CANYONS & CAVES

A Newsletter from the Natural Resources Offices Carlsbad Caverns National Park

Issue No. 9 **Summer 1998**

Edited by Dale L. Pate

TABLE OF CONTENTS

Photo: Elephant Rock in Slaughter Canyon © Dale Pate 1998

RESOURCE NEWS

BAT FLIGHT– Ken Geluso's statement in the last issue concerning flash photography needs some clarification. His corrected statement is as follows: ***"Because we do not know how much flashing lights from the amphitheater affect the bats and because we do know that some types of artificial lights do affect the bats, I recommend that flashes not be used during the evening exit flights of the Mexican Free-tailed bats from Carlsbad Cavern."***

ROCK CLIMBING – A permit is required for all technical climbing activities in the park. This includes climbers utilizing technical aids, as well as unaided free climbing not utilizing technical assistance. A permit can be obtained from the Cave Resources Office. For the safety of those driving to Carlsbad Cavern, climbing within view of Walnut Canyon Drive is strictly forbidden.

FRINGED MYOTIS BATS – On June 25 while using bat detectors equipped with earphones, Stan Allison and Gosia Roemer counted an average of 329 bats leaving Left-hand Tunnel for their nightly feed outside. This is more than double the number of Fringed Myotis bats that were counted in 1996. There were no counts in 1997.

THANKS TO JULIA CRONK for spotting a major sewage leak on the main sewer line that runs to the sewage lagoons. Her observations and fast reporting earned her a Fast Track Award.

SLAUGHTER CANYON CAVE – A correction from last issue. Thanks to Lyn Carranza, Laura Denny, Benny and Thomas Martinez, and Mark Cordova for removing a lot of equipment from the cave.

LAWSUIT OVER MOUNTAIN LIONS – Two organizations, Defenders of Wildlife and Animal Protection of New Mexico, are suing Wildlife Services, an agency within the Department of Agriculture and formerly known as Animal Damage Control, over the mountain lion killing program for Game Management Unit 30. This unit includes the Lincoln National Forest portion of the Guadalupe Mountains and other federal, state, and private lands surrounding Carlsbad Caverns National Park. Wildlife Services is accused of violating the National Environmental Policy Act (NEPA) by killing

mountain lions without reliable estimates of their population. For the last ten years, Wildlife Services has allowed up to 14 lions per year to be harvested from Unit 30 each year.

CONGRATULATIONS to Diane Dubois-Bobno. She has graduated from the NPS Intake Program for Resource Management and will be staying on at the Resource Management Offices here at Carlsbad Caverns NP.

MOUNTAIN LION TRANSECT RESULTS FOR SPRING 1998

by David Roemer

The Spring monitoring transect for mountain lion (*Puma concolor*) sign took place from May 6 through June 16 this year. We had a lot of help from first-time transect participants (Renee Beymer, Chris Roche, Hannah Spaul, Mike Mulheisen and Stan Allison) as well as seasoned veterans (Roemer and Diane Dobos-Bubno). The temperature climbed above 100° F on both of the overnight transects, but we got it done. Congratulations and thanks to Renee for completing all 76 kilometers.

All told, we found 18 standard units of sign (SUS) comprised of 12 scats, 3 tracks, and 3 scrape sites. We actually found much more than this, but the study design has some fairly rigorous guidelines concerning how to define and interpret multiple sign found in a single kilometer. For example, multiple tracks found within one kilometer only count as one official SUS. Even so, the 18 SUS makes for our second-highest Spring total (see Table 1). Despite the high mortality of mountain lions in this area (21 per year during 1982-1985), the great cats still prowl the canyons and mesas of the Guadalupes.

However, at Stone Spring we found the remains of one lion that prowls no longer. This lion was probably an adult female between 6 and 8 years old (based on tooth-wear, distance between canines, and pad measurements). She may have been killed by another mountain lion (cats are strongly territorial which often leads to fights to the death) or she may have become injured while trying to feed. Taking down a mule deer is something of a high-risk activity, even for skilled cats! Because she had been out there for a while, there is no longer any fresh evidence to suggest what caused her death.

Strangely enough, finding a dead mountain lion somehow brings life to the study data. Somewhere in the 11 years of data on lion trends in the Guadalupes are recorded the footprints of this cat. Any of a number of dead mule deer that we have recorded could have been the handiwork of this particular lion. Her offspring may still remain in these mountains, or perhaps they have dispersed to the Sacramentos or beyond. Wherever mountain lions roam, the landscape is made alive by their presence.

Table 1. Summary for mountain lion sign surveys in Carlsbad Caverns National Park, 1987-1998.

		Sign type				Total		
Year	Season	Scat	Scrape	Track	Kill	SUS	Km	FOE*
1987	Fall	7	2	3	1	3	76	0.171
1988	Spring	3	3	1	1		76	0.105
1988	Fall	6	2	0	0		76	0.105
1989	Spring	11	3	0	0	4	76	0.184
1989	Fall	8	0	0	0		76	0.105
1990	Spring	15	2	0	0	7	76	0.224
1990	Fall	5	0	7	0	2	76	0.158
1991	Spring	8	2	1	0	1	76	0.145
1991	Fall	3	0	1	0		76	0.053
1992	Spring	6	0	2	0		76	0.105
1992	Fall	9	1	2	0	2	76	0.158
1993	Spring	9	2	2	0	3	76	0.171
1993	Fall	15	3	3	1	2	76	0.289
1994	Spring	10	12	3	0	5	76	0.329
1994	Fall	11	2	6	0	9	76	0.250
1995	Spring	3	5	5	0	3	76	0.171
1995	Fall	9	0	2	0	1	76	0.145
1996	Spring	12	1	3	0	6	67	0.239
1996	Fall	7	2	4	1	4	76	0.184
1997	Spring	8	0	3	2	3	76	0.171
1997	Fall	3	4	11	0	8	76	0.237
1998	Spring	12	3	3	0	8	76	0.237
Avg	Fall	7.5	1.5	3.5	0.3	12.8	---	0.169
	Spring	8.8	3.0	2.1	0.3	14.2	---	0.189
	Both	8.2	2.2	2.8	0.3	13.5	---	0.179

*FOE is the frequency of encounter, calculated as the total SUS found divided by the number of transect kilometers (SUS/km).

BAT FLIGHT VIEWING: PRESERVING THE OPPORTUNITY

by Gary Vequist

Watching the evening flight of Mexican free-tailed bats (*Tararida brasiliensis)* from Carlsbad Cavern is almost as popular a tourist attraction as touring the cave. The consistent return of the bats to their summer roost has created a sustainable tourism attraction enjoyed by 70,000 park visitors each summer, making it the most popular wildlife viewing location in the Southwest. Just
before darkness something triggers the bats to leave their daytime roost. It's the park's version of Old Faithful Geyser. This summer the crowds are back to view the bats, but we are still waiting for a larger showing of bats.

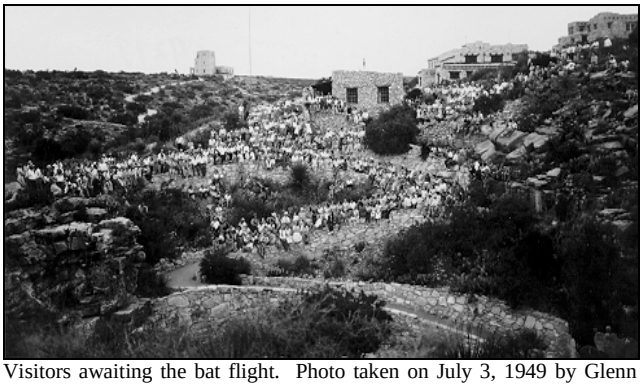
So why do people flock by the thousands to see these furry beasts? I believe people are seeking adventure; to be

Vernon Bailey giving a lecture of bats at the entrance to Carlsbad Cavern. Photo taken on July 3, 1938 by Supt. Boles.

able to watch a creature that infiltrates our imaginations with our beliefs and fears. The evening ranger talks serve as an introduction to get people to appreciate these amazing creatures instead of fearing them. Remember fear exists when we don't understand! This natural phenomena provides a forum to provide an environmental message on the importance of protecting park areas to discover things about our natural world.

Many visitors are from crowded regions where such spectacles of nature no longer exist, except in Austin Texas where bats are an excepted part of the natural urban fauna. The majority of park visitors reported that viewing unpolluted vistas and viewing wildlife were the most important reason for visiting parks! Although many people's preference is to see large charismatic mammals; strangely, the preference here has switched to viewing one of the smallest mammals, bats. Most visitors come to Carlsbad to see the **CAVE**, but they go home talking about the bats.

Early park visitors started gathering to watch the emergence of this colony of bats as a novelty. They came for the unique experience of watching emerging hoards of bats from this dark hole in the earth. The first formal ranger talk was given in July of 1929 in front of a temporary grandstand. During subsequent decades the numbers of human observers increased, while the numbers of our elusive bats decreased.



Visitors awaiting the bat flight. Photo taken on July 3, 1949 by Glenn Haynes.

The park's attempts to balance the species' needs with the desire of visitors to see bats can result in harmful disturbance. Recreational tourism demands can result in actions that degrade bat habitat. In 1963, more due to luck than actual careful planning, an outdoor amphitheater was constructed a sufficient distance away from the primary bat flight path to avoid significant disturbance.

In a report prepared earlier in 1944, it was recognized that precautions were necessary to protect bats from human harassment. Structures were not permitted near the cavern entrance in order to preserve the normal flight-way of the bats. Any new structures near the cave entrance should include plans to accommodate visitors, but at a distance.

The 1944 report further stated: "*Bats use of the entrance from an hour before sundown to an hour after sun-up will prohibit any nocturnal cavern trips via the entrance. Thus any thoughts of extending the hours of operation in the caverns will necessitate entry and exit by elevator."*

Today to reduce disturbance of bats, stringent rules are in place governing activities of observers. Visitors are required to remain seated and quiet during the bat flight. Scientific studies show that bats fly away from noise sources that can disrupt their spiraling flight paths.

Also, prohibited is the use of flash photography, which can deflect the exiting bats back toward the cave entrance creating a bottleneck with potential bat collisions. Reducing human disturbance while safeguarding roosting habitat results in a greater bat population and enhances the viewing opportunities. Here at Carlsbad Caverns we are committed to protect bat populations from further degradation.

In order for visitors to see the bat flight for many years into the future, it is important that the following occur. (1) Visitors become aware that the Park is a sanctuary for all animals, including bats. (2) Viewing bats at Carlsbad Cavern occurs in such a way as to maintain a wild environment without harassment of them. (3) Observing wildlife is an important way to draw visitors to the area, and hence, develop needed support for protected natural areas.

The cave is the *coolest* place in NM, a cool 56F.

RECENT RESTORATION AND SURVEY ACTIVITIES IN CARLSBAD CAVERNS AND LECHUGUILLA CAVE

by Stan Allison

Carlsbad Activities

Joe Sumbera led a survey expedition for a week into Carlsbad Cavern from April 13 through the 17th. Much of the time they surveyed in the Quintessential Right and the Right Hand Fork of the Left Hand Tunnel.

Pat Seiser led a group of 7 cavers on a Carlsbad Cavern survey expedition from May 30th through June 7th. They surveyed 994 feet in the Music Room area. Additional survey was done in the Tuyanamite Maze off of Left Hand Tunnel. Four hundred and eleven feet of boneyard was surveyed in this area. The Tuyanamite Maze is named for the numerous occurrences of the yellow mineral Tuyanamite, a uranium-vanadium mineral. A total of 1,355 feet were surveyed by this group which brings the new surveyed length of Carlsbad Caverns up to 24.68 miles. The old survey of Carlsbad Cavern was 30.9 miles and this remains the official length of the cave at this time.

The Cave Research Foundation (CRF) fielded a restoration trip consisting of fourteen people from June 22 through 25. Two days were spent restoring an area near the Devils' Den. Restorers removed sediment that was 12 to 18 inches thick on top of flowstone. Once the sediments were removed they were able to clean the flowstone and popcorn revealing their natural beauty for the first time in years. Additional work was done in Lower Cave, continuing the long-term clean up of the Rookery.

Lechuguilla Activities

Lois Lyles led a trip out to Grand Guadalupe Junction on April 8-11 to prepare for future restoration trips to this area.

Jim and Val Werker led two Lechuguilla restoration trips in recent months with teams of six to the Big Sky Camp April 8-11 and June 4-8. They installed photomonitoring points, performed rope maintenance and did restoration work in the Pearlsian Gulf and Big Sky areas.

Lois Lyles led a restoration trip of 11 people into Lechuguilla on June 5-10. One group did flowstone restoration in Ghost Town. Another group did restoration work in the Rustcicles area and a third group did work in Snow Whites' Passage and the Deep Secrets area.

April 18 through 25th was a Lechuguilla Exploration and Research Network (LEARN) trip to Lechuguilla led by Ron Delano. Two teams camped in the Rustcicles Camp and two teams camped in the Deep Seas Camp. The Rustcicles teams surveyed 2,613 feet of cave. Most of this was in the TAG Hall area including a dark gray colored boneyard area dubbed the Coal Mine. Climbs were done above the Aragonitemare and TAG Hall. Both climbs led to small amounts of new passage. Teams in the West worked the Sanctuary area, Jackpot, Leaning Tower, Needle Park, Mirage Room and Chandelier Graveyard. These two teams surveyed 2,804 feet of cave.

Garry Petrie led a survey expedition to Lechuguilla from June 13 to 19. Two groups camped in the Deep Seas camp, while another group camped in the Big Sky Camp. The Western teams pushed leads in the Flower Wars area of Southern Climes that connected to Lake Oceechobe. Another lead from the Zonker Maze/Mother Lode area connected to the Southern Cross Room. On the final day one team found an excellent complex with new leads in most directions in the Adobe Room area. Another team discovered the Crinoid Loud Maze near the Chocolate Factory. This maze led to an area with 6-3 foot tall aragonite trees which was named the Frostworks. Also found in this area were green stalactites up to 8 inches long. The mineral that gives the green coloration has not been positively identified yet. The Big Sky team spent time surveying maze leads in the Voids and the Mouses' Delight area. They also fixed several survey loop areas in the Chandelier Ballroom area. Total survey for the expedition was 3,432 feet bringing the total length of Lechuguilla up to 79.85 miles.

VEGETATION MONITORING IN A MANAGEMENT CONTEXT

by Renee Beymer
Surface Resource Management Specialist

Our views of how to preserve biological species, communities, and ecological systems have been evolving over the last 20 years or so. Our increasing knowledge of nature illuminates its many complexities. The real world in which we practice resource management (political, financial) has become more complicated as well.

New ecological concepts have altered our assumptions about the ecological world and altered the main emphasis of ecological research. In general, these changes have led us toward an ecosystem approach, managing for entire systems and habitats instead of single species.

Last month Diane Dobos-Bubno and I attended The Nature Conservancy's (TNC) excellent course, with the same title as this article, to help us shape the future of vegetation management in Carlsbad Caverns NP. The class was a practical approach, emphasizing realism, precision, and creativity. Realism means recognizing that we can't always predict results of actions and that our time and money is very limited. Precision is critical in collecting data and using valid statistical analyses. It can only be achieved by starting with clear management and monitoring objectives and designs. Creativity is called for in selecting which components of the natural world to monitor as indicators. Creative thinking can clarify the results and reduce the expenses needed to get them.

As described by TNC scientists, adaptive management is the process of linking management within a learning framework. It:

- recognizes the low probability of predicting the future state of populations or systems and the complexity of natural systems
- recognizes that extrapolation is difficult
- uses experience to learn incrementally, treats all conservation activities as experiments
- recognizes that local actions may have effects elsewhere, at different scales and at different time lags
- is cyclic and incremental

Monitoring is the cornerstone of adaptive management--the only way to evaluate, learn, and adapt. In a biological context, the rather cumbersome definition of monitoring is: **the acquisition of information to assess the status, and trend in status, of the structure and functioning of biological populations and communities and their habitats, and of larger-scale ecological systems--over time, for the purpose of assessing and directing management activities**. All conservation work is related to management, even when no management activity is taking place. Monitoring provides information on when and what management is needed. The Latin root of monitoring means to warn, as in 'premonition'. This is a good idea to keep in the backs of our minds: we are trying to discover and prevent degradation of the natural system.

Monitoring is good business because it evaluates the success of management actions, the timing of actions, whether standards and regulations are met, and whether actions are cost-effective. But monitoring is not always considered important and urgent. Most agencies and parks do too little monitoring to determine the effects of their actions or lack of action. Often monitoring doesn't get the resources it needs to be done well.

This park is engaging in many management activities for resources, visitors, and infrastructure. We will be applying the principles from this course, and other refinements from the scientific world, to make our monitoring program the best it can be.

PLAGUE: A DISEASE TO AVOID

by Dale Pate

Plague has not always been in the New World. Infected rats were introduced into the San Francisco area from

a cargo ship in 1899. By the 1940's, the plague virus had found its way to New Mexico. In 1988 a major plague outbreak killed many rodents throughout the Guadalupe Mountains area. Plague is a curable disease if caught early, but prevention is the best solution. There are numerous things you can do to prevent exposure to the plague bacteria. Avoid contact with rodents and other wild animals, do not camp in or near animal burrows, wear gloves if handling wildlife, and do not touch sick or dead animals. Also avoid areas where fleas abound. The following descriptions of the different forms of plague and its symptoms have been taken from a pamphlet titled "What is Plague?" published by the Texas Department of Health.

Plague is an extremely infectious disease caused by the bacteria Yersinia pestis. It is primarily a disease of rodents and is transmitted from animal to animal by the bite of an infected flea or by direct contact with infected tissues. The disease may also occur in man and domestic cats.

Plague occurs in three different forms. ***Bubonic plague*** *is the most common form in man. The bubonic form usually results after a bite by an infected flea. As the lymph nodes in the area of the bite filter out the bacteria, they become enlarged and tender.* ***Septicemic plague*** *occurs when the plague bacteria invades the blood stream, resulting in a more severe illness. Septicemic plague may be a primary infection, that is the plague bacteria is introduced directly into the blood stream (perhaps through an open wound in the skin), or may be a secondary illness occurring after the bubonic form.* ***Pneumonic plague*** *is the least common, but most dangerous form of the disease. Plague pneumonia occurs when the plague bacteria infects the lungs. This form of plague is usually a secondary infection to the bubonic or septicemic forms. Cats are particularly susceptible to this form of plague.*

After the incubation period of 2 to 6 days, early symptoms of bubonic plague include fever and painful, swollen lymph nodes. There are no early diagonostic signs of septicemic or pneumonic plague. All three forms or plague may cause high fever, restlessness, confusion, prostration, and other flu-like symptoms. Coma and death will follow if left untreated. If you experience these symptoms after being on an outing or after being bitten by a flea, contact a physician immediately. Plague is curable when diagnosed early.

TEXAS ANTELOPE SQUIRREL
(Ammospermophilus interpres)
by Ken Geluso

All sightings and captures of antelope squirrels on park property occurred along Walnut Canyon, Bat Cave Draw, and upper portions of the Scenic Loop Road. At these locations, elevations ranged from 3,780 to 4,640 feet. On canyon sides, squirrels were observed high on the face of steep cliffs and caught along ledges of rock outcroppings. On top of the reef, one individual was observed in the branches of an oak and later trapped along a rock ledge on a gentle slope of the juniper peneplain.

Most of my encounters with this squirrel occurred on the floor of Walnut Canyon. I observed individuals crossing rocky creek beds, running along their edges, and setting on boulders that make up the bottom of the creek. On three occasions, I found dead squirrels on the paved road of Walnut Canyon, and in each case, the creek bed was located on one side of the road and a cliff on the other. I also captured two antelope squirrels on the floor of Walnut Canyon. Traps were placed under shrubs growing on the grassy bank of the canyon's floor. One individual was caught leaving its burrow which was located in a patch of prickly pear surrounded by a juniper, agarito, and catclaw. The burrow's opening was 65 mm in diameter, and this trapsite was 10.1 meters away from the creek bed.


(Photo by Ken Geluso)

I believe that antelope squirrels are much more widely distributed in the park than what my personal observations indicate. For example, I also observed this species on the flats of the seabed outside the park. This individual was using a burrow in a mound of dirt constructed by a banner-tailed kangaroo rat. The mound was at an elevation of 4,480 feet within the juniper plains and located a half mile south of the park's boundary. At Guadalupe Mountains National Park, the Texas Antelope Squirrel has been encountered in rocky areas up to 6,300 feet and on rocky slopes dominated by lechuguilla, sotol, and ocotillo. Surely, antelope squirrels live in similar habitats at Carlsbad Caverns National Park.

This and the following article on Nelson's Pocket Mouse is from a report titled "Mammals of Carlsbad Caverns National Park: An Annotated Checklist" by Ken Geluso.

NELSON'S POCKET MOUSE *(Chaetodipus nelsoni)*
by Ken Geluso

The southeastern corner of New Mexico is the northern most limit of Nelson's pocket mouse in the United States, and thus far, Carlsbad Caverns National Park is the only place in the state where the pocket mouse is found. The first reported specimen in New Mexico was obtained in January of 1953; however, an earlier specimen is housed in the park's museum and was collected in October of 1952. I captured four additional animals in the park in 1991, one each on 29 April, 20 May, 4 August, and 5 August. Based on these six specimens, this species is active throughout the year in the northern part of its range.

(Photo by Ken Geluso)

Nelson's pocket mice in the present study were captured in live-traps placed on exposed slopes of the eastern escarpment, just west of Slaughter Canyon Draw. Slopes faced southeasterly, had inclines of 21°-22°, and contained many boulders and large slabs of flat rocks. Elevation of traps containing these mice ranged from 4317 to 4457 feet. Grasses grew moderately thick among the rocks and include mesa muhly, sideoats grama, rough tridens, and tanglehead. Other vegetation on the slopes included sotol, ocotillo, lechuguilla, prickly pear, Roemer acacia, mariola, mescalbean, agarito, Spanish dagger, oreganillo, skeletonleaf goldeneye, and some small oaks.

Although I trapped various slopes of the escarpment along its entire length, all four pocket mice were captured on two adjacent slopes separated by a shallow gully. These mice were caught on either the first or second night of trapping. Nearby slopes with similar characteristics produced no pocket mice. Other species caught in the same traplines included white-ankled mice and a white-throated woodrat. It appears that Nelson's pocket mice are rare in the park as a whole, but they can be fairly common in localized spots.

RATTLESNAKE SPRINGS COWBIRD STUDY UPDATE

by Hannah Spaul and David Roemer

Nest searches are again underway at Rattlesnake Springs (RSS) to examine the extent and effects of brood parasitism by brown-headed cowbirds (*Molothrus ater)* on the breeding success of songbirds. The focus this year is on the state-endangered Bell's vireo (*Vireo bellii*), which has been observed to be a preferred host for cowbirds at Rattlesnake Springs (see update in *Canyons and Caves* No. 5) . In addition to documenting and mitigating against brood parasitism, we are collecting information on the habitat preferences of Bell's vireo. This research is part of a larger study on vireo habitat in New Mexico by Jennifer Parody (Department of Biology, UNM).

Nest searches this year have been conducted by Barry Munyan, Chris Roche (SCA), David Roemer, and Hannah Spaul. So far we have found 27 Bell's vireo nests at the Rattlesnake Springs study area, and 3 more along the Black River (BLM) for a total of 30 vireo nests. Including other bird species, we have found 73 nests.

Brood parasitism by cowbirds has been exceptionally high this year. Cowbirds have laid eggs in 16 of 22 (73%) vireo nests that were not otherwise abandoned prior to egg-laying. This parasitism caused nest failure in 10 nests. In addition to parasitism on Bell's vireo, cowbirds have parasitized 8 of 13 (62%) yellow-breasted chat nests, and a nest believed to belong to a painted bunting. As of June 30, we have found 41 cowbird eggs in all nests, compared to 30 during all of last year, and 13 in 1996.

As observed last year, there has been a significant amount of "egg-dumping" whereby cowbirds lay eggs in old and abandoned nests. So far we have found 5 cowbird eggs that have been dumped in abandoned vireo nests. Including dumped eggs, we have found 31 cowbird eggs in 17 vireo nests (1.82 cowbird eggs / nest). Egg-dumping and the high incidence of multiple parasitism on vireos are indications that cowbird egg production is exceeding the breeding capacity of vireo hosts.

The status (for active nests) or outcomes of Bell's vireo nests are summarized in Table 1. Most striking is the high rate of success in the earliest nests that we found, and the failure of every completed nest since mid-May. Although there are other factors that could explain this, the observed boost in cowbird egg production that began in early June is a likely cause.

Table 1. Bell's vireo nests at Rattlesnake Springs and Black River Study Area, 1998.

Nest No.	Date Found	Tree Species	CowbirdEggs [a]	Status/ Results [b]
8A	Jun 29	Russian Olive	?	Building
9A	Jun 29	Russian Olive	1	Incubating
W11	Jun 29		?	Building
2A	Jun 29	Russian Olive	3	CO
5C	Jun 26	Russian Olive	1	Incubating
WR4	Jun 25		?	Building
7A	Jun 24	Russian Olive	1	Incubating
W10	Jun 23		2	Incubating
1A	Jun 18	Hackberry	1	CO
5B	Jun 18	Hackberry	0	AB
W9	Jun 17	Hackberry	1	CO
WR3	Jun 14	Soapberry	3	CO
W7	Jun 12		0	AB
W8	Jun 12		0	AB
3A	Jun 10	Soapberry	4 (2)	CO
5A	Jun 10	Soapberry	3	CO
W6	Jun 4		0	AB
WR2	Jun 2	Hackberry	1 (1)	AB
W5	Jun 1	Hackberry	0	PE
BR1	May 28		3	CO
BR2	May 28	Soapberry	1	CO
BR3	May 28		1	UN
HC2	May 19	Hackberry	1	CO
W2	May 19	Hackberry	1	CO
W4	May 14	Desert Sumac	0	FY (3)
W3	May 12	Hackberry	0	FY (3)
HC1	May 9	Desert Sumac	0	FY (1)
WR1	May 9	Hackberry	3 (2)	FU (3)
W1	May 9	Hackberry	0	FY (1)
6A	May 5	Russian Olive	0	FY (4)
TOTAL COWBIRD EGGS:			**31 (5)**	

[a] Dumped eggs (cowbird eggs laid after nest abandonment by host) are indicated in parentheses following the egg total.

[b] AB= abandoned prior to eggs; CO= failure due to cowbirds; FU= suspected fledging of at least one young; FY= fledged, at least one young seen leaving or in vicinity of nest; PE= probable predation; UN= unknown because not revisited.

In contrast to last year when we addled or removed cowbird eggs from active vireo nests, we are frequently finding vireo nests that are already abandoned, making egg removal a moot point. Only 8 cowbird eggs have been removed from this year's vireo nests, with disappointing

results. We have started shooting cowbirds with a pellet rifle in an attempt to salvage something from the rest of this year's breeding season. This direct management approach is warranted by the high rate of cowbird parasitism and nest abandonment in vireos.

Nest searches, measurements of nest site characteristics, and cowbird management will continue through mid-August. We will GPS all nests, and add the 1998 data to an ongoing database in ArcView GIS. This fall we will complete a report on findings from the three-year study, and make recommendations for management actions that we can undertake to improve the long-term avian diversity at Rattlesnake Springs.

BIOMES: THE PROMISE OF CAVE-DWELLING MICROBES

by Jim Bigelow

A prominent reference book on cave biology said cave microbes were just like surface microbes. To anyone who has been in a cave or knows anything about the exquisite adaptations of cave fish and invertebrates, this seems highly suspect. In the cool dark quiet environment of a cave with only rock and mud and water, it is hard to imagine how cave microbial life could be the same as the sunlit world. There have been various rumors about the medicinal properties of caves, but the only effort to test the idea seems to have been done during the Collins Crystal Cave expedition in the 1950's. In the early 1990's we decided to take another look at the medicinal value of cave organisms. We knew penicillin, and indeed, most of the antibiotics that have revolutionized medicine since the 1950's are produced by soil microbes. We also knew the best place to look for new drugs from nature was to look where new organisms could be found. For some it would be the plants and insects of the tropical rain forests, for us it would be the microbes in the mud of a remote passage. Cave microbes would have incentive after all to produce chemicals against their neighboring microbes; since there isn't much to eat in most caves, a neighboring microbe or invading fungal spore might make a good meal.

But what of the prominent reference book? Larry Mallory (a microbial taxonomist) had done research in Mammoth Cave and from his results we knew the book was wrong. He had recovered many microbes and could identify less than half to genus, much less species level, and these organisms were certainly not like surface microbes. With Larry's microbes and the direction of Miles Hacker, an experienced drug development scientist, we launched a research program of drug discovery from cave microbes. For this project, we coined the term "new drugs from new bugs" (which is to say new microbes). As a serious drug discovery effort, we realized the project was beyond the scope or interest of a university so we formed a company, Biomes Pharmaceuticals, with the expressed goal of discovering badly needed new drugs to fight cancer and infectious diseases. We also wanted to preserve caves by giving them a value beyond being annoying voids in limestone quarries or impromptu out-of-sight, out-of-mind garbage dumps or sewers. Preserving bio-diversity by preserving habitats has been successful above ground in Costa Rica, we hoped it will be successful below ground here.

Our microbial collection is now grown to 3000 strains from sampling trips into Lechuguilla Cave, Mammoth Cave, and lava tube caves. In our work, we use the media or broth the cave microbes have been grown in (with the cave microbes removed). We test the broth (and hence any chemicals the microbes may have secreted into it) against various diseases. Initially, we targeted breast cancer, one of the leading killers of American women. We looked for cave broths that would only kill a type of breast cancer cell (grown in test tubes) that exhibited a specific cellular component, which is prominent in many breast cancer cases. We found 16 cave broths (out of 700 tested) that killed only our targeted cancer cells. With a "hit" rates of 2.3% (a good rate for new drug discovery) we were encouraged. Since then we have looked for new antibacterial antibiotics and found 14 (of 872 tested) hits as well as anti-fungal antibiotics (7 hits out of 240 tested). With resistance to many antibiotics now a common and growing problem, we think our antibiotics hits may prove to be very important. Finally, we are testing our cave broths for the ability to inhibit the capacity of tumors to initiate blood vessel formation. If a tumor can't get nourishment from the blood, it can't grow. In this last activity, we have found 15 hits (of 385 tested). Our progress has been the result of a lot of hard work, much of it from students and other volunteers. With our research we hope to both alleviate human disease and suffering and preserve caves and the cave environment-including both magnificent speleothems and invisible microbes. Visit us on the Web at www.biomes.com

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WEIRD CAVE CREATURES

C O L L E M B O L L A N S

by Jason M. Richards

How would life be without a nose or mouth to breath with? Or even more strange, how would life be without any bodily openings to eliminate waste? You'd explode!!! There are such creatures though, and very common too.....all over the place. However, this article will *just* address the interesting little creature called collembollan found in caves.

Given the fact that collembollans, commonly known as springtails, are found in any kind of climatic conditions including snow (where they are called snowfleas), it is not surprising they are found underground also.

Collembollans are very common in caves, and found throughout caves in the Guadalupe Mountains. Recently, two species of the genus *Arrhopalites* were recorded in Lechuguilla Cave by a Romanian speleologist Serban Sarbu. Until Serban's discovery, the only life beyond the Rift area of Lechuguilla Cave was microbial. The great majority of species of this genus are troglobitic, often showing considerable troglomorphy. They are usually found on water surfaces in caves and appear to be adapted for life on small pools. Surprisingly, the two species found in Lechuguilla are non troglomorphic troglophiles with widespread distributions. They are *Arrhopalites pygmaeus*, found in virtually every cave region in North America and *Arrhopalites whitesidei* found in caves of Alabama, Iowa, Indiana, Missouri, New Mexico,

New York, Virginia Wisconson, and West Virginia. (K. Christiansen)

Several species representing the Families *Sminthuridae* and *Entomobryidae* are found in Carlsbad Cavern. As you walk along the trail, look closely at the middle of small pools. Suspended on the water of many small pools of the Big Room you will find collembollan and if you really look closely you may see mites that feed on collembollan. Collembollan, on the other hand, feed chiefly on algae and decaying matter.

Collembollans are considered by some authorities, to be the most ancient of insects and other entomologists question whether they are insects at all. These strange little creatures have bypassed many of the insect characteristics such as the metamorphic phase of an insects life. Juveniles have the same appearance and habits as adults, with the exception of size. Males and females both have similar appearance.

The "spring" in the common name of springtail refers to the ability of all collembollans to spring away when disturbed. The "spring", a forked organ called the *furcula* is folded under the insect and held down by a catch, the *tenaculum*. When disturbed, the tenaculum is released and the tiny creature is catapulted in the air....such a marvelous toy. Collembollan can bounce themselves up to three feet. By comparison to their size, can you imagine a human jumping 300 yards to avoid their spouse or boss?

Now the really weird part comes in. Collembollan have no tracheal system, the system of tubes used for breathing by most insects. Instead, these little insects breathe right through their skin. Even weirder still, is the fact they have no bodily openings to eliminate waste, they just accumulate bodily waste until they die, which probably accounts for their two week life span. Special cells in collembollan bodies store uric acid and uratess, their own special "cellular sewage treatment plant".

The mating behavior of springtails has been of great interest to scientists. It seems the male deposits sperm droplets in various locations, a method known as indirect sperm transfer, and the female on her daily wanderings comes in contact with the sperm, thus propagation of the species. The unusual part is the fact that many species of collembollan may inhabit one area. How do the females come in contact with the correct sperm from her species, and why are there no hybrids?

As weird as these little creatures seem, they are an important part of the ecosystem in many caves. Although difficult to see, they are there nonetheless, suspended on the surface tension of many pools, or on the surface of moist flowstone. Look for them.

CARLSBAD CAVERN: LOOKING TO THE FUTURE

by Dale L. Pate

An Infiltration Study to investigate pathways for contaminated waters and how they may enter Carlsbad Cavern has been completed. Researchers from the Colorado School of Mines have prepared a final report from this study. As reported in the April 1995 *NSS News*, an infiltration study for Carlsbad Cavern was initiated to investigate (1) infiltration routes and pathways, (2) contaminant levels and sources, and (3) worst-case scenarios for major disasters and how they may affect the cave. This study suggested mitigative measures to eliminate or reduce possible impacts to Carlsbad Cavern.

When development of Carlsbad Cavern began in the early 1900's, the area was remote and difficult to get to. Getting to the cave was a major undertaking requiring a long drive over rough roads. The trip into the cave was an all-day affair. In those early days it was convenient and practical to build structures near the cave entrance. By the early 1930's, the new road through Walnut Canyon was completed and numerous structures, which included parking lots and a maintenance yard were constructed to provide for park operations and to accommodate the visitor. Sewer lines from the Visitor Center and other buildings ran to septic tanks, while excess liquids were sprayed over the open ground directly above Left-Hand Tunnel. The last major building phase occurred during the 1960's as part of a nationwide program to upgrade Park housing. This program added 12 three-bedroom apartments directly above the Guadalupe Room.

Infiltration Studies

Two reports came from this initial study. The first by Mark Brooke as a master's thesis titled *Infiltration Pathways at Carlsbad Caverns National Park Determined by Hydrogeologic and Hydrochemical Characterization and Analysis*. Mark's thesis focused on the infiltration pathways, the hydrologic system domains, and the basic water chemistry of the entire karst system. Ninety-two water samples were analyzed demonstrating that aluminum, zinc, total organic carbon, and nitrate found in the subsurface can be traced from surface input areas. Analysis also shows that there are five distinct hydrologic domains within the cavern system that are defined by topography, hydrogeology, hydrostructure, and hydrochemistry.

The final report, *Determining Water Infiltration Routes from Structures Located Above Carlsbad Cavern, Carlsbad Caverns National Park, Carlsbad, New Mexico*, was completed by Paul K.M. van der Heijde, Kenneth Kolm, Helen Dawson, and Mark Brooke. This report focused on determining the potential pollution from man-made structures and human activities on the cave and determining cave areas most vulnerable to contamination from the surface. This study concluded that although Carlsbad Cavern is highly vulnerable to contamination from infiltration, there are few indications that serious contamination is occurring now. Identified in the report, the most threatened areas in the cave are Quintessential Right, Left-Hand Tunnel, New Section, Main Corridor, Chocolate High, the New Mexico Room, the Scenic Rooms, and the Big Room.

Potential and Known Impacts

All structures located above the cave have the potential to degrade, to varying degrees, the cavern system below. A few of the structures that present some of the most serious threats for contamination are the Maintenance Yard, Bat Flight Parking Lot, and the aging sewer lines. It is conceivable that a

Aerial view of Carlsbad Cavern area with the NPS infrastructure built directly over the cave. The entrance is in the lower central part of the photo. (NPS Photo)

major contamination event could take place if no preventative measures are taken. Measures need to be taken to remove potential sources of contamination, to implement accident mitigation procedures, and to re-engineer infra-structural components.

The Maintenance Yard supports heavy equipment and hazardous materials storage. In addition buried gasoline storage tanks are located there. Any type of catastrophic event such as a fire or major fuel spill could have devastating effects on Carlsbad Cavern. With a fire, thousands of gallons of water would be used to put out the flames. This could easily carry hazardous materials or fuels directly into the cave. The ultimate solution is to remove the entire maintenance yard off the escarpment.

The Bat Flight Parking Lot is in a very strategic location to funnel contaminated surface water runoff directly into the cave. Though convenient parking for the evening bat flights, the lot is situated directly over a major fracture system that is one of the hydrologic domains mentioned in the above paragraphs. This lot collects oil, gas, and radiator fluid spills from parked vehicles. During rainstorm events, contaminated water is funneled directly into Bat Cave Draw where it immediately sinks, directly over the Main Corridor. The location and configuration of the lot limits the installation of water filtering devices. Removal of the Bat Cave Parking Lot and the return of the area covered by pavement to bio-retention plant communities would provide maximum protection to the cave. A shuttle service for handicapped visitors from the upper parking lots down to the cave entrance and back would need to be provided.

The aging sewer lines are a continual problem. Just within the past month, a major leak was discovered in which thousands of gallons of raw sewage was lost. The main sewer line to the sewage lagoons runs directly over Left-Hand Tunnel. Throughout its length, water drippage into Left-Hand Tunnel has high nitrate values compared to the rest of the cave. The sewer system is an antiquated system that must be totally replaced by using state-of-the-art equipment and technology.

Main sewer line leak discovered in early June, 1998. Sewage is flowing from left of photo . Note sewage lagoons in the background. (NPS Photo by Dale Pate)

Summary

Carlsbad Cavern is one of the world's most magnificent caves. Millions of visitors have marveled at this spectacular cavern system. Since it's discovery around the turn of the century, we have learned from many of the mistakes that have been made over the years. We have learned that the infrastructure over the cave threatens the very resource this park was created to protect. It's time that we plan for the future and begin the long process of relocating buildings and other manmade structures off the escarpment to an area that cannot effect the cave. The goals outlined below are a good start in this process. Many of these projects will be funded through the Fee Demonstration Program, which allows the park to retain 80% of all fees collected and stipulates how these fees can be used.

INFILTRATION ACTION PLAN

The General Management Plan for the park states that once the Infiltration Study for the park has been completed, a Development Concept Plan (DCP) must be prepared. The DCP will "specify what actions will be taken to protect Carlsbad Cavern from the effects of surface activities and developments and will analyze the specific impacts of those actions in accordance with the National Environmental Policy Act." The GMP further states that the range of possible actions could include: (1) the use of technology to mitigate the impacts of some human activities and developments, (2) a partial relocation of facilities and possibly, (3) the removal of all facilities except historic structures and the existing Visitor Center off the escarpment

In the meantime, the park is developing an Infiltration Action Plan that will include short-term, medium term, and long-term goals to protect Carlsbad Cavern. The goals listed below are not in prioritized order.

Anyone wanting a copy of the General Management Plan developed in 1996 can obtain one by writing the Superintendent, Carlsbad Caverns National Park, 3225 National Parks Highway, Carlsbad, New Mexico 88220.

Short Term Goals

1. Educate and involve the public concerning the risks to Carlsbad Cavern through press releases, meetings, and other mechanisms.
2. Close the Bat Flight Parking Lot to most parking. Allow limited parking for handicapped individuals and the unloading and loading of buses during bat flights. Also, overflow parking on the three busy holiday weekends, Memorial Day, Independence Day, and Labor Day will be permitted.
3. Identify substances and practices that employees, residents, and visitors should not be using or performing and develop Standard Operating Procedures (SOP's) as guidelines for allowable practices.
4. Enforce the Commercial Vehicle Prohibition. Because of the winding nature of the road up Walnut Canyon and the potential for a major fuel spill, all large trucks will be required to leave the cargo portion of their vehicles at White's City.
5. Develop a Spill Contingency Plan and maintain the necessary equipment to implement such a plan.
6. Establish housing needs for seasonal employees and VIPs offsite. Determine which, if any, permanent employees need to live onsite.
7. Develop budget sources to accomplish goals.
8. Begin the process of replacing all sewer lines.

Medium Term Goals

1. Develop and implement strategies for mitigating fluid-runoff from the maintenance yard, visitor center parking lots, roadways, and from the concessionaire loading dock.
2. Remove center paved section of the Bat Flight Parking Lot and replace with bio-retention plant communities. *
3. Remove gasoline and diesel fueling capabilities from the Maintenance Yard. *
4. Remove propane heating system and develop alternative heating sources.
5. Remove the "bone yard", a storage area for assorted materials.

Long Term Goals

1. Move the Maintenance Facility off the escarpment. *
2. Remove the Bat Flight Parking lot and provide a shuttle-type system for transporting those with walking difficulties from the upper parking lot. *
3. Explore the possibilities of moving the park Generator and associated fuel tank off the escarpment. Replace the fuel storage tank with a smaller one placed above ground. *
4. Remove the non-historic structures. *
5. In conjunction with the construction of a new maintenance facility, build new office spaces for the Resources Management & Visitor Protection Division as well as new dorm-type spaces for use by visiting scientists and short-time volunteers. Convert all historic structures to interpretive sites and storage. Remove water and sewer lines from these structures. *
6. Implement alternative transportation options developed in the General Management Plan. *

* A Development Concept Plan (DCP) will determine if these actions will be implemented.

CALENDAR OF EVENTS

July 25 – Aug. 1	LEARN Survey Expedition in Lechuguilla Cave
Aug. 3 – Aug. 5	National Speleological Society Convention in Sawanee, Tennessee
Sept. 5 – 7	Cave Research Foundation Expedition in Carlsbad Cavern
Sept. 19 –27	LEARN Restoration in Lechuguilla Cave
Sept. 20 – 26	Survey Expedition in Carlsbad Cavern led by Joe Sumbera
Oct. 24 – Nov. 1	LEARN Survey Expedition in Lechuguilla Cave
Nov. 7 – 15	Survey Expedition in Lechuguilla led by Steve Reames