

Canyons & Caves

A Newsletter from the Resource Management Offices
Carlsbad Caverns National Park

Issue No. 17

Summer 2000



Mexican Free-tailed bats occupy the roost in Bat Cave on May 28, 1997. This reflective infrared photo was taken looking straight up from a permanent photo-monitoring point. The dark areas are masses of bats. For more on this photo-monitoring program see page 9. (NPS Photo by Val & Jim Werker)

Edited by Dale L. Pate

Special Thanks to Paula Bauer, Bill Bentley, Kelly Thomas

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Look for Issues of *Canyons & Caves* at the following websites:
<http://www.caver.net/> Once there, go to the Caves & Canyons icon. Bill Bentley has placed all issues on his personal website.
<http://www.nps.gov/cave/> Kelly Thomas is in the process of placing these newsletters on the park website.

RESOURCE NEWS

FBI INVESTIGATION – The Federal Bureau of Investigation has recently been involved with a case of criminal activity associated with trespass in a park cave and the illegal use of explosives.

NEW CAVES – Over the last few months four small caves have been surveyed in the backcountry. This brings the total number of caves in the park to 92.

CHIHUAHUAN DESERT/SOUTHERN SHORTGRASS PRAIRIE EXOTIC PLANT CONTROL TEAM – Carlsbad Caverns National Park has been selected as a base for an exotic plant control team. The team will consist of a three-person crew, crew leader, and program manager. Their focus will be on the control of targeted exotic plants in recoverable areas of the following eleven area National Parks over a five year period: Amistad NRA, Big Bend NP, Fort Davis NHS, Guadalupe Mountains NP, Lake Meredith NRA/Alibates Flint Quarries NM, Carlsbad Caverns NP, White Sands NM, Capulin Volcano NM, Bents Old Fort NHS, and Washita Battlefield NHS. The team's primary target species will be Saltcedar or Tamarisk (*Tamarix ramossisima*) and Russian-olive (*Elaeagnus angustifolia*), both highly invasive exotic trees commonly found at springs and along waterways in the desert southwest.

NEW POSITIONS IN THE RESOURCE MANAGEMENT OFFICES – Myra Barnes has recently accepted the permanent Wildlife Biologist position in the Surface Resources Office. Paul Burger has recently filled the permanent Hydrologist position and Tom Bemis recently accepted the new Physical Science Technician position in the Cave Resources Office. Congratulations and welcome to the Resource Management Offices.

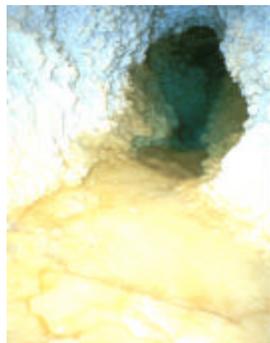
HIGH GUADS RESTORATION PROJECT – In January 1996, the US Forest Service closed a number of popular caves to recreational caving in Lincoln National Forest because of vandalism and cumulative damage to these resources. In January 1999, the High Guads Restoration Project was initiated to give volunteers the opportunity to help restore features in the closed caves and to work with the US Forest Service to better maintain and monitor these caves once they are reopened. The project holds work weekends

every month and has accomplished a number of worthwhile goals so far. Anyone interested in volunteering on this project should contact Susan Herpin.

RESTORATION IN PELLUCIDAR – Over the years, Jim & Val Werker have led numerous restoration efforts in Lechuguilla Cave. Their most recent trip in December 1999 cleaned mud and corrosion residues out of pools and off of flowstone in Pellucidar, an area in the Western Branch of the cave. Pellucidar was discovered fairly soon after the Rift had broken out and is most famous for its subaqueous helictites, the first to be discovered in the cave. These helictites as well as cave pearls and other features were threatened by mud that had been tracked into the area. The following pictures show the extent of the problem and the results of some of their efforts. We extend our thanks to Jim & Val and the numerous folks that have worked with them for all their hard work.



BEFORE picture of mud in a pool.



AFTER picture of the same pool.

(Photos *Val Hildreath-Werker* 1999)

WELCOME to Doug Sheperd, a new seasonal biological technician in the Surface Resources Office. Doug will be monitoring breeding birds and managing cowbirds at Rattlesnake Springs this summer.

WELCOME BACK to Jed Holmes. He is an Student Conservation Association volunteer for the Cave Resources Office for a couple of months this summer.

ADIOS to Ben Laws, a Student Conservation Association volunteer for Surfaces Resources. Ben heads to Alaska to monitor fish species aboard commercial fishing vessels.

ETERNAL KISS OR FRUSTRATED LOVERS?

by Garnet Goodrich

One of the mysteries of Carlsbad Caverns National Park has now been solved. When I started working here in November as a seasonal for the interpretation division, I was fascinated with the story of the Eternal Kiss. One version of the story goes like this: the formation in the Kings Palace is called the Eternal Kiss because a stalactite and stalagmite just barely touch (making it a column) in what looks like a kiss. Many people have declared their love next to this formation to show that their love is as strong as rock and set in stone. However one day a maintenance man was changing a light bulb in the light directly across from the

formation. He was up on a ladder and looked across and wondered whether they really touched or not. He decided to find out for himself. He moved the ladder so it leaned against the formation and climbed up. Looking at it he still couldn't tell, so reached into his wallet, pulled out a credit card and slid it into the space. So with this new knowledge, the formations name was changed from Eternal Kiss to the Frustrated Lovers. The moral of the story is that even though your love is set in stone, no matter how strong it is, a credit card can always come between it.

Upon hearing this story I wanted to know whether they really did touch or not. So I went to a great source of information, Bob Hoff, our park historian. Bob stated that he didn't know whether they touched or not and that he had talked to the maintenance person and he denied ever going up the formation and checking. I then went to Dale Pate our cave management specialist and asked him. He didn't know, but said that we could find out. He told me to remind him and we would see. After several months of reminding Dale, the day finally happened. On Thursday, April 13, 2000 at 4:45 I met Dale Pate, Paul Burger and Betty Cogdill (another seasonal) to find out whether they touch or not. Dale decided to use a ladder to get up to the middle of the formation. We padded a ladder and leaned it carefully against the formation. Dale went up the ladder and looked but couldn't tell. He reached into his wallet and pulled out..... no not a credit card, but his drivers license and slid it into the very small space.



A New Mexico Driver's License fits snugly between the stalagmite and the stalactite. (NPS Photo by Dale Pate)

So for the next x number of years it will remain the Frustrated Lovers until water once again drips down and helps it become the Eternal Kiss.

LIVING IN LION COUNTRY

by David Roemer

Reprinted from Canyons & Caves No. 11

If you live or work at Carlsbad Caverns, then you live and work in mountain lion country. Mountain lions have always been here, preying on mule deer and playing an important role in the ecosystem. Mountain lions are generally elusive animals, and are not often seen. Don't let that fool you into thinking that these powerful predators aren't there. If you've spent much time hiking in the

Guadalupe Mountains, then chances are that they've seen you - perhaps at a closer distance than you may realize.

WHAT TO DO IF YOU LIVE IN LION COUNTRY

Like any wildlife, mountain lions can be dangerous. As more people move into new subdivisions and recreate in parks and open spaces, encounters with lions will probably increase. Although human/lion interactions are infrequent, they are potentially dangerous. Serious consequences, including injuries and death, have resulted from such interactions. We can live with these predators if we respect mountain lions and their habitat. At Carlsbad Caverns National Park mountain lions are a protected and valued part of our natural heritage. To reduce the risk of problems with mountain lions at the park, we urge you to follow these simple precautions:

- Make lots of noise if you come and go during the times that mountain lions are most active - dusk to dawn.
- Closely supervise children whenever they play outdoors. Make sure children are not playing outside after dusk or before dawn. Talk to children about lions and teach them what to do if they meet one.
- Eliminate hiding places for lions, especially around children's play areas. Make it difficult for lions to approach unseen.
- Do not encourage wildlife to come near to your house. Predators follow prey. Store all garbage securely and **don't feed any wildlife**.
- Keep your pet under control, preferably indoors. Roaming pets, including dogs, are easy prey and can attract mountain lions. Bring pets in at night. Don't feed pets outside; this can attract raccoons and other animals that are eaten by lions.
- Encourage your neighbors to follow these precautions. Prevention is far preferable to a lion problem in the housing area.

WHAT TO DO IF YOU MEET A MOUNTAIN LION

People rarely get more than a brief glimpse of a mountain lion in the wild. Lion attacks on people are rare, with fewer than a dozen fatalities in North America in more than 100 years. Most survivors of attacks never saw the lion before first contact. Generally speaking, whether you have just seen a lion, or have just been grabbed by one, do your best to not act like prey! Specifically, the following guidelines may be helpful:

- When you hike in mountain lion country, go in a group and make plenty of noise to reduce your chances of surprising a lion. A sturdy walking stick can be used to ward off a lion. Make sure children are close to you and within your sight at all times.
- Do not approach a lion, kittens, or a kill site (if you're not sure, just stay away from dead animals). Give lions a way to escape a confrontation.
- **STAY CALM** when you meet a lion. Talk calmly yet firmly to it. Move slowly.

- **DO NOT RUN AWAY.** Face the lion and stand upright. Back away slowly only if you can do so safely. Running will likely stimulate the lion's instinct to chase and attack, so don't do it.
- **DO ALL YOU CAN TO APPEAR LARGER.** Raise your arms and open your jacket if you are wearing one. If you have children with you, protect them by picking them up so they won't panic and run.
- If the lion behaves aggressively, throw stones, branches or whatever you can get your hands on without crouching down or turning your back. Wave your arms slowly and speak firmly. You must try to convince the lion that you are not prey, and that in fact, you may be a danger to the lion.
- **FIGHT BACK AGGRESSIVELY** if a lion attacks you. Do not play dead, or you will be. People, even children, have fought back successfully with rocks, sticks, caps, garden tools, and bare hands. Remain standing or try to get back up. Always face the lion.

Human safety in mountain lion country is everyone's responsibility. Make sure that you and your family and guests take the proper precautions and know what to do in case of a lion encounter. Adopt an attitude of respect, not fear, and we can coexist with these magnificent animals.



MOUNTAIN LION MONITORING PROJECT: SPRING 2000

by Gavin Emmons

The mountain lion (*Puma concolor*) transect for spring of 2000 took place from April 24 to May 15 of this year. Participants in the transect project included new recruits (Gavin Emmons, Ben Laws, and Kale Bowling) as well as seasoned veterans (Dave Roemer and Renee Beymer). We are especially grateful for Laura Denny's assistance in shuttling transect participants up the crumbling, eroded mess of Guadalupe Ridge Road to the West Slaughter Canyon trail junction - and most of it in two-wheel drive no less! Many thanks to everyone involved in the process of logistics, transportation, and sloging over cliffs and into canyons for the transect!

Background and Methods

The transects were divided into five one-day transects in the Walnut Canyon drainage, one one-day transect in Slaughter Canyon, one two-day transect in Rattlesnake Canyon, and one two-day transect in Slaughter Canyon. To improve consistency in locating mountain lion sign, G. Emmons and

B. Laws participated in every transect, and D. Roemer and R. Beymer alternated to participate in every other transect (Table 1). Field methods followed the protocol in Smith et al. (1988) and described further in Harveson et al. (1999), and this was briefly reviewed to familiarize new participants with the mountain lion track survey process.



Mountain lion (*Puma concolor*) (NPS Photo)

Mountain lion signs – tracks, scat, scrapes, or kills – were recorded as standard units of sign (SUS), according to the following criteria detailed in Harveson et al. (1999):

- 1.) tracks having three-lobed pads, rounded toes, and width of the heel pad exceeding 42 mm;
- 2.) scat that is segmented, contains mammal hair, and is greater than 29 mm in diameter;
- 3.) scrapes greater than 15 mm wide, and those containing lion scat and/or urine evidence; and
- 4.) kills marked by a combination of canine punctures, broken rib entry, drag marks, the removal of the rumen, and the presence of tracks, scat, or scrapes.

Furthermore, only 1 SUS was recorded per marked kilometer along the transect to provide a more accurate correlation between individual sign and individual lions.

Daytime temperatures ranged from 50°F to over 100°F during the transect period. There was no precipitation during this time, and minimal rainfall for the 4-month period prior to the survey. These factors may have contributed to the preservation of sign over the past six months, and the concentration of sign along park drainages near permanent and intermittent water sources.

Results

We found 16 standard units of sign (SUS) comprised of 13 scats, 1 scrape, and 2 kills. Sign was found in 11 different kilometers. Our findings of 16 SUS were above the average of 15.0 SUS over the past thirteen years of transect findings

Table 1. – Transect Segments and Participants for Spring 2000 Mountain Lion Transects

| Date | Kilometers | Participants |
|--------------------|-----------------------------------|---|
| Apr. 24 | Walnut Canyon Km 26-28 | D. Roemer, G. Emmons, B. Laws, K. Bowling |
| Apr. 25 | Walnut Canyon Km 1-6 | R. Beymer, G. Emmons, B. Laws |
| Apr. 26 | Walnut Canyon Km 6-13 | D. Roemer, G. Emmons, B. Laws |
| Apr. 27 | Walnut Canyon Km 13-20 | R. Beymer, G. Emmons, B. Laws |
| Apr. 30 – May 1 | Rattlesnake Canyon Km 28-45 | R. Beymer, G. Emmons, B. Laws |
| May 3 | Walnut Canyon Km 20-26 | D. Roemer, G. Emmons, B. Laws |
| May 10 | Slaughter Canyon Km 46-54 | D. Roemer, G. Emmons, B. Laws |
| May 14 – 15 | Slaughter Canyon Km 54-76 | D. Roemer, G. Emmons, B. Laws |

Discussion

So what do these results mean? First, the spring 2000 findings provide some important insights into the strengths and disadvantages of the track survey approach. The essential ingredient for an effective record of mountain lion sign is a group of volunteers willing to hike the length of the transect. As a result, the track survey is inexpensive and safe, especially compared to radio telemetry and flight tracking techniques. The accessibility of the track survey approach has also made possible the consistent data collection of mountain lion sign in the park for the past thirteen years, providing an impressive, long-term record of lion activity in the area.

On the flip side, the use of track surveys does have a number of limitations. The quality and quantity of mountain lion sign observed along the transect is heavily influenced by the observer abilities and placement of volunteers along the transect (especially in wide canyon drainages). Although the Spring 2000 transect was completed with no precipitation during the study and little rainfall for the prior 4 months, significant wind, rain, and snow storms during previous transects have washed out some lion sign and hampered volunteers in their capacity to find remaining sign.

The interpretation of sign is another issue that is important to consider. Mountain lion scrapes and tracks in particular can be difficult to identify with a certainty. For the purposes of the spring 2000 transect, we only recorded scrapes and tracks that were clearly evidence of mountain lions (i.e. scrapes containing lion urine or scat and distinct tracks measuring over 42 mm).

It is also worth mentioning that further sign of mountain lion activity was recorded through the course of the spring transect, but was not included with the final

transect results because it did not qualify as SUS. This sign included 1 track and 3 scrapes (within the kilometers of other SUS), 3 scats less than 30 mm in diameter, 3 scats (greater than 29 mm but off the transect line), a kill at Oak Springs (found after the area was walked by the transect team), a kill near Yucca Canyon (off the transect), and lion sightings in Walnut Canyon near the Grammer drainage (by D. Roemer on May 1), and near Oak Springs on the Loop Road (by P. Burger on May 15). Therefore, the Spring 2000 results may provide a conservative representation that does not fully account for mountain lion population numbers or activity within the park (especially in the context of subadult and kitten sign that does not fit the dimensional requirements for SUS).

The quality of mountain lion sign found this spring was very exciting. A number of scats and kills found were fresh, as evidenced by odor and moistness of contents, confirming recent lion activity in the park. We also discovered concentrations of fresh sign in several areas: Oak Springs, the Grammer drainage, the Lechuguilla drainage, and the Yucca drainage. Presence of recent mountain lion activity was further confirmed by lion sightings (in the first two areas), and by human observation of the above sites only weeks prior to the deposition of mountain lion sign. Perhaps



Mountain lion scat. (NPS Photo by Ben Laws)

the most fascinating example of this occurred in our findings along the length of the Lechuguilla drainage, where we discovered a fresh, lion-killed barbary sheep (*Ammotragus lervia*) and mule deer (*Odocoileus hemionus*), tracks near the kills, and several scats. The barbary sheep's carcass had been placed in a shallow, grass-filled depression, and the evidence of bloody drag marks, the discarded rumen, numerous tracks, and the condition of the kill allowed us to determine where the lion ambushed the sheep, where it dragged it and fed on it, and its direction of travel afterwards. In effect, the concentration of mountain lion sign at these sites revealed where lions may have recently



Lion-killed barbary sheep covered lightly by grass. (NPS Photo by Ben Laws)

focused their activities in the park, and aspects of their behavior at those sites.

This raises the question of how many lions are in the park. Harveson et al. (1999) determined that there were no identifiable positive or negative population trends from fall 1987 to spring 1996. According to the Harvey and Stanley Associates project estimating lion density in the Guadalupe Mountains (Smith et al. 1986), and recalculating for the area of Carlsbad Caverns National Park, we may have 4 adult lions and 7 subadults and kittens roaming through the park. It will be interesting to see if the sites of concentrated lion sign found this spring will continue to be focal points for lion activity, and yield further information on lion behavior within the park.

References

- Harveson, L.A., B. Route, F. Armstrong, N.J. Silvy, and M.E. Tewes. 1999. Trends in populations of mountain lion in Carlsbad Caverns and Guadalupe Mountains National Parks. *The Southwestern Naturalist* 44 (4): 490-494.
- Smith, T.E., R.R. Duke, M.J. Kutilek, and H.T. Stanley. 1986. Mountain lions (*Felis concolor*) in the vicinity of Carlsbad Caverns National Park, NM., and Guadalupe Mountains National Park, TX. Harvey Stanley and Assoc., Inc. Alviso, CA. 137 pp.

WHITE HOREHOUND AN INVADING PLANT PEST

by Diane M. Dobos-Bubno

Walking to the cave along the visitor route or spending some time at an exhibit pullout allows many of our visitors and staff to enjoy some of the plants of the Chihuahuan Desert uplands. Unfortunately, not all the plants along our roadways and walkways are native and those that are not often can negatively affect the native plants of the desert region.

Such a plant is *Marrubium vulgare*, white horehound, an upright perennial originally from Europe and Asia. Horehound infestations occur throughout North America yet most states don't even list it as a noxious weed. New Mexico certainly does not. It is, however, listed as such in Australia, where it has seriously affected the grazing industry, particularly the wool industry, and infests native grasslands.

Horehound can be identified by the wooly appearance of its opposite leaves, greenish on top, whitish underneath. The leaves are round with a corrugated edge and a network of prominent veins. The plant can grow to just over two feet. Some of the plants in the park are quite bushy with hardy, woody stems. Since the plant is a member of the mint family (Lamiaceae, formerly Labiatae), the stems, also wooly, have a squarish shape. The upper stems have whorls of small white flowers in dense clusters that eventually form into fruits called nutlets. The plant propagates solely by the seeds found within the nutlets. As the nutlets form, the calyx (the cup of green sepals forming the base of the flower) develops spinelike teeth that curve downward and become hooklike with age.



White Horehound (*Marrubium vulgare*) leaves. Photo by Dr. Bill Bushing. Borrowed from the Catalina Island Conservancy website.

Horehound does well in arid environments where it survives the low rainfall and outcompetes annual grasses. It is highly invasive in disturbed areas lacking vegetation, such as both the old Rattlesnake Springs and Walnut Canyon horse corrals, where it can form dense monocultures. Presently, horehound is found throughout Rattlesnake Springs, in the developed areas of Carlsbad Caverns National Park (CAVE) along roadways, trails and parking lots, around all the administrative and visitor service buildings, and in the residential area. It has also been spotted

at locations in the backcountry where goats, sheep and cattle once grazed, notably Putnam cabin and Able springs. The hooked teeth on its tiny, brownish fruit attach to the fur of wildlife, stock animals, or the clothing and socks of humans, spreading it further. Water also spreads it along drainages, washes and creeks.

Though the plant is widely accepted as being “weedy”, the popularized medicinal aspect of this plant (horehound candy and other homeopathic uses) makes it difficult to find information on the best methods to eradicate it. Since the plant is a perennial, an important aspect of control is to destroy the taproot. Without doing so, resprouting occurs. Controlling *Marrubium vulgare* at CAVE requires an experimental approach over the next few years. The steps of that approach involve removing plants using different methods, evaluating which method, or combination, is successful, and following-up to remove new seedlings.

References

- Horehound-*Marrubium vulgare*. [An Illustrated Guide to Arizona Weeds](#), University of Arizona Press. 1972.
Weiss, John. [Biological Control of Horehound in South Eastern Australia](#). Proceedings from Agricultural Pest Biological Control Seminar, October 4 1995.

WEEKLONG RESTORATION IN CARLSBAD CAVERN A SUCCESS

by Stan Allison

The Cave Research Foundation fielded a group of 14 volunteers in two major restoration projects in Carlsbad Cavern from June 12-16. The main work area was near Cave Man Junction where red clay from early trail building activities had been inappropriately placed on formations. Volunteers first removed most of the clay from the work area and then began doing fine restoration work with brushes, spray bottles and sponges. Their work revealed stalagmites, flowstone and even cave pearls that had probably not been seen for more than 60 years.



The Crew: Back row from left - Brad Blackburn, Scott Stark, Frank Everitt, Walter Feaster, Ed Woten, John McIntyre, Dale Pate. Bottom row from left - Bill Bentley Co-Leader, Barbe Barker Co-Leader, Donna Mosesmann, Dorothy Mladenka, Rosanne Larson (Photo by Paula Bauer)

The second work area, an ongoing project of the Permian Basin Speleological Society, was the continued removal of blast rubble from the Old Lunchroom at the start of the Big Room. When the elevator shafts in Carlsbad Cavern were originally excavated much of the blast rubble was placed near the start of the Big Room on top of the natural cave floors. Rubble removal involved a lot of hard work shoveling the rubble into five gallon buckets, filling up wheel-barrow and then transporting the rubble to a dump truck behind the visitor center. The benefits of removing this rubble are easily apparent when the original cave floors are revealed. As workers progressed, numerous historical artifacts were found, including coffee mugs and bottles. All artifacts are surveyed to pinpoint their location, documented and turned over to Cultural Resources. Volunteers removed 3 dump truck loads of rubble during the week.

In addition to those in the photograph, Michael Bromka, Brian Coffey and Ed Peyton contributed to the restoration of Carlsbad Cavern. Several NPS employees and SCA volunteers also pitched in and helped. These included Brien Chartier, Susan Herpin and Carrie Mathias. The restoration that these volunteers performed is greatly appreciated by everyone who cares about Carlsbad Cavern.

A TALE OF TWO NESTS: SPRING 2000 BELL'S VIREO UPDATE by David Roemer

During the second week of April, Bell's vireo returned to breeding habitats in southern New Mexico, and their exuberant song was once again heard among the chorus of songbirds echoing in the riparian woodlands of Rattlesnake Springs. Rattlesnake Springs and the adjacent Black River are a critical habitat area for Bell's vireo, which is listed as threatened by the state of New Mexico. Though the vireos have returned to Rattlesnake Springs for many years, their future is uncertain due to the high rate of nest failure that they experience here. Since 1996, resource managers at Carlsbad Caverns have been monitoring the vireo population in an attempt to understand why vireo nests are so unsuccessful, and determine ways to manage for healthier populations.

We have observed that the main cause of nest failure in Bell's vireo is brood parasitism by brown-headed cowbirds. Cowbirds do not build nests of their own, but instead lay their eggs in the nests of other "host" species, relying upon the host to incubate their eggs and care for their young. The cowbirds at Rattlesnake Springs have demonstrated a strong preference for Bell's vireo hosts, laying anywhere from 1 to 5 eggs in most vireo nests. Also, the adult female cowbird frequently removes one or more vireo eggs to increase the chances that her own egg will hatch. In some cases, one or more female cowbirds have removed all of the vireo eggs.

Bell's vireos do not take this sort of treatment lying down, and we have noted aggressive behavior of vireos towards cowbirds. On 6 June, I observed a female cowbird land in an empty vireo nest. Within seconds, the male and female vireos attacked the cowbird, locking their talons into the cowbird's back and delivering several blows with their beaks until they tumbled out of the nest and drove the



Bell's vireo (*Vireo bellii*) are associated with desert riparian woodlands in the southwest. (Photo borrowed from The Audubon Society Encyclopedia of North American Birds by John K. Terres. Photo by Herbert Clarke.)

cowbird away. Vigorous nest defense is a good strategy against being parasitized, but it must be practiced all of the time to be effective. Vireos tend to leave their nests unguarded during the time between finishing nest construction and the onset of egg-laying (usually 1-2 days). As a result, cowbirds frequently lay their eggs in vireo nests before the vireos have begun to lay any of their own.



Two brown-headed cowbird eggs compete with three host eggs in this Bell's vireo nest. (NPS Photo by Dave Roemer)

Once a cowbird egg has been laid in a vireo nest, the vireos may still try to prevent it from hatching. In 1998, we observed that a Bell's vireo pair built a new floor over 2 cowbird eggs in their nest. These eggs were removed from the heat of incubation, and never hatched. Above the new floor they had built, the vireos successfully hatched and fledged their own young. Unfortunately, we have only seen this done once in over 100 parasitized Bell's vireo nests, so the practice is not common.

By far, the most common response that we have seen is nest abandonment. The vireos simply pack it in and build a new nest. Last year, one vireo pair built 8 nests in response to nest failure by predation or parasitism. Since nest-building takes 5 or 6 days to complete, the pair spent a month and a half of the breeding season just building nests. As may be guessed, they never successfully raised a brood that year.

Two Bell's vireo nests (given the identification numbers BEVI-W-1A & BEVI-W-3B) from this year illustrate the various fates that befall vireo nests at Rattlesnake Springs. Both were parasitized by cowbirds, and both were managed in an attempt to prevent cowbird eggs from hatching. One nest was successful, which makes it something of a rarity. The fate of the other nest is far more typical. These entries, describing nest contents and vireo behavior, are edited from field notes and data collected by Gavin Emmons and myself.

BEVI-W-1A

2 May: Found nest at 0900. It is 1.5 meters high in a hackberry tree. The male and female were in the area 0840-0855. The female gave an alarm call for 5 seconds, possibly at a Northern Mockingbird. The nest looks complete.

5 May: Checked nest at 0955. The male is singing nearby. No alarm calls from either bird. The nest is still empty.

12 May: At 0905 the male flushed from the nest. Inside were 3 Bell's vireo eggs and 1 cowbird egg. I removed the cowbird egg, which was warm from incubation. The male was singing from close by after he flushed. I was at the nest for 1 minute and neither bird alarmed.

20 May: The female flushed from the nest at 1020. No alarm. The nest has 3 Bell's vireo eggs still. Normal clutch size is 4 eggs, so the cowbirds must have removed one when they parasitized it.

24 May: I checked the nest at 0815 and found 3 Bell's vireo nestlings, approximately 1-2 days old. The male vireo is singing nearby.

31 May: At 0640 there was only 1 chick in the nest. The male is singing in the nest tree and the female is here too. The adults are feeding a fledged vireo, possibly two. The fledgling is begging for food from the parents.

6 June: At 0730 I checked the nest and found that another cowbird egg has been dumped here, although the nest is no longer being used by vireos. A fledgling is near the nest site, begging for food from the singing adult male. This nest has succeeded in fledgling at least 1 (likely 3) vireos.

BEVI-W-3B

20 May: Found nest at 1000 in a hackberry tree, 2 meters high. The female gave an alarm call for 15 seconds as I was near. The male is singing rapidly and forcefully from the nest tree.

23 May: At 0810 the nest contained 2 Bell's vireo eggs and 1 cowbird egg. I shook the cowbird egg to render it non-viable and replaced it in the nest. The male was singing nearby and didn't alarm. The female wasn't seen. Two minutes after adding the cowbird egg, the male returned to the nest and sat in it to incubate.

26 May: At 0840 the nest contained 3 cowbird eggs. All of the vireo eggs are gone. The male is singing in the area but this nest is probably abandoned. All cowbird eggs removed.

To date, only six pairs of Bell's vireo have successfully fledged young at Rattlesnake Springs. Fourteen other pairs have thus far been unsuccessful. We hope that through management we will be able to turn things around for Bell's vireo and other riparian-associated songbirds at Rattlesnake Springs.

MERRIAM'S KANGAROO RAT

(Dipodomys merriami)

by Ken Geluso

Merriam's kangaroo rat inhabits a variety of seabed habitats at Carlsbad Caverns National Park, ranging from 3,640 to 4,330 feet in elevation. This species was captured in both open and grassy habitats of the desert scrubland. In open areas, they were much more common on silty soil intermixed with small stones than in rocky situations containing Lechuguilla. In grassy patches, they were taken in areas where tall shrubs grow close together, as well as, in those places where low shrubs are widely scattered. Merriam's kangaroo rats also were captured in the arid grasslands and juniper plains. At Rattlesnake Springs, they were common in the shrub habitat around the horse barn where very little grass was present on the silty soil, and they also were trapped in the small section of desert scrub near the shooting range.



Merriam's kangaroo rat.

(Photo by Ken Geluso)

Similar to the situation with banner-tailed kangaroo rats, Baily (1928) states that *Dipodomys Merriami* are common "on the high limestone ridges about the Carlsbad Cave." Again, I caught no kangaroo rats of this species on the reef. I have traveled the paved road of Walnut Canyon at night numerous times without seeing a kangaroo rat scamper across the road. I have seen them, along dirt roads of the seabed at the base of the escarpment.

The presence of Merriam's kangaroo rats is less obvious than bannertails because they do not form mounds when constructing their burrows. Single burrow openings of this species often are placed near or under shrubs and cacti; the diameters of these openings range from 5-6 centimeters. It was not uncommon to catch *Dipodomys Merriami* in traps set around the mounds of the Bannertail kangaroo rat.

BAT PHOTOMONITORING UPDATE

by David Roemer

The evening flight of Mexican free-tailed bats (*Tadarida brasiliensis mexicana*) from the entrance of Carlsbad Cavern is one of the park's principal visitor attractions, second only to the cavern itself. Free-tailed bats are a migratory, colonial species that feeds entirely on insects. The colony at Carlsbad gives birth and fledges their young from June through September before migrating south to winter in Mexico.

Scientists and resource staff at Carlsbad Caverns National Park have documented a population decline and large-scale die-offs in the bat colony beginning in 1955 (Ahlstrand 1974, Altenbach et al. 1979, Constantine 1967). Similar declines have been noted throughout the southwestern U.S. and Mexico. Residues of organochlorine pesticides (primarily DDT and its metabolite DDE) have probably contributed to the decline of the bat colony at Carlsbad and elsewhere (Geluso et al. 1976, Clark 1988). Despite the ban of DDT in the U.S. in 1972, DDT contamination in the Pecos River Valley and Guadalupe Mountains may still cause harmful effects to wildlife (Clark and Krynskiy 1983). Whether bats are on the road to recovery is uncertain.

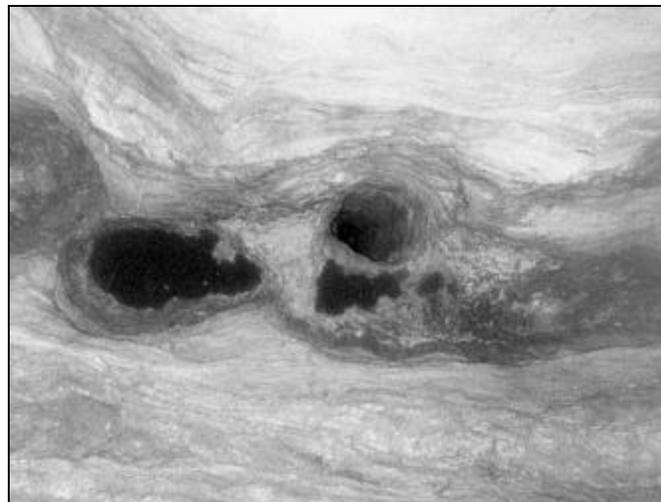
The health of the free-tailed bat colony at Carlsbad is therefore an important concern of park visitors, ecologists, and resource managers. What are the population trends of the colony? Has the bat population recovered following the plugging of the guano shafts in 1980? How has the population responded to a decrease in the use of DDT and other organochlorine pesticides? Are bat numbers as high as they may have been in the early 1900s? And what degree of fluctuation in the colony can be considered to be a "normal" response to changing environmental conditions, such as drought?

Attempts to answer these questions have been hampered by the problems inherent in sampling the bat colony (i.e., roost geography and inaccessibility, nocturnal behavior of bats, large numbers of bats, etc.). The size of the free-tailed bat colony at Carlsbad has been estimated using a variety of techniques since the 1920s, providing estimates ranging from 8.7 million to 200,000 bats. These estimates have included visual observations of activity (Bailey 1928, Allison 1937), capture-recapture studies (Constantine 1967), still photography (Altenbach et al. 1979) and computer-assisted video analysis of outflights. These methods have been generally limited by cost and labor intensiveness, sources of error (i.e., observer bias), and a lack of statistical precision, thereby limiting their usefulness as a method for assessing long-term trends in the colony.

Infrared Photomonitoring

One promising methodology for monitoring the bat population involves the use of reflective infrared photography to document the location and size of the bat colony within the Bat Cave portion of Carlsbad Cavern. This method, funded in part by the Adopt-a-Bat program, has been in use since 1996 (Route et al. in prep). Black and white infrared photographs are taken from permanent photo-

points in Bat Cave to document the extent of roosting bats. These photographs, taken during five days in early summer, ten days in mid-summer (when pups are present), and five days in late summer, are then overlaid with a grid that measures square feet of ceiling space. Colony size can be estimated by taking the area and multiplying by 200 bats per square foot ($2,153/\text{m}^2$), a conservative estimate of roosting density (McCracken 1984).



Mexican free-tailed bats (black patches) roosting in natural domes and near an old mine shaft (center right) on cave ceiling in Carlsbad Cavern, New Mexico. Image taken June 2, 2000 using reflective infrared photography. This image contains all of the bats present in Bat Cave on this day, occupying approximately 8.25 square meters of ceiling. (NPS Photo by Val & Jim Werker)

June 2000 Results

The results from this year's count are presented below. The photographs were taken and developed by Val Hildreth-Werker and Jim Werker of Southwestern Composites and Photography. The ceiling area was independently calculated by Jim Werker, Ben Laws, and David Roemer. Applying a conservative roost density of 200 bats per square foot ($2,153/\text{m}^2$), the population for the 5-day period was 42,000 +/- 16,000 (95% confidence interval) with daily fluctuations between 18,000 on June 2 and 64,000 on June 5.

Discussion

High daily variability was noted during the photo-period, with an overall increasing trend evident. This is possibly due to bats immigrating to the roost. The first rains of the season, which usually correlate with increases in bat numbers at the cavern, occurred during the photo-session. The differences in ceiling area observed could also be due to changes in roosting density, or variable utilization of roosting surfaces that are not visible to the camera (i.e., domes and cracks). In other words, there *could* be the exact same number of bats in the cave each day, only they are spaced and aligned rather differently as to appear greater on some days than on others. While this probably does occur to some extent, I feel that bat immigration in response to the drought-ending rains better explains the observed increase in ceiling area.

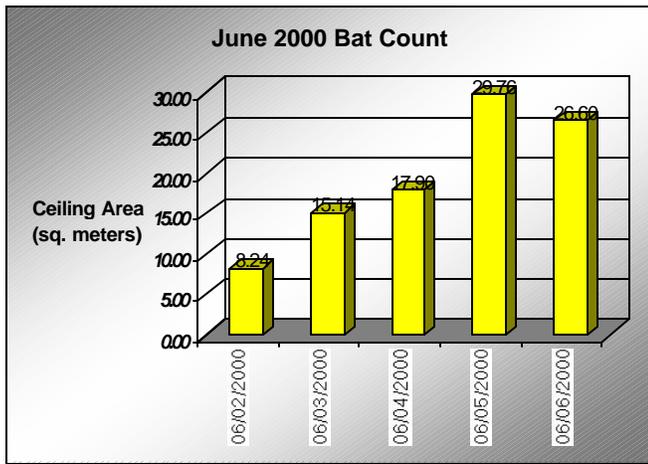


Fig. 1. Ceiling area figures are averaged from 3 independent counts. Rain fell in the area during the photo-period, ending a period of drought and possibly affecting bat numbers.

Bat immigration and emigration with respect to the roost at Carlsbad Cavern is not a new phenomenon. During 1936 when Allison (1937) calculated a bat population of 8.7 million, there were many disappointing bat flights in August when “not over 100 bats flew out” according to park files. During the summer of 1998 park researchers noted Mexican free-tailed bats flying into the cavern with baby bats attached to them. Presumably, these bats were born in other nursery locations in the region, and were moved to Carlsbad when conditions became favorable here, or unfavorable elsewhere. While this elasticity in roost habitat is truly fascinating, it greatly complicates our monitoring efforts, stretching the error bars for our five-day bat counts beyond where we would wish them to go.

Despite the sometimes tricky task of arriving at a population figure for the bats, the infrared photographs do shed some light on the changing roost configurations of the colony, and provide adequate data to determine population trends. These photographs serve as a permanent record of the colony, and can help us examine how the colony changes within season and from year to year. For example, a photograph of the same area from four years ago is included below. It appears evident from the photograph that there were more bats in the roost on June 2, 1996. Indeed, the population estimate for the period (May 29 to June 2) was 193,000 +/- 51,000 bats.

Evaluating colony size and assessing long-term trends in the Mexican free-tailed bat population at Carlsbad Caverns is a critical need for informed resource stewardship. For this and future bat inventory and monitoring efforts to be successful, methods should:

- Provide a consistent estimate of the minimum population size;
- Provide a measure of statistical precision so that annual trends could be compared;
- Be user-friendly so that revolving park staff can collect consistent data;
- Be relatively inexpensive so that monitoring can be done annually; and
- Have the potential for being comparable with data collected elsewhere so that immigration and emigration, as well as regional trends, can be assessed.



Mexican free-tailed bats (black patches) roosting in natural domes and near an old mine shaft (center right) on cave ceiling in Carlsbad Cavern, New Mexico. Image taken June 2, 1996 using reflective infrared photography. This and other photographs taken on June 2, 1996, indicated a total ceiling area of over 130 square meters of bats. (NPS Photo by Val & Jim Werker)

We will be conducting our next counts during July 17-24 and August 25-29. The ten-day count in mid-July is an interesting time to monitor, as any pups born in Bat Cave this year should still be present and dependent on their moms for feeding. Adult female bats that are lactating are expected to exhibit a strong fidelity to the roost site during this period, and thus be regularly photographed during the photo-session.

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CAVE QUESTIONS by *Stacey Haynie*
& **ANSWERS** by *Paul Burger, Dale Pate,*
& *Jason Richards*

Carlsbad Cavern – Big Room

Where do we get the figure 14 acres or 14 football fields to describe the Big Room? While we don't know where the figure of 14 football fields or 14 acres came from (perhaps Bob Hoff or Fred McVaugh can find a historical reference for this), we can calculate the size of the Big Room in reference to football fields and acres. The *Atlas of Great Caves of the World* by Courbon, Chabert, Bosted & Lindsley published in 1989 on page 17 states that the floor area of the Big Room in Carlsbad Cavern is 33,210 square meters. 33,210 sq. meters equals approximately 357,480 sq. ft. A football field is 360 feet long (which includes the end zones) by 160 feet wide or equal to 57,600 sq. ft. By dividing 357,480 sq. ft. into 57,600 sq. ft., you roughly get that **6.2 football fields would fit into the Big Room.**

In acres, one acre is equal to 4,840 sq. yards or 43,560 sq. feet. Divide 43,560 sq. ft into 357,480 sq. ft. and we find that the **Big Room is 8.2 acres** in size (more or less).

Carlsbad Cavern - King's Palace

Why are 75 visitors allowed on the King's Palace tour? When the area became a guided tour area only, the Superintendent and Chief of I&VS made the decision to limit the tour size to 75 based on a number of factors. This number was arrived at by determining what the largest group size could be handled while still providing a good interpretive tour and protecting the fragile resources of the area.

Why is the green lake green? The blue-green color of green lake is a result of light shining through the water. The deeper the water, the further light travels through it, the bluer the color.

Why is the floor of the King's Palace so flat? There is some speculation that some of the floor of the King's Palace was filled in which would allow early visitors the opportunity to wander around enjoying the room. It may be though that most of the room was flat to begin with and everyone just crushed the floor features as they walked over them. There are photographs from the early days showing dozens and dozens of people in the room.

What's above the King's Palace area to make these series of rooms so wet? The King's Palace area is located along a major north-south fracture system. You can trace this system from Chocolate High, through the New Mexico Room and the King's Palace, and out into the east end of the Big Room

towards Crystal Springs Dome. The joints pointed out on the "Joints and Solutioning " wayside are part of this system. This fracture system captures water moving horizontally in the Yates or along the Yates/Tansil contact and brings it down through the massive Capitan limestone into the cave.

Spider Cave

What geologic layer is the cave in? Spider Cave is in the Yates, backreef formation.

Is this also a sulfuric acid made cave? Yes. The reason Spider is shaped so differently is because fracturing is much more prominent in the backreef beds. Dissolution occurred preferentially along the fractures and gave the cave its mazy character.

What is the surveyed length of the cave? The surveyed length of Spider Cave is 3.54 miles (5.7 kilometers) of mapped passage. The deepest point in Spider is 152.9 feet below the entrance level.

Is the survey of the cave completed or is there more to survey? The possibility of more passage yet to be discovered in Spider Cave is great. The high volume of air exchange in Spider Cave suggests a larger cave than is presently known. However, as with lots of caves the size of the unknown passages may not be large enough for humans to explore.

Did the cave get "lost" due to a flood and when did the gate get installed? The records we have on Spider Cave are confusing, but a time line by Ken Baker or Paul Spangle written on November 9, 1958 indicated that a flood in 1941 filled the entrance to Spider Cave with gravel. We then have a report from John Getchell, who with several others, entered Spider Cave on August 18, 1946. Presumably, the entrance was once again filled with gravel sometime between 1946 and 1958. The area where the Spider Cave entrance is located was relocated on September 23, 1958. It took three trips to dig the entrance out and it was reopened on November 6, 1958. Evidently, losing the entrance to Spider Cave had been an ongoing problem. Bob Crisman and others in 1959 (you can see the date in the photograph below) built the rock structure over the entrance and placed a flat metal gate at the top of the structure. You could probably fry eggs on this plate during the heat of the summer.



The old Spider Cave gate was installed in 1959.
(NPS Photo by Harry Burgess)

How come the speleothems are so white compared with other area caves? The natural color of calcite is white or translucent clear when active; this is the case in Spider Cave. The white color of the formations is due to it's drying out and the effects of the corrosive atmosphere.

Where did the harvestmen (daddy longlegs) go? The habitat for the harvestmen (daddy longlegs) changed when the original gate was installed, making the entrance passage unsuitable. They left to find new homes in rock crevices, holes and other hiding places in the limestone.

Are harvestmen (daddy longlegs) venomous? "The story about harvestmen being venomous and so on is completely untrue, and is the most common old wive's tale about them." So stated Dr. William Elliott, a noted cave biologist with the Missouri Department of Conservation. Dr. Elliott goes on to say that part of the misunderstanding comes from Australia where there is a "daddy-longlegs spider", a true spider that is quite venomous.

Have there been any rescues from the cave? There was a "mock rescue" from Spider Cave in 1996. There have been no real rescues that we know of.

How did the new gate and entryway change the cave? Did it also change water flow patterns? If you mean the rock structure and steel plate lid, then it significantly changed the entrance area. The harvestmen stopped using the cave and access was severely restricted for raccoons and other animals. Obviously, it did not restrict everything because rattlesnakes have always been found in the entrance area, even before the new gate was installed. The rock structure also allows less water to enter the cave during floods than when the entrance was natural. The present open-style stainless steel gate replaced the old steel plate and was installed by Harry Burgess, Dale Pate and Jason Richards in August 1995.



The new Spider Cave gate is made of stainless steel bars which makes it easier for animals to utilize the cave. (NPS Photo by Harry Burgess)

The present gate is "critter friendly" and allows rain to fall directly down the entrance shaft, however, does nothing for water flow unless the flood reaches above the level of the rock structure. Scorpions used to wait by the small gaps in the lid at sundown to capture an easy meal as cave crickets would exit. Now, invertebrates such as harvestmen and cave crickets have greater freedom to enter and exit the cave without fear of predators.

Slaughter Canyon Cave

What geologic layer is the cave in? The cave is developed in the massive Capitan (main reef) just below the contact between the Yates (Backreef) and the Capitan. Wen Cave is located at the contact between the Capitan forereef beds and the massive Capitan.

What did the natural entrance originally look like? Dr. R.M.P. Burnet described the entrance in an article in Natural History Magazine from May, 1938 as follows: "This cave was well concealed by a fall of rock from above covering the mouth so that it was invisible from above or below." Perhaps Fred McVaugh can find an old photograph of the original entrance in the museum.

Why does the Xmas Tree sparkle? The Christmas Tree sparkles as the cave dries out and water has stopped dripping onto the formation. As the Christmas Tree dries out, crystal faces are exposed that reflect light causing the Christmas Tree to sparkle. It is not known whether these crystals are calcite or some other mineral such as gypsum. When the cave is wetter and water covers the surface of the Christmas Tree, then it does not sparkle.

Why does the rope to the Xmas Tree room reek? The rope reeks from all the organic materials that are rubbed into it from the hundreds of hands that use the rope and the bacteria that feeds on those organic materials. That is why we replace the rope occasionally.

Is the Monarch the 3rd tallest column in the world? Any numbers that may be going around are pure speculation. While the Monarch is probably one of the tallest columns in the US, there is no way of knowing its present ranking in the world. There are probably a number of columns that are taller. When talking to visitors about the height of this spectacular column, it would be safe to say that it is one of the tallest columns in the world, but stay away from saying the 3rd or any other number.

What are the second and first tallest columns? Well, the Bicentennial Column in Ogle Cave is taller, but once again, there is no way a number can accurately be assigned to any of our columns.

Has anyone studied the pictographs in the cave? When did this occur and by whom? In 1990 & 1991 Mike & Barbara Bilbo began studies on the rock art in the cave, though their work should only be considered as preliminary. Mike and Barbara identified approximately 50 panels, some of them very faint. Their work focused mostly on documenting what art was there. Dr. John Greer, a rock art expert, visited the site in 1992 and felt that the art probably represented three separate periods of time. No other studies have been done on this art.

Where were the pottery shards found and where are they now? Dr. Burnet in his 1938 article claims to have found parts of four pottery vessels at the base of a bank of stalagmites and near a pool of water. He states that they had only penetrated 500 feet into the cave. Jeff Denny may be able to answer the question of where these shards are now.

Is there evidence of prehistoric people camping in the cave? There has not been any archeological survey done in the cave and so no prehistoric discoveries of camping areas have been found. Obviously, the cave has been extensively used at times by prehistoric people and the possibility of important discoveries is great. This is all the more reason for

everyone to understand how important it is to not disturb any material in the cave, historic or prehistoric.

Were the items we see in “the museum” actually found there? Other than the tire tracks, everything in that area was picked up from other areas of the cave and placed there. Material appears to have been moved to this location to aid in the interpretation of the guano mining.

The bats stopped coming to the cave. Why? There are numerous reasons why bats may have stopped roosting in Slaughter Canyon Cave. If the bat roost is as old as recent evidence shows (1/2 to 1 million years old), then that leaves lots of time for things to happen. Perhaps a long drought occurred and the bats could not sustain their numbers in the area. Perhaps trees grew into the entrance and they couldn't enter the cave easily anymore. Dr. Burnet states that the entrance had a large collapsed rock over it, so the collapse of the entrance may have prevented bats from returning to the cave.

Why did they leave other areas of the cave? Over long periods of time, the bats moved around in the cave to roost for a variety of reasons. We see daily fluctuations in where the bats roost in Carlsbad Cavern. It was probably the same there.

RECENT OBSERVATIONS OF TOADS AT RATTLESNAKE SPRINGS

by David Roemer

Heavy thunderstorms that brought rain and flooding to Rattlesnake Springs on June 11 and June 12 also triggered the emergence of desert toads. Large breeding choruses of Couch's spadefoot (*Scaphiopus couchii*), New Mexico spadefoot (*Spea multiplicatus*), western green toad (*Bufo debilis insidiosus*), and Texas toad (*Bufo speciosus*) established themselves around temporary ponds that had formed in the desert lowlands near the springs.

One particularly large pond, where all four species were present, was formed behind the shooting range in the northwest corner of Rattlesnake Springs. The pond inundates a large area both on and off the park. Except where noted, all observations are from this location, which I visited on June 12 and June 13. On the second night I was accompanied by Gavin Emmons and Ben Laws. Gavin and Doug Shepherd also visited the pond on the morning of June 13.

Western Green Toad

On the nights of June 12 and June 13 western green toads were numerous on the banks along the shoreline of the pond. They were also occasionally found calling from shallow water or beneath emergent vegetation. In addition to this locality I also heard them from a smaller pond at the intersection of the Black River and Hwy. 62-180 on the evening of June 17. Their call is an explosive high-pitched trill that usually lasts for 3 – 5 seconds. When they call from right next to you, the sound is almost deafening. Western green toads were first documented in the park by Keith Geluso on May 25, 1992, along the dirt road leading to Yucca Canyon (Geluso 1994).

Texas Toad

Gavin and Doug noted Texas toads at the shooting range pond on the morning of June 13, however they were not observed there on the evenings of June 12 or 13. This large toad can be identified by the oval-shaped parotoid gland, and the sausage-shaped vocal sac that projects up and outward when it calls. There were 10-20 individuals out in the water among emergent vegetation. Degenhardt et al. (1996) state that Texas toads are abundant in mesquite grasslands along the Black River.



Western green toad (*Bufo debilis insidiosus*) photographed at Rattlesnake Springs, June 13, 2000. (NPS Photo by Dave Roemer)

Couch's Spadefoot

Couch's spadefoot were observed calling from underground burrows around a small pond just south of Rattlesnake Springs on the evening of June 11. On June 12 there were 20-25 Couch's spadefoot calling from a small pond along the park road that leads to the shooting range, however on June 13 this small pond was completely silent. New Mexico spadefoot toads were present at both ponds, but Couch's spadefoot were more numerous. At the large shooting range pond, Couch's spadefoot were observed calling in the open water on the evenings of June 12 and 13 and the morning of June 13. Some individuals were also observed along the shore in areas where the water had receded slightly. Couch's spadefoot has a call that sounds like a bleating goat, repeated at 5 – 10 second intervals.

New Mexico Spadefoot

New Mexico spadefoot toads were calling from the surface of the water at the small pond south of Rattlesnake Springs on June 11. On June 12 there was only one New Mexico spadefoot calling from the small pond along the road that leads to the shooting range. At the shooting range pond, New Mexico spadefoot toads were in the majority on June 12 and 13, floating along the edge of the pond, sometimes observed in amplexus. Their call, which never ceased, has been described as running your finger over a large metallic comb.



New Mexico spadefoot (*Spea multiplicata*) photographed at Rattlesnake Springs, June 13, 2000. (NPS Photo by Dave Roemer)

Selected References

For further reading on the ecology of toads, I recommend Degenhardt et al. (1996) and the park-specific reports by Gehlbach (1964) and especially Geluso (1994). Keith Geluso photographed toads from the park while helping his father Ken work with small mammals during 1991-93. He confirmed the presence of 4 toad species that Gehlbach (1964) noted, plus he documented western green toad and Great Plains toad (*Bufo cognatus*), which had not been previously found in the park.

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ALLIGATOR JUNIPER (*Juniperus deppeana* var. *deppeana*) by Dale Pate

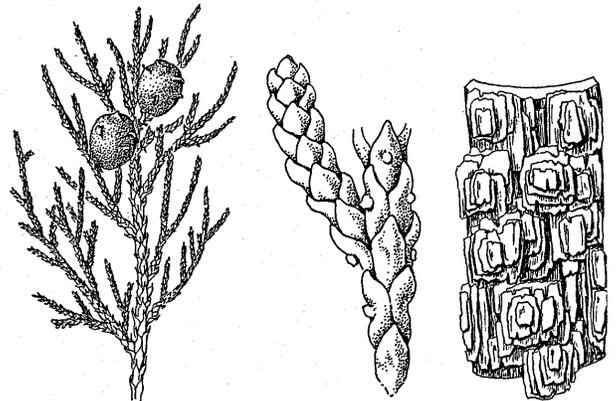
Alligator juniper is a prominent tree found at higher elevations in Carlsbad Caverns National Park. This species is easily recognizable because of its bark that resembles the plates on an alligator's back. In the park, this small tree can reach 20 to 30 feet in height, have a trunk diameter of 2 to 3 feet and may reach an age of 500 to 800 years old. The alligator juniper is found throughout the mountains of west Texas, westward through the desert ranges of New Mexico and Arizona and south into Mexico.

Junipers are part of the Cypress family Cupressaceae which contains about 20 separate genera and 130 species throughout the world. All species of the cypress family are evergreen trees or shrubs. There are about 60 species of junipers found in the northern hemisphere. Several different species of juniper, including the Alligator juniper, are found throughout the Guadalupe Mountains.



Trunk of an Alligator Juniper. Photo © Dale L. Pate

The alligator juniper produces marble-size berries that are blue-gray in color turning reddish brown upon maturing. These berries are an important food source for birds and animals. The berries were also an important food source for American Indians and were eaten fresh or stored for winter use.



Leaves, berries and bark of *Juniperus deppeana* var. *deppeana*. Sketches borrowed from *Trees and Shrubs of the Trans-Pecos and Adjacent Areas* by A. Michael Powell

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