following:

“We ain't going to find *squat* today!”

At this announcement, the countenances of our two passengers dropped noticeably. But our driver, one Candi Gruenwald, remained unaffected.

“I'll bet we find at least one tortoise,” came her response.

With this rebuttal, Stuart Bengson and a young man named Troy brightened considerably. As Candi was in a leadership position on this expedition, I remained quietly skeptical. It has always been understood that leadership at times requires whoppers to be told for the betterment of morale in the ranks. There was serious danger that a suggestion to visit a sports bar instead of continuing with this foolish mission would cause a mutiny in the ranks.

Our goal on this miserable day was to locate and remove any encountered reptiles from a tract of land slated for development by a local mining concern. Stuart was there in his official role as reclamations manager for the mine. Troy was his young neighbor/friend who wanted to help, and Candi was the woman who participated in the local tortoise adoption scene. As for my presence, it was a herp trip, a free ride, and I was invited. (The latter statement being an indictment on the difficulties of finding qualified volunteer help for field work.)

To make a long story short, under what I would have considered impossible weather conditions, we not only found two tortoises, but three Gila monsters as well! The tortoises were given up for adoption, and the Gila monsters were relocated to another hillside located out of the range of the bulldozers.

It did not take too long for the events of this day to circulate around the local herpetological community. About two weeks later, a friend by the name of Jim Kane approached me. Unbe-

knownst to me, Jim and another friend, one Frank Retes, had been quietly studying tortoises, Gila monsters, and rattlesnakes during the colder months of winter. Jim informed me that he thought it unfortunate that we had to remove the reptiles encountered, for he and Frank were finding that some of their reptiles were using some form of homing instinct to return to their winter sheltersites year after year.

This statement intrigued me, and I had several phone conversations with Frank about his findings. One thing that Frank stressed repeatedly was that the impact of human observations must be kept minimal in order for the reptiles to return to their “dens.” To handle them, or pester them unduly could drive them away.

In other words, “hands-off herping” needed to be brought into play. As one who had already found most of the local reptiles, fondling each and every find was no longer necessary. The thought of being able to monitor wild reptiles for several years in a row was appealing, and my attitude was one of “Yeah! I'll try it!”

On March 9, 1991, my good friend and constant sidekick Dennis Caldwell found a desert tortoise (*Gopherus agassizii*). This in itself is not newsworthy, as Dennis is quite good at this sort of thing. What *is* newsworthy is what followed with this particular tortoise.

Dennis called me upslope for a look at his find. At my arrival, I was delighted to see a very large female tortoise facing out of an opening beneath a knee-high slab of quartz/limestone bedrock. Her eyes were bright, clear, and inquisitive, the visible front portion of her carapace was weathered and worn, and her scaly forearms pumped in and out of her protective shell ever so slightly. I was touched by the sight of this wonderful matriarch of the desert, and impressed that she seemed to be unafraid of us. In the remote stretch of desert hillside we were roaming, we may very well been the first humans that she had ever seen.

Dennis quietly fumbled with lenses and such, and snapped one quick picture of his otherwise undisturbed subject. While the photographer was thus occupied, his companion took notes on the exact whereabouts of the lair of this tortoise. A one-armed saguaro cactus was located nearby, and the name “Turtle Hill” was assigned to the patch of ground we were exploring. As we quietly turned to leave, we had no way of knowing that we had just discovered our first “repeating” reptile.

On June 1, 1991, I went back to visit my new “subject.” As expected, she wasn't there, and her shelter had been filled in by a pack rat. This indicated that the tortoise had not been around for a while. On December 29, 1991, Don Swann and I

assailed Turtle Hill. The one armed saguaro was spotted, and we zeroed in on the spot. The cleared-out pack rat debris at the base of the rock face told me what had developed before or I looked in the hole. It came as no surprise to view the posterior of a very large female tortoise within the shallow depths of her winter burrow. The tortoise had returned!

Encouraged by this success, Don, Dennis, Jim, Dan Bell and I began roaming the foothills surrounding the Tucson area in search of more tortoises. By the end of the winter of 1992, we had found 23 individuals, spread out over seven mountain ranges. As if this wasn't enough to drive us manic, we also found the winter lairs of three Gila monsters (*Heloderma s. suspectum*), four chuckwallas (*Sauromalus obesus tumidus*), a Sonoran lyresnake (*Trimorphodon biscutatus lambda*), and six western diamondback rattlesnakes (*Crotalus atrox*—hereinafter called “*atrox*”). The same “hands-off herping” philosophy was applied, and the decision to regroup to check on these the following winter was unanimous.

During the winter of 1992–93, we were not surprised to note that many of the tortoises had returned. One of the Gila monsters had returned, as did the lyresnake, two of the chuckwallas, and two of the *atrox*. While in the process of checking on these, more tortoises, Gila monsters, chuckwallas, lyresnakes, and *atrox* were discovered. Careful notes were made of the whereabouts of each reptile's den, and each den was visited several times throughout the course of the winter.

The years have rolled past. The winter of 1996–97 is behind me now, and I anxiously await the onset of the winter of 1997–98. A few details should now be clarified, for this Author is about to lay some numbers on the reader.

By “wintertime” I mean astronomical winter—that time period between the winter solstice (December 21 or 22) and the spring equinox (March 20 or 21). The observations from which my data are taken occurred between February 16, 1991, and February 16, 1997. Thus, the following summary draws from exactly six years of information. In all, 158 field trips were included.

All totaled, working from least to greatest, we have found 15 Gila monsters, 23 lyresnakes, 79 chuckwallas, 87 tortoises, and 87 *atrox*. These reptiles were found by careful searches of the hillsides of several mountain ranges around the Tucson area.

It should be noted that it is possible that the occasional reptile was accidentally counted twice. It is also possible that a new reptile was discovered and discounted as a previous find. Your author is doing the best he can in recounting these numbers. Hands-off herping has its disadvantages in trying to relay precise information to discerning herpers. With a few exceptions, these reptiles have been monitored with a strict “hands-off” policy. We do not molest these reptiles in any way, shape or form. We do not weigh, or mark, or measure, or probe, or apply transmitters to any of our animals. We have learned, as did Frank Retes and Jim Kane, that to do so might increase the risk of a reptile not returning the following year.

Having said that, I must admit to a few incidents of human-

to-herp interaction. Some tortoises were pulled from their burrows and processed during the late winter periods of 1992 and 1994. This was done while assisting grad students with their projects, under the proper permits. Three lyresnakes were poked at by an overzealous visitor to the plots, who wanted to try to coax them from their crevices so he could handle one. Lastly, a single male *atrox* was manipulated with snake tongs by another visitor who could not restrain himself from doing so.

The results of these intrusions are mixed, and confusing. It would appear that the female tortoises were the most affected: none returned to use their respective sheltersites the following year. Of the lyresnakes molested, two appeared to skip a year, and then returned the year after. The other has yet to return. The male *atrox* also skipped a year, and returned the year following.

Thus far, the chuckwallas and Gila monsters have managed to avoid any such attentions. And the intent now is to adhere to the original plan of hands-off herping for all future winter forays, for all the reptiles that are encountered. In so doing, we eliminate the possibility of human intervention being the cause of a nonreturning herp.

It is important to note that some of the reptiles do not return even if they are not molested. Some skip a year and return the following year, some select other nearby shelters, and some are never seen again. Of the first few herps discovered, very few have continued to return for the entire six years under discussion. For example, my longest-running tortoise dates back to late fall/early winter 1991; she has returned every year since. My longest repeating Gila monster dates back to March 13 of 1992. A lyresnake has returned every year since the same March 13, 1992, date. For *atrox*, we go way back to March of 1991. My champion for repeating behavior is a chuckwalla that has used the same sheltersite since March 9, 1991!

Up to this point, one detail has been omitted. The word “returned” has been used, and would imply that the object that “returned” would have had to “leave.” The “arrival” of reptiles to their winter dens is called “ingress,” and the “departure” is called “egress.” Ingress generally occurs around mid-November, and egress happens very close to the first day of spring. The time periods just mentioned could at best be called general, because there is a tendency of some individuals of each species to shift about, or use a series of sheltersites throughout the winter. This behavior is little understood by science, but the fact is, it happens. Ingress in particular appears to vary from year to year, and species to species. Egress, on the other hand, is nearly universal amongst the animals under observation. By April 1, the vast majority of herps have cleared out. For the most part, I couldn't *buy* a herp in my very best winter locations.

One last detail remains before discussing the actual sheltersite selection of the reptiles under discussion. Those from the northern climes might read this and say “Shoot, Roger, what's the big deal? You are in the south, of course you are seeing reptiles during the winter!” This is both true, and not true. Approximately 80% of the reptiles in our area become scarce



Female desert tortoise (*Gopherus agassizii*) in winter sheltersite. This particular tortoise has been returning to the same shelter since November 1991. Photograph by the author.



Winter basking behavior in *Gopherus agassizii*, January 13, 1993. Female tortoise in front of sheltersite. Photograph by Dan Bell.



Rock crevice used by a wintering lyresnake. Photograph by the author.



Sonoran lyresnake (*Trimorphodon biscutatus lambda*) as it appeared in the crevice shown at left on March 20, 1994. Photograph by Dan Bell.



Chuckwalla (*Sauromalus obesus tumidus*) wintering in a shallow rock crevice, March 12, 1994. Photograph by Dan Bell.



Winter sheltersite of a Gila monster. Photograph by the author.

or invisible from late October through mid-March, much like those that dwell in more northerly latitudes. Examples of rarely- to never-encountered winter herps would include the more common colubrids, such as longnose snakes, (*Rhinocheilus lecontei*), desert kingsnakes, (*Lampropeltis getula splendida*), or western patchnose snakes, (*Salvadora hexalepis*). Many years of careful winter searches have not yielded any sidewinders, (*Crotalus cerastes*). Such lizards as desert iguanas, (*Dipsosaurus dorsalis*), and leopard lizards, (*Gambelia wislizenii*), are completely absent during the winter months, as are the Couch's spadefoots (*Scaphiopus couchii*), and Sonoran Desert toads, (*Bufo alvarius*). These and other herps too numerous to mention here abound on our plots during the warmer months of spring, and/or summer.

It should also be added that the five species under discussion are not the sole winter-active herps in our area. Canyon tree-frogs (*Hyla arenicolor*) are very winter-active, as are side-blotched lizards (*Uta stansburiana*), and tree lizards (*Urosaurus ornatus*). Multitudes of these three species can be observed on any warm winter's day, and all three species have been observed in copulation. Lowland leopard frogs (*Rana yavapaiensis*), also are not only winter-active, but lay their eggs during this time period. Sonoran mud turtles, (*Kinosternon sonoriense*) can be seen swimming and basking during winter time periods. Four tiger rattlesnakes (*Crotalus tigris*) have also been seen basking during winter, and a total of 14 black-tailed rattlesnakes (*Crotalus molossus*) were observed either basking or moving about, well away from any obvious sheltersites.

The few weeks previous to the first day of spring (March 20), also brings on some activity from other Arizona herps, most notably zebratail lizards, (*Callisaurus draconoides*), greater earless lizards, (*Cophosaurus texanus*), and whiptail lizards (*Cnemidophorus* spp.). The occasional regal horned lizard (*Phrynosoma solare*), and collared lizard, (*Crotaphytus collaris*) show themselves, as well as Clark's spiny lizards, (*Sceloporus clarkii*). The Sonoran gopher snake (*Pituophis catenifer affinis*), and red coachwhip (*Masticophis flagellum piceus*) also turn up occasionally. But activity in these herps is generally confined to only the very warmest days (usually above 80°F).

Getting back to the five species under discussion, there is not much in the herp literature that deals with their wintertime behavior. Even with tortoises, which in our area have been well studied, not much can be found to back what we are seeing. Most of the local herpetologists seldom get out to monitor winter activities, but instead focus their studies on summer activities of herps. Because winter documentation in the herp literature is scanty, it is extremely difficult to cite the observations of others.

We know that on our "plots," tortoises routinely bask during the winter months (see Martin, 1995). They also move from shelter to shelter, sometimes in the dead of winter. Close to the Tucson area, all 87 tortoises found have some sort of rock structure as part of their sheltersite. These rock structures have some form of hole beneath them. Some of these holes are not very deep, one of my tortoises, a female, dens with two-thirds of her body in the breeze (see Bailey, 1992). In other

cases, the actual burrow is quite deep. The deepest-denning tortoise that I can see appears to be about 4 meters down. There is another large male that dens out of sight, and I can see about 6 meters into its burrow. Of the five species of reptiles under discussion, only tortoises have been observed feeding during winter time periods (see Bailey, 1992).

The tortoises under our observation appear to be mostly solitary denners. Out of 87 tortoises found, only once were two seen to spend the entire winter together in one shelter. This was observed during the winter of 1994-95 and, in this case, one was a male and the other was a female. Some tortoises have also been observed sharing their hibernacula with *atrox*. Every winter since 1991-92, at least two cases of this happening appear in my notes. The two species appear to coexist peacefully when this happens. *Atrox* have been observed coiled around, or crawling over, their larger-bodied "burrow buddies." The benefits of this occurrence to either species remains in question. It may just be that the chosen shelter suits both parties in question.

Chuckwallas are rock crevice denners. Close to Tucson, they primarily winter alone, but on two occasions I have observed two together for the entire winter. Moving 100 miles westward, however, I found 17 that had infested a large rock face that was split into several crevices. The few chuckwallas that I routinely check have shown winter activity. I might see them in their crevice on a cold January day. A week of warm



Lyresnake and chuckwalla, as observed basking on February 21, 1994, about 30 cm apart in a vertical rock crevice. Photograph by the author.

weather will follow, and I will find their crevice empty. Then, a week later, the weather will turn cold, and the “chuck” will once again be visible in the home crevice. For reasons unknown, the chuckwallas are moving about in the dead of winter. Perhaps like tortoises, they also may be foraging for food. My camera will always be ready for anything that presents itself along these lines.

My data is scanty on Gila monsters. But I do have six that den quite close to one another, and have seen all six basking at the mouths of their crevices during the month of February. A favored basking position of theirs is to sit with only their heads showing out of their holes. Their shelters are generally a small hole under a rock. I went out with a fiber optics borescope to look at all 12 of my “monster” dens. (Remember, the first three discovered were removed, as was their habitat not long afterwards!) They are all very similar. They have a tight entranceway, with barely enough room for the monster to crawl inside. The first inner chamber beneath their boulder home is well scalloped out, which allows the monster to enter the hole head first, do a Gila U-turn, and face back out of the hole again. In every case, the inner chamber has holes that allow the monster to go even deeper beneath the surface. I have seen Gilas basking during every month of winter, but much more so during February and March (see Martin, 1997).

As for lyresnakes, they are also a winter basking species, and can be viewed at the mouths of their rock crevice shelters every month of the winter. They select rock crevices that are rather narrow, and most times these crevices run perpendicular to the ground. In all of my lyresnake crevices, there is a hole at the base of the crevice that allows the lyresnake to go underground. Lyresnake behavior consists of moving forward, back, up and down in the crevice. In this way, they are able to thermoregulate and seek optimum body temperatures. On very cold days, they will crawl into the holes at the base of their shelters, and be hidden from view. I have never witnessed more than one lyresnake per crevice at a given time, but do have a crevice that has yielded three different lyresnakes. There are hints from others that they den communally (Retes, pers. com.), but that has yet to be witnessed by this author. (Author's note, added 2-12-98: The lyresnakes are making a “lyre” out of me! In one of our plots, we have observed three lyresnakes sharing one crevice. Hats off to Retes!) I have also observed chuckwallas and lyresnakes using the same shelter-sites together, and they seem to co-exist peacefully.

Thus far, this author has written of basking, shifting, feeding and relocation of reptiles from one shelter to another during astronomical winter. This is all well and fine, but what follows is an account of the undisputed champion of winter behaviors, the western diamondback rattlesnake. Yes, they also bask, and shift, and move freely from shelter to shelter throughout the winter months. But they also do other things, which will be discussed shortly.

The winter sheltersites, or dens, of *atrox* can be broken down into three types. The “crevice dens” will be discussed first. The crevice dens can be compared to chuckwalla and lyresnake dens, although the crevice is generally wider. The crevices also tend to be more horizontal than those selected by

chuckwallas and lyresnakes. Like the chuckwalla dens to the west of Tucson, I have seen as many as 17 *atrox* in one rock formation that is split into a series of crevices. Each crevice in this particular densite usually contains one to four individuals. The second type of den is the “soil burrow” type of den, which contains the insulating debris of a pack rat (*Neotoma albigula*). I have only been able to find three such dens in my searching. By far the most spectacular dens are the “gash” type dens. These consist of wide splits at the base of large rock formations. They generally are about 30 cm tall, by as much as two meters wide. These gashes taper inward, becoming narrower the deeper one goes, and in all six of my gash dens, the snakes can crawl deep enough to be out of sight. Another feature that all six gash dens share is a protective, overhanging rock shelf. Erika Nowak, a researcher for the Colorado Plateau Research Station, has suggested (pers. com.) that such a shelf might serve to thwart avian predators. Our gash dens always contain more than one snake, but in our area, I have never seen more than 21 snakes. Our local *atrox* do not seem to gather in the huge numbers that can be found elsewhere around the country.

Another phenomenon in the local *atrox* dens is the apparent absence of communal denning with other snakes. This runs contrary to the observations of many other herpetologists studying other species of denning rattlesnakes. Never have I looked into an *atrox* den of any type and seen any other type of snake within the den. Having said that, I did observe a *C. molossus* basking just outside an *atrox* den, very close to two of them. Five times I have observed coachwhips (*Masticophis flagellum piceus*) prowling about *outside* the entranceway to a den. Never have I observed predatory action on the part of these coachwhips (i. e., predation on an *atrox* by a *Masticophis*).

A necessary ingredient to all our *atrox* dens appears to be the debris of the pack rat. In all six of our gash dens, the entranceway is piled high with whatever happens to thrill the industrious little rodents the most. In our area, the many-spined teddy-bear cholla pods appear to be a popular pack rat “decoration.” Nowak (pers. com.) indicates that in her *atrox* dens, (170 miles to the north), the “decorations of choice” by *Neotoma* are prickly-pear cactus-pads. It is interesting to note that in one of our dens, the pack rats have appeared to die off. During the winter of 1996–97, none of the usual debris appeared in the front of the den. The snake numbers fell dramatically in this particular den. Whether or not this was a direct result of the absence of *Neotoma* is purely a matter of speculation on the part of this author.

I have many observations of strange interactions between pack rats and *atrox* during the colder months. For example, on November 25, 1995, a group of six of us saw a pack rat resting with one of its paws against the flanks of a very large *atrox*. One week later, on a solo jaunt, I saw what appeared to be the same rat snuggled against the flanks of the same snake. The rat was sleeping when first viewed, and only lazily opened one eye when my light hit it in the face. It does not surprise me that the snakes do not appear to eat the rats during the colder months. What does surprise me is the fact that the rats seem to know they are safe.

However, as spring approaches, and the temperatures begin



Example of a “crevice den” for *Crotalus atrox*. As many as eight snakes have been visible in this particular den. Photograph by Don Swann.



Example of a “gash den” for *Crotalus atrox*. As many as 21 snakes have been observed at one time in this den. Photograph by the author.



Aggregation of *Crotalus atrox*, March 19, 1995, in front of the gash den pictured above. Note the position of the large snake on top of the pile. This male appeared to be protecting his harem from the disturbance. Photograph by the author.



Two *Crotalus atrox* fleeing from the photographer, January 31, 1993. Note the build-up of cholla pods and other debris, which may serve to increase humidity, as well as insulate the den. This is the handiwork of the pack rat, *Neotoma albigula*. The snakes are unaffected by the spines. Photograph by Dan Bell.



Two male *Crotalus atrox* captured in full ascent during combat, March 22, 1996. The snake in the background, which is standing taller, was the victor in this well-fought match. Photograph by the author.



A pair of *Crotalus atrox* mating, March 19, 1995. Photograph by the author.

to rise, the rodents become extremely wary. On March 17, 1997, we accidentally scared a large *atrox* into a narrow opening at one of our “soil” dens. A pack rat came scurrying out of the hole, saw us, and two other *atrox* out basking. It jumped back into the entrance of its burrow, and nervously watched both us and the snake behind it. As the snakes become more active in some of our other dens, the rats are often observed in constant motion, always managing to avoid the snakes.

Based on my own observations, I have come to the conclusion that at certain times, (namely the colder months of late fall and early winter), there appears to be a true symbiotic relationship between predator and prey. The predator benefits in many ways from this relationship. The first and foremost of these is the insulation to the den that the debris gathered by the rat provides. As soon as ingress is complete, the rats begin to rebuild their midden. At times, this debris gets piled in such a way as to completely wall in the snakes. Nowak (pers. com.) indicates the same patterns of “den-walling” in her *atrox* shelters. Temperatures can occasionally drop into the 20s (F) during the Arizona winters, and there can be no question about the benefits of this semi-sealed chamber. Going back to my observation of the rat sleeping against the flanks of a large *atrox*, there may be a form of mutual warmth-sharing involved. The body warmth of the rats may increase the ambient temperature within the den. It is even remotely possible that the bodies of the snakes may be used by the rats as a crude form of blanket to trap their own body heat. As improbable as this all may seem, pack rats and rattlesnakes have been seen denning together in other parts of the country as well. There is much work that should be done to investigate the unusual relationship between these two animals.

As for other ways the rats may benefit from the presence of the snakes, I have observed snakes ingressing with full sets of rattles, and egressing with rattles that appear to be chewed off. In March 1996, I also observed a pack rat nibbling on the remains of a hawk-killed snake. It might also make sense that



*Neotoma albigula* caught between a rock and a hard place, March 17, 1997. At the time this photo transpired, a large *atrox* had entered the den and was behind the rat. Two more *atrox* were basking out front and two photographers were mucking up the works. Note how high the debris is piled at the entranceway of this densite. Photograph by the author.

a larger predator, such as bobcat or badger, might think twice about trying to dig a pack rat out of a midden infested with *atrox*!

Putting aside any suppositions on pack rats and *atrox*, we now explore two behaviors in *atrox* that seem absent in the other four species of reptiles under discussion. We speak of combat (i.e., agonistic behavior—see Schuett and Gillingham, 1989), and mating. Both have been observed numerous times during astronomical winter in the Tucson area.

*Atrox* combat is truly a spectacular event, not soon to be forgotten by anyone fortunate enough to witness it. The fight begins when one male snake rises in the air and issues its challenge. This rising is performed by the snake standing as high as balance will permit, generally one-half of the body length. Many things can happen after the first snake rises into the air. The “intruder” may not like what it sees and flee in all-out panic. Sometimes the aggressor will give chase, and pursue the intruder for distances of up to 50 meters. Sometimes, the intruder will rise to meet the challenge, only to decide that discretion is the better part of valor, and to drop and run is the best course of action. At times, both snakes will rise, and then both drop without combat occurring. When this happens, some sort of decision appears to be reached between the two participants.

But there are also times when two evenly matched snakes will rise, neither will be intimidated, and all hell breaks loose.

The beginning stages of combat are slow, graceful, and downright poetic to witness. Both snakes rise in the air, and seem to waver like stalks of grass in the breeze. They face each other, turn their heads sideways so that they are looking at each other through one eye, turn their heads 180 degrees to each other, and then face each other again. Their straight, periscope-like forms then begin to draw into “S” shaped curves, the two “S” shapes begin to merge as one as they wrap about each other, and then the full fury of the fighting is unleashed.

Once “wrapped” about each other, the idea appears to be for one snake to knock the other to the ground. Seldom is the knockdown clean, usually the snakes are so tangled up with each other that they wind up knocking themselves to the dirt along with their opponent. In spite of the furious action, the snakes do not hiss, rattle, or bite each other, but their “sparing” is otherwise quite audible. As they twist and tumble about, their scales grate against each other, much like rubbing two pieces of sandpaper, and the sound of them hitting the ground together is quite loud. These bouts can last for hours, but my longest viewed episode lasted 20 minutes. Eventually, the combat reaches a conclusion when the winning snake chases the loser away. But even this effort does not insure that the losing snake will not “sneak” back into the den. My observations match those of Beaupre (1995): the losing snake will, at times, swing a wide circle around the den, and sneak back in when the “victor” is not paying attention. In observations of captive pit vipers, researchers are discovering that the loser sacrifices its immediate mating rights (Gillingham et al., 1983; Schuett et al., 1996).

But there is a gentler side to *atrox* as well, and every late winter/early spring, I witness this with clocklike regularity. I am speaking of the spring mating, which only lately has come to light in the herp-literature (Beaupre, 1995). The mating is always a great joy to behold, and is both a happy and sad time for me. I am happy when I see it, for it means that future generations of *atrox* are forthcoming, yet I am sad because it signifies the end of another fantastic winter herping season. Soon after the mating, the snakes disperse, fanning out into the flats that surround their winter hibernacula.

There is so much more that could be discussed concerning wild aggregations of *atrox*. For just one example, consider the alpha-males, and their importance to the success of the dens. These alpha-males are generally the first to arrive in the fall, and the last to leave in the spring. They also tend to be the last to enter the den for prolonged “hibernation,” and are often the only ones out basking during the colder winter months. Are they “standing guard” over the entire den? This author thinks so! Male-to-male sexual encounters have been observed, as has the successful mating of smaller, less-dominant males while alpha-males look on (see Schuett and Gillingham, 1989). I have also seen smaller male snakes “hide” female snakes by shielding them from sight with their bodies (Beaupre, 1995, describes this behavior as “stacking”). I have seen male snakes

guard their harems from photographers by positioning themselves on top of clusters of females. As denning *atrox* appear to be social animals, there is much that could be learned from studying their social interactions!

There can be no solid conclusion to what is unfolding in the Tucson area during the winter months. There are too many areas that still need more research and documentation. We are seeing the reptiles under discussion use some sort of homing instinct to zero in on appealing sheltersites. We know that these reptiles arrive and leave, we know *when* they arrive and leave, but don't know specifically what triggers this. We see evidence of *atrox* being more advanced in behavioral modes than the other four species under discussion.

In closing, the date of this writing is November 8, 1997. At this time, we have lyresnakes appearing in home crevices, chuckwallas have not yet arrived, some tortoises are home, some are moving towards home. No Gilas have shown themselves yet. In some of the *atrox* dens, ingress appears complete, in others, it has barely begun. The cycle has started again, just as it has for perhaps several thousand years. We earnestly look forward to the next go-around in hope that the months ahead will yield new knowledge and insights into little-understood phenomena.

#### Literature Cited and References

- Bailey, S. J. 1992. Hibernacula use and home range of the desert tortoise (*Gopherus agassizii*) in the San Pedro Valley, Arizona. Unpubl. M.S. Thesis, University of Arizona, Tucson, Arizona.
- Beaupre, S. J. 1995. Sexual size dimorphism in the western diamondback rattlesnake (*Crotalus atrox*): Integrating natural history, behavior, and physiology. *Sonoran Herpetologist* 8(3): 112-118.
- Gillingham, J. C., C. C. Carpenter and J. B. Murphy. 1983. Courtship, male combat and dominance in the western diamondback rattlesnake (*Crotalus atrox*). *J. Herpetology* 17(3):265-270.
- Martin, B. E. 1995. Ecology of the desert tortoise (*Gopherus agassizii*) in a desert-grassland community in Southern Arizona. Unpubl. M.S. Thesis, University of Arizona, Tucson, Arizona.
- . 1997. How I spent the prime of my life living with Gila monsters. *Sonoran Herpetologist* 10(10):106-110.
- Nowak, E. M. 1998. Implications of nuisance rattlesnake relocation at Montezuma Castle National Monument. *Sonoran Herpetologist* 11(1): 2-5.
- Schuett, G. W. 1996. Fighting dynamics of male copperheads, *Agkistrodon contortrix* (Serpentes, Viperidae): Stress-induced inhibition of sexual behavior in losers. *Zoo Biology* 15:209-221.
- Schuett, G. W., and J. C. Gillingham. 1989. Male-male agonistic behavior of the copperhead (*Agkistrodon contortrix*). *Amphibia-Reptilia* 10:243-266.
- Schuett, G. W., H. J. Harlow, J. D. Rose, E. A. Van Kirk and W. J. Murdoch. 1996. Levels of plasma corticosterone and testosterone in male copperheads (*Agkistrodon contortrix*) following staged fights. *Hormones and Behavior* 30:60-68.