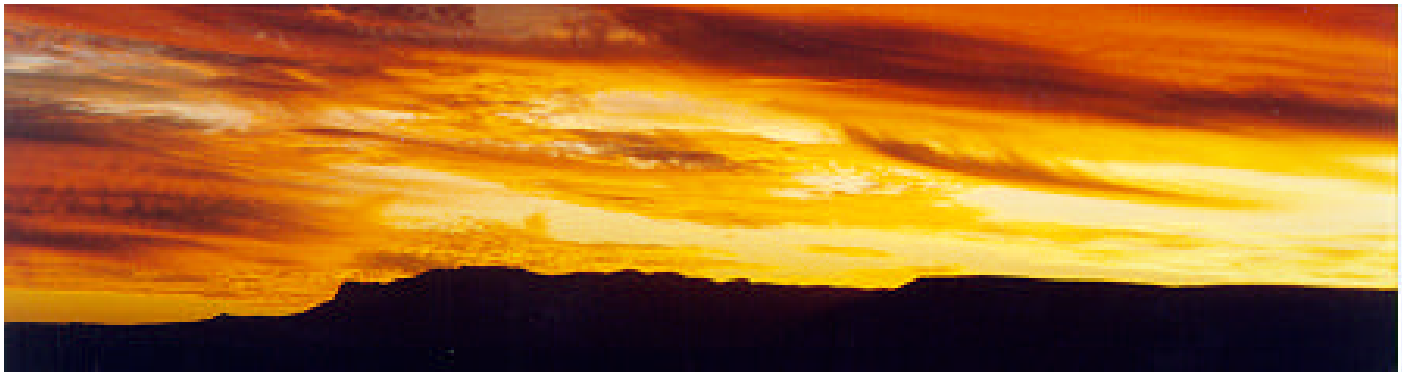
Canyons & Caves

A Newsletter from the Resource Management Offices
Carlsbad Caverns National Park



Issue No. 14 **FALL 1999**

"In this era of heightened environmental concern, it is essential that scientific knowledge form the foundation for any meaningful effort to preserve ecological resources. If the National Park Service is to fully shoulder this complex, challenging responsibility at last, it must conduct scientifically informed management that insists on ecological preservation as the highest of many worthy priorities. This priority must spring not merely from the concerns of specific individuals or groups within the Service, but from an institutionalized ethic that is reflected in full-faith support of all environmental laws, in appropriate natural resources policies and practices, in budget and staffing allocations, and in the organizational structures of parks and central offices. When—and only when—the National Park Service thoroughly attunes it own land management and organizational attitudes to ecological principles can it lay serious claim to leadership in the preservation of the natural environment."

Quote by Richard West Sellars from his book, **Preserving Nature in the National Parks: A History** published in 1997.

Edited by Dale L. Pate
Special Thanks to Paula Bauer, Bill Bentley, Kelly Thomas

TABLE OF CONTENTS

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.

Top Photo – Sunset over the Guadalupe Mountains
©Dale L. Pate 1999

RESOURCE NEWS

NEPA News - CCNP has three projects proceeding through the National Environmental Policy Act (NEPA) process as environmental assessments this summer:

*Expand Telephone Line Capacity for Visitor Center and Offices
*Access Culvert Replacement, Lechuguilla Cave
*Visitor Walkway Installation, Lower Cave, Carlsbad Cavern

Public review is completed and assessed and **a *Finding of No Significant Impact (FONSI)*** has been prepared for all three. The FONSIs have been "recommended" by the park superintendent and submitted to the deputy regional director for final signature. As soon as we receive the signed FONSIs, compliance will be complete and notification will be sent to all interested parties that work is cleared to begin.

Busy Fall for Surface Resources - Surface Resources is having an exceptionally busy fall season this year. In addition to the semi-annual month-long cougar transect, work is beginning on the park's vegetation map (see related article in this issue). Other important projects that must be done this fall include: writing the new Resource Management Plan, revegetation work on the waterline project, and ongoing weed management work including

preparation of a weed management plan for Rattlesnake Springs (RSS).

Patrick McCarthy, director of stewardship for The Nature Conservancy (TNC) and other TNC officials will be in the park October 5-6. TNC is a park neighbor with lands in the RSS riparian area. They will be here for a site visit and to discuss joint management concerns with the park. Of course, the discussions will include the issue of weeds!

To assist us in our fieldwork, we will be joined by Student Conservation Association volunteer Patrick Brady this week. Patrick hails from the Houston area and is very enthusiastic about working in his first national park.

National Cave & Karst Research Institute (NCKRI) – A steering committee meeting was held in Denver August 18-19 to continue the long process of making the NCKRI a reality. A position description for the Director of the Institute was developed. Plans are for an interim Director to be chosen and in Carlsbad by October 1 or as soon as possible after that date. See the article by Ronal Kerbo in this issue for more details on the steering committee meeting.

REINTRODUCED FISH POPULATIONS AT RATTLESNAKE SPRINGS

by Gary Vequist

Rattlesnake Springs saturates riparian wetlands within a detached unit of the park. The springs were acquired in 1934 to provide a reliable domestic water supply for Carlsbad Caverns National Park visitors. Years ago, the springs area was walled with rocks and concrete to create a pond approximately 50 feet across and up to 7 feet deep. Water from the pond is diverted into two outlets: a cement-lined canal diverts water to neighboring Washington Ranch and the natural drainage releases water into a wetland and riparian area on its way to the Black River. The ponded springs, natural drainage, and cement-lined canal serve as habitat for reintroduced native fish species.

In the historic past, Green sunfish were introduced into the springs area. It is likely that this non-native sunfish eliminated the two native fish, the roundnose minnow and the greenthroat darter from the springs. In July 1991, 133 roundnose minnows (*Dionda episcopa*) and 132 greenthroat darters *(Etheostoma lepidum*) were transferred from nearby Blue Spring to Rattlesnake Springs. To enable these fish to become established it was necessary to remove the green sunfish *(Lepomis cyanellus*), a highly efficient predator that quickly consumes other fish prey. As many green sunfish as possible were netted and released into nearby Brantley Lake. The pond was then drained to the level of the springs and a toxicant was used to kill the remaining sunfish. The stocked native fish (greenthroat darter and roundnose minnow) have survived and appear to have established sustainable populations in these stenothermal spring-fed waters.

Roundnose minnows are found discontinuously along the Pecos River system in New Mexico. They are restricted primarily to shallow pools of headwater springs, especially those in the Black River drainage. The minnows are one to three inches long and feed on aquatic vegetation. The breeding males turn bright orange. The species adapts well to habitat that has been modified, such as the cement-lined canal that funnels water to Washington Ranch. It was once considered threatened in New Mexico, but was removed from the state list in 1983 after surveys found it more common than previously believed.

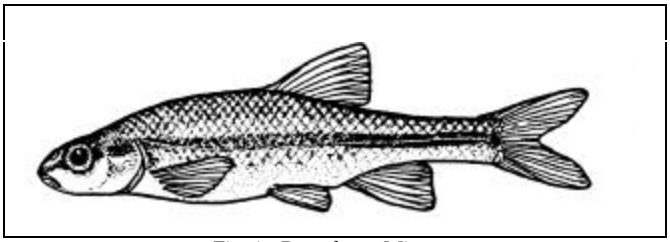


Fig. 1 - Roundnose Minnow

Greenthroat darters are a small secretive fish that bottom feeds on insects, crustaceans and aquatic plants. These fish are found in the lower Pecos, mainly in gravel bottoms of clear water springs or small, swift streams. These two-inch long fish are related to walleye perch. The breeding males have brilliant blue-green throats and red/blue bands on the dorsal fins. Greenthroat darters are a state-endangered species. Depletion of water flows, combined with pollution, has kept the species from waters where it might otherwise live, and threatens its survival where it does persist.

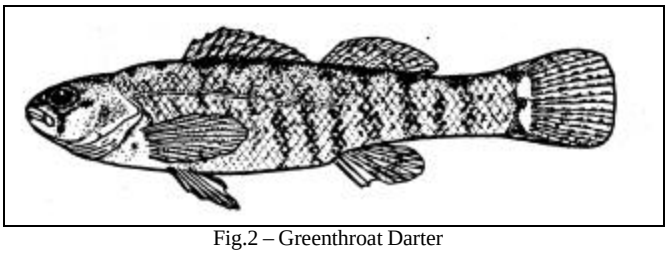


Fig.2 – Greenthroat Darter

Rattlesnake Springs is a significant aquatic resource. In the desert environment, riparian wetlands are a source of water and shade for various species of animals and plants and dramatically influences their distribution. The wetland community provides critical habitat for threatened fish (e.g. green-throated darters), rare amphibians (e.g. leopard frogs), and rare migratory birds (e.g. Bell's vireos).

BAT BANDING

by Dale Pate

From the mid-1950's through the early 1960's, there was extensive banding of Mexican free-tailed bats from Carlsbad Cavern and a number of other known Mexican free-tailed bat sites in Texas, New Mexico, Oklahoma and portions of Mexico. Contrary to popular belief, a review of Denny Constantine's paper "Activity Patterns of the Mexican free-tailed bat" published in 1967 shows that there have been at least nine recaptures of Mexican free-tailed bats at seven different locations in Mexico from those that were banded at Carlsbad Cavern.

These locations are as follows: (1) Cueva de Laguna Seca, **Coahuila** (2) Cuevas de Las Garrochas, **Jalisco** (3) Cueva del Rincon de la Virgen, **Nuevo Leon** (4) General Teran, **Nuevo Leon** (5) Cueva La Chinacatua,

Sinaloa (6) 3 individuals from Carbo, **Sonora** and (7) Municipal Miguel Alemen, **Tamaulipas.** There were also two bats that were banded at Cueva del Rincon de la Virgen in Nuevo Leon that were recaptured here at Carlsbad Cavern.

In addition, bats banded at Carlsbad Cavern were also recaptured in the following states: eight **New Mexico** locations; ten **Texas** locations; four locations in **Oklahoma** and one location in **Arizona**.

This December, Dr. Troy Best of Auburn University and Dr. Celia Lopez-Gonzalez of Centro Interdisciplinario de Investigacion para el Desarrollo Integral Regional Unidad Durango (CIIDIR-Durango) will lead an expedition, partially funded by the Adopt-A-Bat program, to verify that a number of the caves studied by Constantine and others in Mexico still have viable populations of Mexican free-tailed bats. If they do, they will then obtain as much information as possible on the roost sites, population sizes, sex ratios, ecological data and determine relative numbers of other bat species utilizing the same roost sites. Dave Roemer will participate in this international effort to learn more about the bats that utilize Carlsbad Cavern.

RECENT LECHUGUILLA EXPLORATION

by Stan Allison

In an amazing office expedition to Lechuguilla, .77 miles of cave was added to the length of Lechuguilla without taking a step inside of the cave. All of it was done at a computer workstation. Over the years there had been numerous surveys that had not been entered into the Parks' database for various reasons. Garry Petrie, has been very active with the Lechuguilla data and has generated a list of surveys that were missing from the parks database. These surveys were entered bringing the cave up to a total of 103.03 miles. This office expedition had many perils such as carpal-tunnel syndrome, office-gut and coffee-burnout but fortunately there were no accidents suffered other than a serious coffee spill during this dangerous expedition.

Now to be more serious. Mark Rosbrook led the next expedition to Lechuguilla July 24-31. Highlights from this trip include a climb above the Temple of Dagon that was called Delilah's Spiral Staircase. This challenging climb led up over 180 feet and ended in a well-decorated chamber called the Jewel Box. Snake dancer helictites in this area approach 3 feet in height! This climb was led in aqua-sox and clean clothes and with clean ropes to minimize the impacts to the flowstone and other formations encountered. A team in the Far East did a climb that led to a pool. Some columns in the area reminded them of Kachina dolls, so they named the area Kachina Lakes. As many of the pristine pools in Lechuguilla have significant microbe resources, the trip leader elected to stop the survey at that point to prevent contamination of the pool. Two other teams were surveying in the West and Southwest making no major discoveries yet finding a fair amount of additional passage. Overall the expedition surveyed .52 miles bringing the length of Lechuguilla to 103.55 miles.

Snake dancer helictites in Delilah's Spiral Staircase.
(Photo ©Mark Rosbrook)

On August 7-15 there was a LEARN survey and exploration expedition led by John Lyles. A breakthrough on this expedition was responsible for the cave mileage jumping to 104.37 miles with .82 miles of cave being explored. One group returned to the Kachina Lakes area. Attempting to climb around the lake, one of the explorers accidentally fell into the pool and contaminated it. Despite this unfortunate incident, they found and surveyed about 600 feet beyond the pool including a pool with subaqueous helictites and elemental sulfur in gypsum. Later in the trip one of the members suffered from a dislocated shoulder. Fortunately the team was able to exit the cave without assistance. Exploration in the Southwest resulted in no major discoveries. Midway through the intended week long camp, the Southwest group had checked all of the unexplored leads on their list and made the wise decision to exit the cave rather than to stay and impact the cave more with less results.

Two groups explored in the Far West. One group checked a passage that had been surveyed on April 1, 1990. Survey notes from this 1990 survey indicated a small lead at the end. Feeling airflow in the passage they explored ahead, eventually discovering a large room called Zanzibar. Zanzibar is an aragonite filled 530 feet long, 100 feet wide and at least 20 feet tall room. Off of Zanzibar, several other rooms were discovered including Christmas in August, The Birthday Chamber and The Nativity Chamber. Entering the Nativity Chamber required that the initial explorers wear aqua-socks and clean clothes as they carefully weaved their way between soda straws and flowstone. They arrived in a room that is approximately 180 feet long, 100 feet wide and over 25 feet tall. Due to the delicate nature of the room and the presence of pools they backed out of the room and recommended that it be closed for now. Currently the room is closed and it is hoped that further exploration will lead to a bypass of this room. Overall the Zanzibar discovery is the most significant discovery in Lechuguilla since 1997 when the Sanctuary was discovered. This area has airflow and is on the edge of the known cave, so it has very good potential for more discoveries. As this article is written, groups are exploring in this area. We can only imagine what wonders they may be exploring right now.

FROG IN THE FLUME: MANAGEMENT OF THE RIO GRANDE LEOPARD FROG

by David Roemer

The Rio Grande leopard frog (*Rana berlandieri*) ranges from west Texas and southeastern New Mexico, south to Mexico and Central America (Fig. 1). In New Mexico, the frog is known only from Eddy County, where it lives along streams, spring runs, and other permanent water sources, including stock tanks (Degenhardt, et al. 1996). The riparian areas and developed water sources in the lower Pecos River valley constitute the northwest range limit for the species, except for an introduced population in the lower Colorado River in Arizona (Platz 1991).

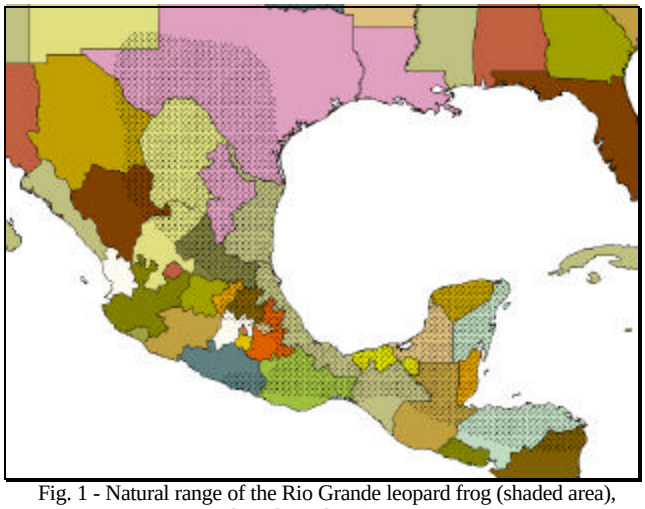


Fig. 1 - Natural range of the Rio Grande leopard frog (shaded area), based on Platz (1991).

Description

The Rio Grande leopard frog is a rather large frog, reaching an adult size of 56-112 mm (Platz 1991). Non-breeding young of the year individuals that Krupa (1997) observed at Rattlesnake Springs were 30-44 mm. Rio Grande leopard frogs have dark dorsal spots that are usually ringed with a light halo, and have pronounced dorsolateral folds of skin. Both of these characteristics are visible in the photograph below (Fig. 2).

Another frog found at Rattlesnake Springs, the bullfrog (*Rana catesbeiana*), is highly variable in color and usually much larger than the leopard frog - often greater than 200 mm. Also, the bullfrog lacks the long dorsolateral folds of the leopard frog. With practice, it is easy to distinguish the two species. The mating calls are also very different. The bullfrog call is a deep, booming *br-wum*, often heard near the picnic area at night and in the early morning. The voice of the Rio Grande leopard frog is a quiet short guttural trill, heard near the spring pond and along the west portions of the irrigation flume.

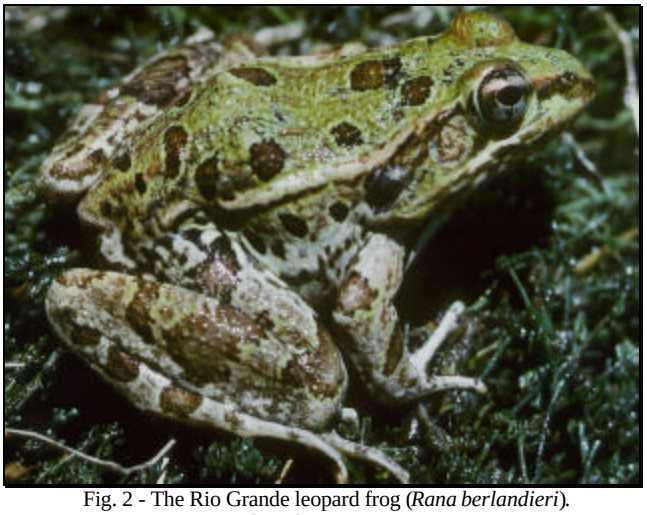


Fig. 2 - The Rio Grande leopard frog (*Rana berlandieri*). (Photo by Jim Krupa)

Leopard Frogs and Bullfrogs

The leopard frog and the bullfrog were the only two true frogs (Family Ranidae) found at Rattlesnake Springs by Jim Krupa in 1997. The non-native bullfrog was probably introduced to the Rattlesnake Springs area in the 1950s. Thebullfrog is a voracious predator that can, and will, eat virtually anything that it can fit into its mouth. The bullfrog has been implicated as a potential cause for the decline of native aquatic vertebrates in Oregon, Arizona, and Chihuahua (see Conant 1977, Degenhardt et al. 1996). When Krupa (1997) examined the stomach contents of bullfrogs from Rattlesnake Springs, he found that bullfrogs consumed a smorgasbord of native insects, vertebrates, and vegetative matter. Their diet included wasps, sticks, crayfish, snails, a Texas blind snake (*Leptotyphlops dulcis*), and a silky pocket mouse (*Perognathus flavus*). One adult leopard frog and one tadpole were also found, confirming that bullfrogs do indeed eat leopard frogs.

While leopard frogs didn't constitute a large portion of the diet of bullfrogs that were examined, Krupa (1997) observed that bullfrogs greatly outnumbered leopard frogs at Rattlesnake Springs, particularly in the natural stream drainage (Table 1). The only area in which leopard frogs appeared to be doing well was the irrigation flume, where bullfrogs were never observed.

My informal observations at Rattlesnake Springs this year agree with Jim Krupa's findings from 1997. On several nights in June and July, I walked the length of the stream and irrigation system listening for adult frog calls and counting the juvenile leopard frogs that would jump into the water as I passed by. Along the flumes there were as many as 15 leopard frogs, and no bullfrogs. Along the stream there were only bullfrogs near the picnic area, but there were two leopard frogs calling closer to the pond. At the pond there were two more leopard frogs, and apparently no bullfrogs.

Table 1. Bullfrogs and Leopard Frogs at Rattlesnake Springs, from Krupa (1997).

Location	Date	Adult Bullfrogs	Adult Leopard Frogs
Stream	June 01	20	1
Stream	June 07	56	3
Stream	June 09	7	1
Spring Pond	June 04	3	2
Spring Pond	June 07	3	2
Spring Pond	June 09	0	3
Spring Pond	June 13	2	4
Flume	June 02	0	5
Flume	June 03	0	4

Note: Bullfrogs were being actively removed throughout the survey, so the number of bullfrogs on successive days is probably understated.

The Management Challenge

Carlsbad Caverns National Park is called upon to preserve the full complement of native plants and animals, and ecosystem processes that are found within our park borders. Where the Rio Grande leopard frog is concerned, our park provides important habitat at the northwestern range limit for the species, which like many amphibians worldwide, may be experiencing population decline (see Jennings and Hayes 1994, Heyer et al. 1994). Unfortunately, the habitat the park provides seems to consist largely of the irrigation flumes that deliver water to Washington Ranch.

This situation potentially puts the leopard frog into conflict with other activities that are needed for proper maintenance of the irrigation flume. Draining and repair work, clearing aquatic vegetation from inside the flume, and trimming vegetation from outside of the flume are all activities that can put the frog at risk, if they are done in quick succession or during the peak breeding season. Timing these activities away from the breeding season (March through September) will prevent the destruction of egg masses that are attached to aquatic vegetation, and hopefully keep the frog population stable and viable.

While the maintenance of habitat in the flumes for leopard frogs and other aquatic wildlife is not exactly the "preferred option" of wildlife managers, it is a necessary action due to the degraded condition of the natural habitat at Rattlesnake Springs. With more than half of the spring flow diverted from the natural system to the irrigation flumes, the natural channel begins to silt up and change from a lively riffle stream habitat to a series of stagnant ponds. Conversely, the flumes become better habitat for some plants and animals. The absence of bullfrogs, which appear to prefer the large quiet-water ponds in the natural stream, may be the reason why.

It is possible that increased water flow to the stream could create conditions more favorable to the leopard frog, and less favorable to the bullfrog, while restoring and reconnecting the spring flow to the Black River. This is simply not possible in the near future, since there are numerous legal issues that such an action might raise. Our management options for the meantime, should be: (1) to improve the natural stream habitat by removing bullfrogs and ensuring sufficient water flow, and (2) to accept a compromise condition between the natural values and utilitarian purposes of the irrigation system to ensure that leopard frogs can continue to breed there successfully.

While we would like to see the leopard frog thriving in the natural stream, it won't be very easily done. More than 100 bullfrogs have been removed from Rattlesnake Springs during 1997-1998, yet they still hold a monopoly on most of the natural habitat found there. Through continued bullfrog management, and coordinated maintenance of the irrigation system, we should continue to hear the quiet nighttime voice of the leopard frog.

Bibliography

For further reading on the Rio Grande leopard frog, and amphibians and reptiles in general, I recommend:

Conant, R. 1977. Semiaquatic reptiles and amphibians of the Chihuahuan Desert and their relationships to drainage patterns of the region. *In* R.H. Wauer and D.H. Riskind (eds.), Transactions of the Symposium on the Biological Resources of the Chihuahuan Desert Region, United States and Mexico, pp. 455-491. U.S. Dept. Interior, National Park Service, Trans. and Proc. Series (3). 658pp.

Degenhardt, W.G., Painter, C.W., and A.H. Price. 1996. Amphibians and reptiles of New Mexico. University of New Mexico Press. 431pp.

Heyer, W.R., M.A. Donnelly, R.W. McDiarmid, L.C. Hayek, and M.S. Foster, eds. 1994. Measuring and monitoring biological diversity: standard methods for amphibians. Smithsonian Institution Press, Washington. 364pp.

Krupa, J.J. 1997. Final report: amphibians and reptiles of Rattlesnake Springs, Carlsbad Caverns National Park, and the impact of the non-native bullfrog on the herpetofauna. Unpubl. Rept. Carlsbad Caverns National Park. 25pp.

Jennings, M.R. and M.P. Hayes. 1994. Decline of native Ranid frogs in the desert southwest. *In* P.R. Brown and J.W. Wright (eds.), Herpetology of the North American deserts: Proceedings of a symposium, pp. 183-211. Southwest Herpetological Society Special Publ. No. 5. 311pp.

Platz, J.E. 1991. Rana berlandieri. Catalogue of American amphibians and reptiles: 508.1-508.4.

Stebbins, R.C. 1985. Western reptiles and amphibians (Peterson Field Guide Series). Houghton Mifflin Co., Boston. 336pp.

LARGEST LECHUGUILLA PLANTS IN THE PARK?

Ina Bausenwein stands behind some Lechuguilla plants that stand well over 3 feet tall. These are found in Slaughter Canyon. (Photo © Gosia Roemer)

NATIONAL CAVE AND KARST RESEARCH INSTITUTE STEERING COMMITTEE MEETS

by Ronal Kerbo

A steering committee meeting for the start-up of the National Cave and Karst Research Institute (NCKRI) was hosted by the Geologic Resources Division's Science and Technical Services Branch in Denver, Colorado August 18-19. Attending for the National Park Service were: Rod Horrocks (WICA), Joel Despain (SEKI), Mike Wiles (JECA), Dale Pate (CAVE), Larry Norris (IMR), Ron Kerbo (GRD); Jim Goodbar, BLM; also asked for input but unable to attend this meeting were: NPS: Rick Olson (MACA), and Lindsay McClelland (GRD); Jerry Trout, USFS, and Bob Currie, USFWS.

From upper right side around table clockwise: Mike Wiles, NPS (JECA); Joel Despain, NPS (SEKI); Jim Goodbar, BLM; Rod Horrocks, NPS (WICA); Dale Pate NPS (CAVE)

The Geologic Resources Division is providing the steering committee chair for the remainder of the fiscal year for start-up of the National Cave and Karst Research Institute. This role has been added to the current duties of the Science and Technical Services Branch's National Cave Management Coordinator. Among several tasks before the NCKRI Steering Committee was to 1). refine the stated mission, goals, and objectives of the NCKRI, and 2). develop a draft position description (PD) for an interim institute director, 3). Draft recommendations for alternatives for the structure of the Institute, and 4). participate in finalizing the organizational model.

The first meeting resulted in a soon to come draft of the institute director's PD a refined mission and a set of recommendations for the start up of the Institute. Of particular concern to the steering committee members was the following:

The Institute in order to foster sound science will:
1). create a Chief of Science on staff.
2). appoint a science advisory board.
3). function as a central clearinghouse.
4). not keep cave locations or sensitive information.
5). support issue driven science supporting resource management.
6). not support research projects that are not locally approved.
7). be interdisciplinary and include all aspects of speleology.
8). promote sustainability in karst systems and resources.

The Institute in order to support cave education programs will:
1). include an educational coordinator on staff.
2). plug into the Learning Center initiative.
3). support Web and internet based education.
4). network with cave groups.
5). support educational programs already being conducted.
6). provide outreach to the public and agency staffs in forums such as seminars and symposia.
7). provide information and assistance to the NPS Interpretive Division.

The Institute in order to support centralization of speleogical information, the protection of sensitive information, and provide expertise should :
1). not be a repository for sensitive information and locations.
2). be a resource for informational sources and contacts.
3). provide for database management and web site management.

The Institute goals in order to address research needs on federal lands should include:
1). a Service wide assessment of needs.
2). agency dependent protocols (how done).
3). the identification of needs through land use planning systems (i.e. in the NPS – Resource Management Plans).
4). a call for research "needs".
5). maintaining a database of the "needs".
6). maintaining a list of funding sources.
7). the channeling of funding to researchers.

The Institute should provide services that are:
1). balanced for all agencies.
2). based on consultation and provide assistance for writing proposals.

THE WHORLED MILKPLANT
(*Asciepias Subverticillata)*
by Diane Dobos-Bubno

The whorled milkweed showed itself to me last month, its delicate flowers dancing atop fragile umbrella-like stalks much like tiny ballerinas. While relocating two wetlands test pits at Rattlesnake Springs, I noticed a field of plants with clusters offering their radiant white flowers. My quick identification shrugged it off as yarrow, a plant familiar to me from my years in California's coastal scrublands. On closer inspection, though, the difference was revealed.

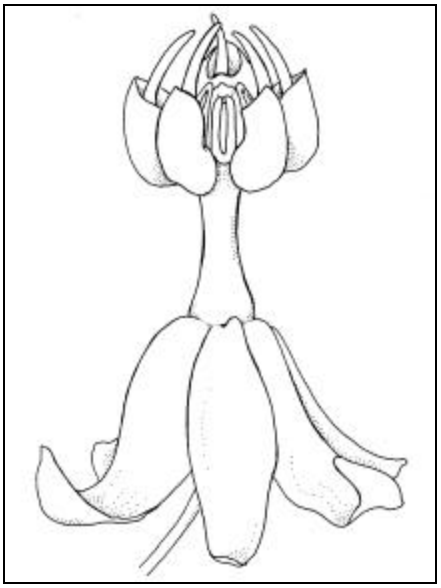

Photo Courtesy of Dr. A. P. Knight, Colorado University

Before I go any further, I would like to rectify an injustice. The name milkweed ends with "weed", a connotation that usually gives the gardener and homeowner an excuse to eradicate a plant by ripping it out by its roots. I opt, instead, to use "plant" in place of weed, a practice I started in California, particularly for native species. So, from here on, I will refer to this plant as a milkplant.

Commonly known as whorled, horsetail or poison milkplant, the specific name for this plant is *Asclepias subverticillata* in the family Asclepiadàceae. The characteristics of this family are well represented in this particular plant. This native perennial herb has opposite leaves; in this case, long narrow leaves. The flowers are arranged on what looks like the upside down skeleton of an umbrella, with a single flower sitting atop each umbrella rib.


From Munz and Keck, 1968

For me, milkplant flowers are the most amazing in the flower world. The flowers of *A. subverticillata* are an intriguing adaptation that reminds me of five tiny unsheathed cat claws delicately connected to a five-sepaled skirt. The drawings don't do justice to its appearance since the interiors of the petals are a light rose that contrast with the white exterior of the modified petal.


From Sawyer and Smith, 1981

Another key indicator of a milkplant is a milky sap (hence, the common name) that oozes from broken stems or torn leaves. These characteristics should help you find this plant at Rattlesnake Springs. Of nine milkplants listed in the park, only one is known at that location. The plant is easily found between the picnic area and the stream course. Look for a plant approximately two feet tall surrounded by a profusion of tarantula wasps and butterflies during flowering. The blooming period is May – September (Correll and Keck, 1970); many of the plants at Rattlesnake Springs might now be releasing numerous seeds, each with a tuft of silky hairs.

The Whorled MilkPlant (NPS Photo by Mark Bremer)

The genus *Asclepias* comes from Asclepius who, in Greek mythology, was the god of medicine. This is appropriate since most of the plants in this family have historic and current medicinal uses. The roots of milkplants are the part most used for this purpose. Navajo uses of this particular species include treating stomach problems, skin diseases, nose congestion, and acne. Another family member, *Asclepias tubersosa*, pleurisy root or butterfly plant, can be found in teas and herbal tinctures to clear bronchial congestion. The plants and sap of all milkplants contain asclepain, a proteolytic enzyme that gives some rationale to the old folk remedy of rubbing the milky juice on warts (Moore, 1977).

It's hard to believe that a plant named after Asclepius, the healer of healers, has earned a bad rap. The entire above ground parts of the plant can be quite toxic, particularly to livestock. Whorled milkplant, the very species at Rattlesnake Springs, reputes as the most toxic. The milky sap contains a resinoid, galitoxin, which can be deadly to sheep, especially, by directly affecting the respiratory, digestive and nervous systems. Milkplants also contain various toxic cardenolides (cardiac glycosides) that affect proper heart functioning. As a result, being a native does not protect it from eradication attempts in regions where cattle and sheep are an economic reality. Though cattle and sheep find the plant generally distasteful, overgrazing of some rangelands may force livestock to graze on this less palatable forage. In some cases, the plant may accidentally wind up in feed, poisoning farm animals (A. P. Knight, 1999).

However, this plant doesn't negatively affect all animals. Milkplants are well known as larval food for the Monarch and Desert queen butterflies (see *Butterflies of the Fall*, Canyons and Caves No.3, Fall 1996). The very same toxic substances that affect livestock are stored in the Monarch and Queen caterpillars to be released into their system in the adult stage, protecting them from many predators. Perhaps the Monarchs find the milkplant nectar as pleasing as I find the sight of ballerinas delicately balancing in the wind.

References:

1. Carlsbad Caverns National Park, Vascular Plants of Rattlesnake Springs, 1985-1988.
2. Correll, Donovan S., Johnston, Marshall C. Manual of the Vascular Plants of Texas, Texas Research Foundation, 1970.
3. Knight, A.P. Guide to Poisonous Plants, http://www.vth.colostate.edu, Colorado State University, 1999.
4. Moore, Michael. Medicinal Plants of the Mountain West, Museum of New Mexico Press, 1977.
5. Munz, Philip and David Keck. A California Flora and Supplement, University of California Press, 1968.
6. Poisonous Plant Research Laboratory, USDA/Agricultural Research Service, http://www.pprl.usu.edu/default.htm, US Department of Agriculture, 1999.
7. Sawyer, John O. Jr. and James P. Smith Jr. Keys to the Familys and General of Vascular Plants in Northwest California, Mad River Press, 1981.

TEXAS MADRONE
(Arbutus xalapensis var. *texana)*
by Dale Pate

A favorite tree of many, the Texas Madrone is found in canyon bottoms and rocky slopes throughout much of the park at elevations of between 2,000 to 6,000 feet. This small evergreen tree usually has several short, crooked trunks with a rounded crown of crooked, spreading branches. The bark of the tree peels off in paper-thin sheets, leaving the tree with a bare look throughout most of the year. The peeled tree's trunk varies in color from a light cream to a vibrant rusty red and is quite striking. The leaves stay green year round and are 1 to 3 ½ inches long. The flowers of the tree are white to pink and produce a fruit that is berrylike, round and usually bright red. This fruit contains a large number of flat seeds that mature in the fall. This fruit is edible and is utilized by numerous species of birds.

A Texas Madrone in Slaughter Canyon. (Photo © Dale L. Pate)

The Texas Madrone is an uncommon species that ranges from the Edwards Plateau of central Texas to the Trans-Pecos region of west Texas, north into the Guadalupe Mountains of Texas and New Mexico and south into the northeastern portions of Mexico. The National Champion (the largest known example of the species) is found in the Chisos Mountains of west Texas and is 30 feet tall with a 42 ft. crown spread and the trunk has a 9.3 ft. girth.

The bright red berries of the Texas Madrone. (Photo © Dale L. Pate)

Throughout the world there are approximately 20 species of madrones found in Asia, the Mediterranean region, and North and South America. Two good reference sources to learn more about this tree and many others are as follows: (1) "The Audubon Society Field Guide to North American Trees" published by Alfred A. Knopf, Inc. and (2) Trees and Shrubs of the Trans-Pecos and Adjacent Regions by A. Michael Powell and published by the University of Texas Press.

THE GLOWING GREEN LIGHT: AN EXPLANATION

by Jason Richards

You've seen it while you were walking down the trail on a hot summer's night, a small green glowing dot. It's not usual to go through life glowing green, unless of course you're a phengodid or more commonly known as glowworms.

These little insects from the Family Phengodidae are super interesting. The males are black beetles 7 to 16 mm long with a purplish luster and with two red, rosy, or yellowish marks near the lateral margins of the prothorax (the segment near the front of the insect and containing the first set of legs). The adult females never leave the larval stage though they do have compound eyes. This condition, of course, keeps the males happy as they are always chasing younger appearing females.

The most interesting aspect about the female is that they glow constantly to attract their male counterparts, thus the name glowworm. The light emitted by these insects is unique in being cold, nearly 100% of the energy given off is light. As a comparison, an electric light bulb gives off 90% of the energy as heat. The light given off by glowworms and other insects such as fireflys is produced by the oxidation in the insect of a substance called luciferin.

There are two species of phengodids known in southern New Mexico. One species, *Zarhipis integripennis*, is found in Dona Ana County and may extend into Eddy County. The most likely candidate to be found in the Carlsbad Caverns National Park is the second of the two species, *Mastinocerus texanus.*

During the day, the females will be down in vegetation next to rocks and the males can be seen at night flying around porch lights. Glowworms are predacious little critters and feed on soft-bodied insects and worms. Thanks to Richard Fagerlund, "the bug man" from the University of New Mexico in Albuquerque for providing this information.

ADOPT-A-BAT PROJECTS

The adopt-a-bat program, which was begun in 1994, has been a great success. The money received from this program is to help further the study of and education for the conservation of bats. Occasionally, the funds are also used to help fund other important scientific studies. The total amount received for this program has been over $120,000. Recent projects that have been funded by this program are as follows:

1. Replace data recording devices used in the monitoring of sound levels in Bat Cave. ($689)
2. A survey of Mexican free-tailed bat wintering sites that have had confirmed reports of banded bats from Carlsbad Cavern in Arizona and Mexico. This project is led by Dr. Troy Best in cooperation with Mexican researchers. ($6,000)
3. Travel costs for two researchers to present results of bat studies to park staff and to the public during the 1999 International Bat Festival to held in Carlsbad September 24-25.
4. Matching funds to support endangered cactus taxonomic and distribution studies. ($5,000)

A VEGETATION MAP OF CARLSBAD CAVERNS NATIONAL PARK

by Renee Beymer

Fieldwork begins September 28 (three days ahead of schedule!) on a two-year project to prepare a vegetation map for the entire park. The work is being funded with fee demonstration money, through a cooperative agreement with the New Mexico Natural Heritage Program (NMNHP), University of New Mexico.

Esteban Muldavin, Ph.D., an ecologist and senior research scientist at NMNHP, will be the principal investigator. He and a field crew of botanists and technical mapping experts will be conducting the work, with help from the Surface Resources staff. Muldavin developed the GAP VEG classification system for New Mexico for the GAP Analysis project. GAP is a national vegetation mapping system. Muldavin has done extensive vegetation mapping in the Chihuahuan Desert, including: Holloman Air Force Base, Jornada, Big Bend National Park and in the state of Chihuahua across the border from Big Bend, and the Borderlands Ecosystem Management Area of southwest New Mexico and southeast Arizona. The NMNHP team will be in the park this fall September 28-October 6 and October

12-20. There will be a field session next fall, and there may be a spring session as well.

NMNHP has agreed to conduct a one-day field seminar in our park to summarize findings of the project following its completion, probably in early 2002. The following excerpts from the study plan from the cooperative agreement help explain the project.

Part I: Vegetation Survey. The vegetation associations of CAVE will be sampled and described in detail. The first field session will be primarily be a reconnaissance survey to sample the range of variation among vegetation associations and provide a basis for the development of a preliminary vegetation classification to guide map development and future sampling. The second session will be held August through mid-October of 2000, and will focus on replication of sampling to cover the range of variation within plant associations and on problem areas in the mapping process.

Sampling design and implementation will follow NMNHP protocols for the establishment of "standard" plots, i.e., 400 m^2 in size with a complete inventory of species with ocular abundance estimations, and a set of baseline environmental variables (slope, aspect, elevation, landform, etc.). Permanent documentary photo points will be established for all plots. All plots will be geo-referenced to within five meters using global positioning systems (GPS). All plant species will be identified to the finest level possible and supported by voucher specimens collected during the field season. The target is to acquire 160 vegetation plots over the course of the two field seasons. The large amount of wilderness area in the park may hinder accessibility and hence reduce that number, but this still seems to be a reasonable goal that will meet classification and mapping needs.

Data will be quality-controlled and entered into the NMNHP Plant Ecology Database (Microsoft Access-based). The floristic and environmental information will be subjected to multivariate analysis, and a preliminary vegetation classification of CAVE will be produced which follows the National Vegetation Classification (Grossman et al. 1998) and meets national data standards (Table 1). A final report will be produced with details of the methods and results, and will be delivered, including digital versions, for editing by the park.

Grossman, D.H., D. Faber-langendoen, A.S. Weakley, M. Anderson, P. Bougeron, R. Crawford, K. Goodin, S. Landall, K. Patterson, Pyne, M. Reid, and L. Sneddon. 1998. International classification of ecological associations: terrestrial vegetation of the United States. Vol. 1. The Nature Conservancy, Arlington, Virginia.

Part II: Vegetation Map. The vegetation map will be developed using a combination of *available* Thematic Mapper (TM) satellite imagery and digital ortho-photographs provided by CAVE. We will use an image analysis technique we have developed over the years which is particularly effective for mapping vegetation in arid landscapes. TM imagery with 28.5 m resolution will be used for its spectral qualities, and the digital ortho-photos, with their high spatial resolution (greater than 5 m) but limited spectral information, will be used as a "texture" element for detecting shrublands and woodlands versus grasslands.

Mapping in areas of high relief can pose significant mapping problems, particularly in areas of deep shadows, and special analysis and groundwork may have to be applied to these areas. The map will be developed using a supervised image classification strategy based on the ground data collected during the vegetation survey. Plots will be classified according to national classification and used as models ("seeds") for vegetation expression across the landscape in the mapping process. With the involvement of park staff, seeds that are not well discriminated from one another either spatially or spectrally will be grouped together to form map units representing complexes of plant associations. Those that are will remain as their own map units. The highest resolution possible will be sought within the limits of image resolution, with a target of 1:24,000 scale and a minimum map unit size of 0.2 hectare, approximately the size of two TM pixels. A statistically independent validation data set will be developed based on a stratified random ground sampling to determine the accuracy of the map classes, with a goal of 80 percent accuracy per map class. Hard-copy maps will be produced, and a compact disc will be provided containing the digital files for the map in export format (.e00) for use in a GIS, plus the database of all field data. Federal Geographic Data Committee-compliant metadata will accompany the data files.

Project Milestones

8/1/1999 -- Initiate Project with agreement on study plan.
9/1/99 to 10/1/99 -- Develop field maps to guide sampling.

10/1/99 to 11/15/99 -- Field Session I (4 weeks).

10/15 to 6/30/2000 -- Preliminary vegetation map and interim report (map to help guide rare plant and animal surveys).

7/30/2000 to 10/15/2000 -- Field Session II (10 weeks).
10/15/2000 to 9/30/2001 -- Analysis, final map production and final report.

10/1/2001 to 12/31/2001 -- Final report review period.

Table 1. U.S. National Vegetation Classification physiognomic-floristic hierarchy for terrestrial vegetation (Grossman et al. 1998) with a supplemental Alliance Group level.

Level	Primary Basis for Classification	Example
Class	Growth form and structure of vegetation	Woodland
Subclass	Growth form characteristics, e.g., leaf phenology	Deciduous Woodland
Group	Leaf types, corresponding to climate	Cold-deciduous Woodland
Subgroup	Relative human impact	Natural/Semi-natural
Formation	Additional physiognomic and environmental factors	Temporarily Flooded Cold-deciduous Woodland
[Alliance Group]	[Regional floristically and environmentally related Alliances]	[Chihuahuan Desert Deciduous Desert Scrub]
Alliance	Dominant/diagnostic species of the uppermost or dominant stratum	*Populus deltoides* Temporarily Flooded Woodland Alliance
Association	Additional dominant/diagnostic species from any stratum	*Populus deltoides/Salix exigua* Woodland Association