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Carlsbad Caverns National Park

Canyons & Caves

Newsletter of the Resources Stewardship & Science Division

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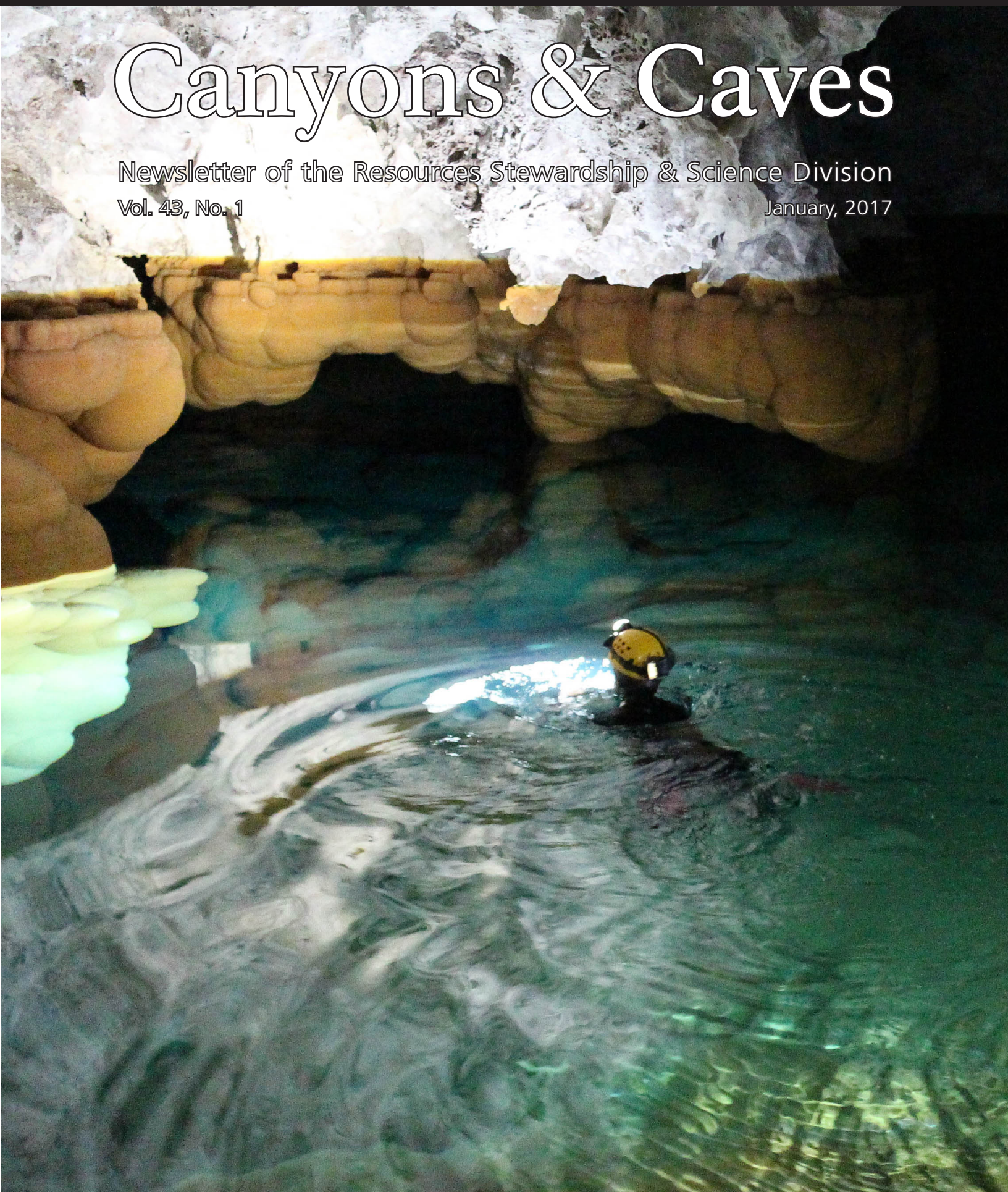
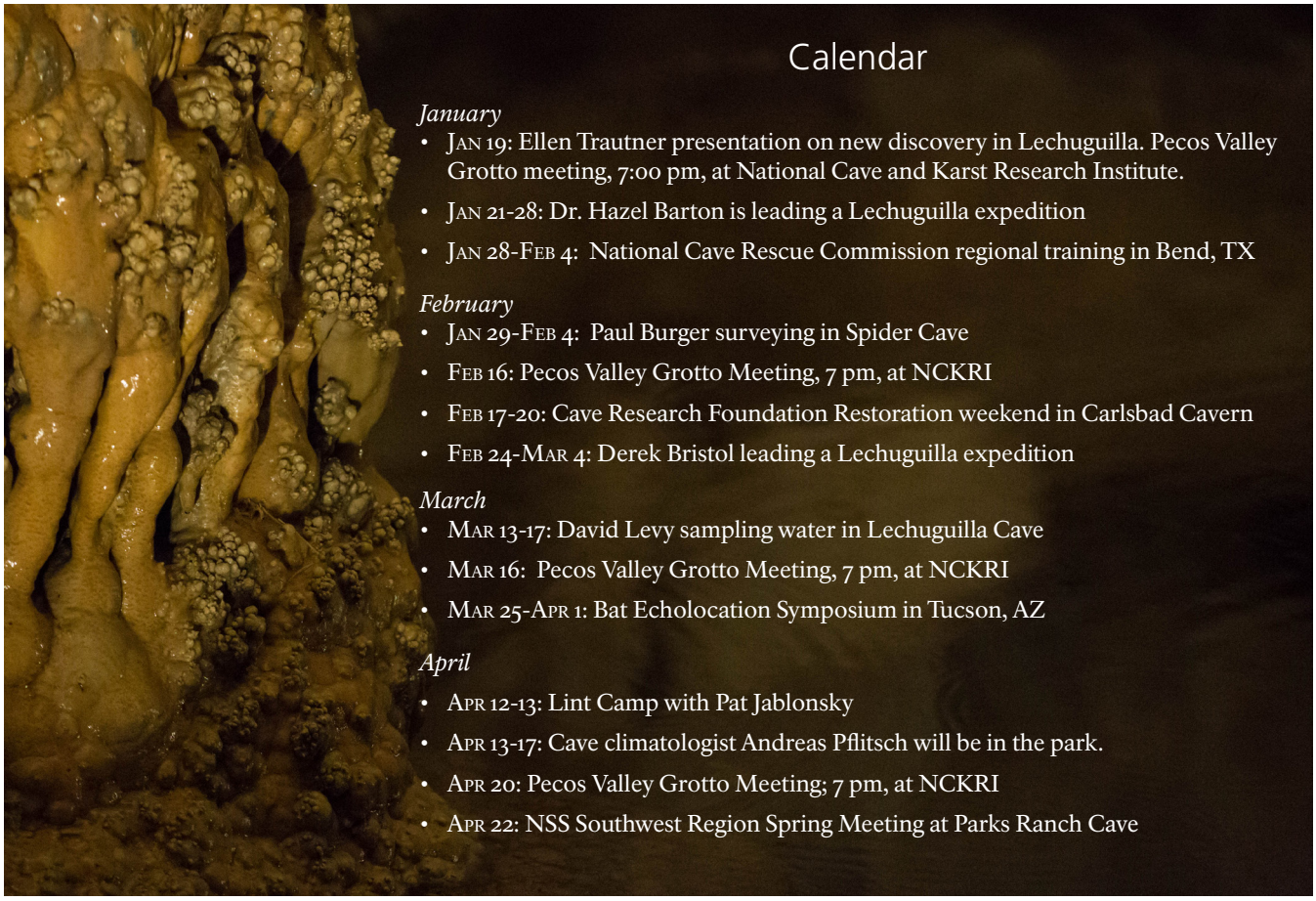
January, 2017



Editor's Letter

We are excited to resurrect the *Canyons and Caves* newsletter with this issue. We feel it is absolutely critical that we provide the latest information to park staff, so each of you can answer the thoughtful questions that our visitors are asking. Because the newsletter will come out quarterly, we hope to keep you abreast of upcoming resource management events and research projects. We also hope to be able recognize our successes and let other parks and researchers know about the status of on-going projects and research. This electronic newsletter is the vehicle we hope to accomplish all this with. *Canyons and Caves* will be divided into the Physical, Biological, and Cultural sciences, the three programs of the Resource Management Division. We are lucky to have Cathryn Hoyt as our production editor, as she brings a fresh and professional look to *Canyons and Caves*.

Rodney D. Horrocks



Calendar

January

- Jan 19: Ellen Trautner presentation on new discovery in Lechuguilla. Pecos Valley Grotto meeting, 7:00 pm, at National Cave and Karst Research Institute.
- Jan 21-28: Dr. Hazel Barton is leading a Lechuguilla expedition
- Jan 28-Feb 4: National Cave Rescue Commission regional training in Bend, TX

February

- Jan 29-Feb 4: Paul Burger surveying in Spider Cave
- Feb 16: Pecos Valley Grotto Meeting, 7 pm, at NCKRI
- Feb 17-20: Cave Research Foundation Restoration weekend in Carlsbad Cavern
- Feb 24-Mar 4: Derek Bristol leading a Lechuguilla expedition

March

- Mar 13-17: David Levy sampling water in Lechuguilla Cave
- Mar 16: Pecos Valley Grotto Meeting, 7 pm, at NCKRI
- Mar 25-Apr 1: Bat Echolocation Symposium in Tucson, AZ

April

- Apr 12-13: Lint Camp with Pat Jablonsky
- Apr 13-17: Cave climatologist Andreas Pflitsch will be in the park.
- Apr 20: Pecos Valley Grotto Meeting; 7 pm, at NCKRI
- Apr 22: NSS Southwest Region Spring Meeting at Parks Ranch Cave

Canyons & Caves

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EDITORIAL
Rod Horrocks *Editor*
Ellen Trautner *Associate Editor*
Cathryn Hoyt *Production Editor*

CONTRIBUTING AUTHORS
Luis Florez
Rod Horrocks
Cathryn Hoyt
Sam Denman
Ellen Trautner

PHOTOGRAPHERS & ARTWORK
Gosia Allison-Kosior
Dan Austin
Luis Florez
Tim Fogg
Jennifer Foote
Art Fortini
Cathryn Hoyt
James Hunter
Jaco Webber
Max Wisshak

EDITORIAL ENQUIRIES
Resources Stewardship & Sciences Division
3225 National Parks Highway
Carlsbad, NM 88220
rod_horrocks@nps.gov

www.nps.gov/cave

Image Front Cover:
Hazel Barton, dressed in a wet suit with hoodie, swims across Lake Castrovalva in Lechuguilla Cave. Photo by Tim Fogg.

Luis Florez, John Davis, and John Mitchell show off their day's haul after pulling Johnson grass at Rattlesnake Springs. Photo by Jaco Webber.

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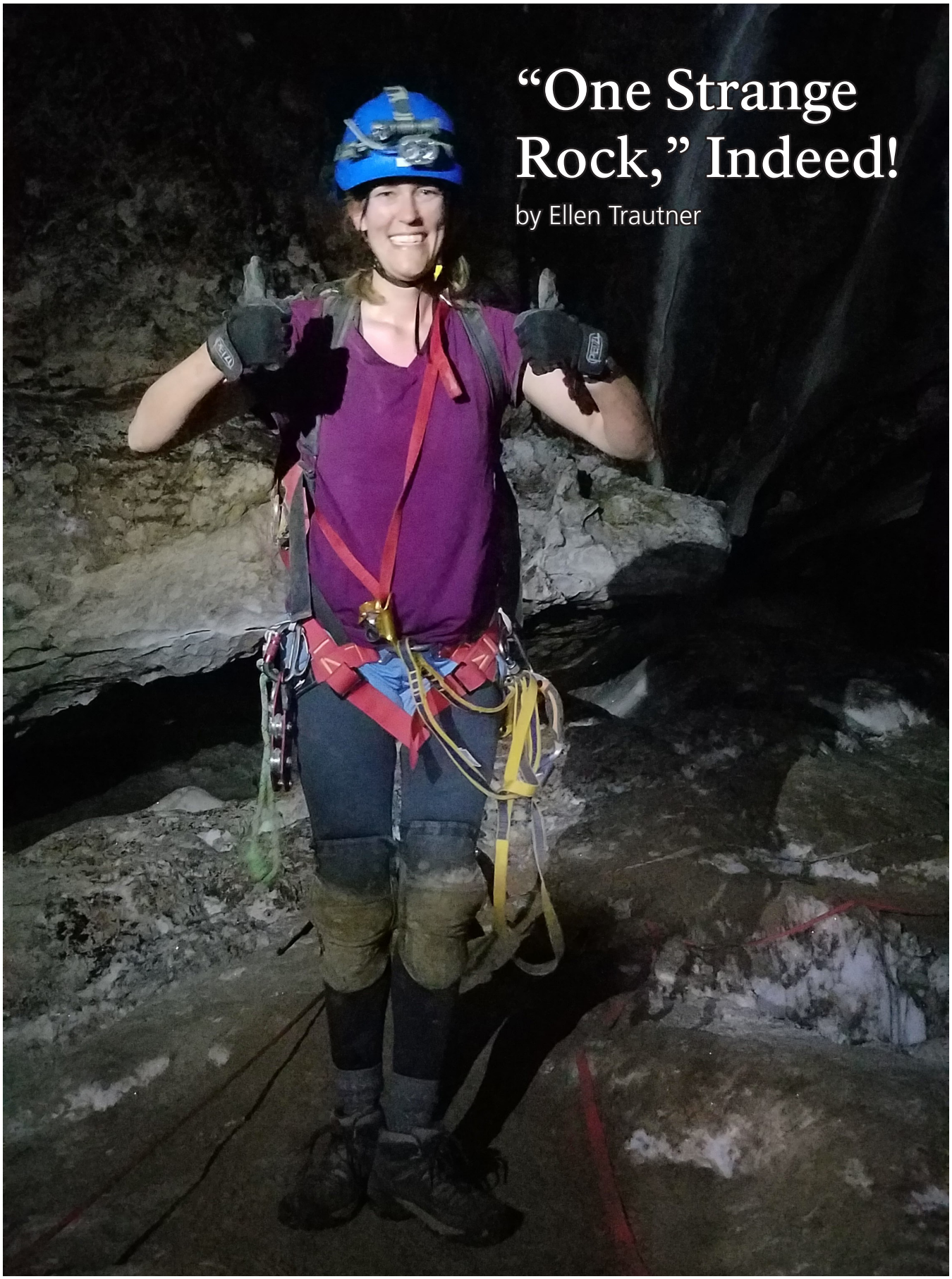


“One Strange Rock,” Indeed!

by Ellen Trautner

In late October 2016, I accompanied crew members from Nutopia, a London-based production company, into Lechuguilla Cave to film a sequence for an upcoming National Geographic series called "One Strange Rock." This ten episode event will air in 2018 and will feature all the many strange and unique ways life has developed on this planet. Filming in Lechuguilla focused on microbial life that thrives in the extreme cave environment. Because travel time to and from the filming sites would have been very slow if we came from the surface each day, we camped in the cave for eight days and seven nights.

There were six of us who spent the entire week underground. This included four crew members from Nutopia: Chris, the assistant producer and onsite director, Johnny the cameraman, Mark the sound guy, and Tim the rope safety advisor. Dr. Hazel Barton, a well-known microbiologist who has been coming to Lechuguilla for almost twenty years, rounded out our camping group. Besides the six of us who were in there continually, Nutopia had hired six very experienced Lechuguilla cavers to be their sherpas. Each day, a team of three would come into the cave to bring fresh batteries and other equipment, and then carry out used batteries and that day's rushes. These sherpas also brought in all the camera gear at the beginning of the week and hauled it out at the end, which was no easy task as there were eleven large bags of equipment.

Filming took place primarily in the southwestern branch of the cave. This area includes such highlights as Chandelier Ballroom, Pearlsian Gulf, and the Lebarge Borehole. We camped in the branch's designated camping site, Big Sky. This was my first camping trip inside Lechuguilla, or any cave for that matter. The filming permit required a park representative to be present during all filming, and I was the only person available. Having just started in Cave Resources in June, I happened to be in the right place at the right time. I talked to many people who had camped in Lechuguilla before, including Rod, and they gave me advice on packing and logistics.

We entered the cave on October 21st. Between film crew, sherpas, a microbiologist and myself, there were eleven people entering the cave. To avoid bottlenecks at the entrance rope and Boulder Falls, we divided into three groups and spaced our entries about an hour apart. I was part of the last group, and we entered the cave a little after one p.m. Down, down, down we went, deeper into the cave. There were many drops where we used ropes, several traverses over exposed ledges, and at the end, an uphill climb with two more ropes to use as hand lines. Thankfully, the crawling is minimal to get to camp, since we all were hauling our camp duffels, which weighed about thirty pounds each. The sherpas with the camera gear had even bigger packs.

We took it slow, making several breaks, and finally rolled into camp about 7:15 p.m. The sherpas turned around to head back to the surface, and those of us camping set up our tarps, sleeping bags, and started making dinner. We brought several small backpacking stoves so we were able to boil water. We poured boiling water into our freeze dried dinners and ate directly from the packaging. This is also how we ate our oatmeal each morning. There is no gray water in Lechuguilla, so you cannot wash dishes, wash your hands, or otherwise bathe or rinse. Water is for drinking and cooking only. Personal hygiene is limited to wet wipes, hand sanitizer, and teeth brushing—but spitting into a baggie. For me, deal-

Ellen arrives at Big Sky Camp with her camp duffel. Photo by Gosia Allison-Kosior.

Chris, Mark, and Johnny set up the "jib" in Pearlsian Gulf. Photo by James Hunter.

ing with limited hygiene was the biggest challenge of camping in the cave.

By 9:30 pm, we were all ready for bed. Of course the darkness is immediate, and almost tangible, when the last person turns off their headlamp. The silence, which I would have enjoyed, is not present when you have six people sleeping in the same room. Because the cave itself is so still and quiet, any little noise someone makes—a cough, a snore, adjusting their sleeping bag—sounds like a shot in the dark. Ironically, I had to sleep with ear plugs in the cave!

Sunday morning we woke up to total darkness and the sound of Hazel's alarm going off. After breakfast, we headed over to Pearlsian Gulf, a short walk away from our camp. It certainly made moving camera gear easy, as we could make multiple trips quickly. Pearlsian Gulf is a lake surrounded by flowstone, stalagmites, and of course cave pearls. It is a clean area, which means we each had to wear a clean set of clothes and our aqua socks. We spread out tarps to put the camera gear on so that it would not scratch the flowstone or get wet. Then the slow process of filming began. Although Pearlsian Gulf was perhaps the easiest of all the sites to film, due to relatively flat, even floors and plenty of walking space, there is also a learning curve for cave photography. Setting up shots, figuring out lighting, and keeping the lenses from fogging all presented themselves as challenges during this time. How to get amazing shots while avoiding delicate floors and the lake,

necessitated creative thinking. Fortunately, Chris, Johnny, Mark, and Tim all were extremely conscientious about cave protection the entire week. They were willing to endure extra hardships if it meant the cave would be better protected. Johnny, who manned the camera, particularly had great spatial awareness, which was important when he was getting very close to delicate speleothems.

The second day of filming was special for all of us. We were visiting Lake Castrovalva, an area that had been discovered in the eighties but the far shores hadn't been visited in twenty years. The original discoverers of the lake named it for a "Doctor Who" episode, which in turn had gotten the name from a lithograph by artist M.C. Escher. To approach the lake, we had to change into aqua socks and clean clothes, but the filming permit including the far side of the lake. The only way to get there was by swimming. Our trusty sherpas had packed us skin suits, which were like wet suits without any insulation, and we had to wear the suits along with aqua socks and swim caps in order to contain our hair, skin cells, dirt, etc. Once we had all our equipment packed into clean dry bags, we were ready to get in the water. It was COLD. Johnny recorded Hazel, Chris and I getting in and swimming out and back. If any sound was recorded at that time, it would have been completely full of our yelps and screams because of the cold.

Once we made it to the other side, we were in awe of what we saw. Caves always feel somewhat otherworldly to me, but this was the first time I felt I was on a completely different planet. The beautiful clear water, the giant lily pads that we tiptoed on, the pristine nature of this place; it was like nothing I had experienced before. Although we usually played music while we filmed to fill the monotonous silence, we had no need of music on that day. Castrovalva made its own music.

The next three days were more challenging in many ways. We filmed one day in Land of the Lost, and two in Chandelier Ballroom. There was no flat flowstone for us to easily walk on and set up the camera. In Land of the Lost, any step off trail

Chris, Johnny, and Hazel filming at the chandeliers. Photo by Gosia Allison-Kosior.

Johnny filming Lake Chandalar in Lebare Borehole. Photo by Gosia Allison-Kosior.

meant risking injury to beautiful aragonite bushes. The trail was narrow and went up and down over breakdown. Once the camera was set up on the trail, the only way to get to the other side was by crawling underneath it while someone held on to the tripod legs. In the Chandelier Ballroom, we had a little more room to work with, but setting up the camera so close to the chandeliers meant someone always had to be holding the tripod, and someone else always had to be spotting the camera as Johnny moved in close to get macro shots of the crystals. Once again, Johnny demonstrated his excellent spatial awareness. Once he got to this filming site, he familiarized himself with exactly where he could and could not go, and it seemed like he automatically gained muscle memory for those spots.

Over the course of the week, our filming sites moved farther away from camp and closer to the entrance. This was done intentionally, to aid the sherpas in bringing the packs out of the cave at the end. Each day, at the end of filming, some of the gear would get moved on to the next site. By the end of the second day in Chandelier Ballroom, most of the bags had moved on to the Lebarge Borehole. Thursday morning, we woke up early and made our way to the Chandelier Ballroom to pick up the remaining gear bags and shuttled them through Tinseltown Maze into the Lebarge Borehole. We did big "expedition" shots in the borehole of Hazel leading her team through the cave. They also filmed a lot of "science" shots that day, of Hazel collecting microbial samples and testing them. After three days of stressful filming in Land of the Lost and Chandelier Ballroom, it felt nice to be back in aqua socks on relatively flat flowstone, far away from delicate crystals.

That evening we wrapped filming a little earlier, because the sherpas were waiting to take some gear all the way to Boulder Falls. The next day, Friday, was going to be our exit day. We kept one small camera for filming on the way out. When

Friday morning rolled around, we packed up quickly. It was our eighth day in the cave and we all had "entrance fever." We said goodbye to Big Sky Camp. We passed familiar sites: the turn-off to Lake Castrovalva, Land of the Lost, Chandelier Ballroom, and Lebarge Borehole. We slowly made our way up the Little White Bastard, one at a time on rope. We stopped to film in Snow White's Passage and encountered the sherpa team heading down to fetch the last six bags from Lebarge Borehole. Between the four sherpas that came in that day, they got all the bags to Boulder Falls in record time while we were still working our way through the Rift. Unfortunately we all arrived at the bottom of Boulder Falls at the same time, which meant a long wait while each person climbed the rope.

The surface never smelled so good. After a good night's sleep on a real bed, we went back into the cave on Saturday to film sequences at Boulder Falls and the entrance airlock. The final challenge was hauling all eleven bags of gear out of the cave. We set up a haul system to get them up Boulder Falls, and then the sherpas started doing laps from the top of the Falls to the airlock. Eventually, all gear made it out, and everyone who remained shouldered a pack or two (or in some cases, three) and we hiked back to the cars.

The whole experience was productive, enjoyable, and successful. The film crew and the sherpa teams were all great people and made the experience a positive one. I even got to play at being part of the film crew by creating a "2nd unit" team with Hazel to film behind the scenes footage for "The Making Of" special that will be released in conjunction with the series. Lechuguilla truly is a strange and wonderful place and belongs in the bigger story of "One Strange Rock." I will never forget this trip, my first week completely underground, and I look forward to seeing it brought to life on screen.

The team that pulled all the bags out of the cave on the last day. Front row L to R: Ellen Trautner, James Hunter, Stan Allison. Back row L to R: Chris Baron, Tim Fogg, Johnny Rogers, Gosia Allison-Kosior, Harlan Taney, Beth Cortright, Derek Bristol. Photo by Gosia Allison-Kosior.

The Squeeze

Resource Notes & News

Lechuguilla Cave Expedition Summaries, 2014-2016

Thirty years after a group of explorers squirmed their way through a hole and into Lechuguilla Cave, the cave continues to surprise us. Explorers continue to find new passages and researchers learn more about the diversity of life within this pristine cave system.

Kent Taylor led day trips to the Ghost Town area, November 8-14, 2014

Kent led some day trips to the Lake of the Blue Midgets in the Ghost Town area of Lechuguilla Cave. The survey crew attempted to climb to a visible passage beyond the Lake of the Blue Midgets but had to abort their trip to prevent loose material from being knocked into the lake. Returning later, they determined the lead was not worth pursuing. They surveyed a few shots in a couple of boneyard areas and then failed to climb into another lead they had noticed in the area.

Hazel Barton Expedition to the Lebarge Borehole area, November 9-15, 2014

Hazel led a 6-person expedition to the Lebarge Borehole and Voids area in the Southwest Branch of Lechuguilla Cave. While resurveying a dead-end passage at the top of a fissure lead above the Lebarge Borehole, they discovered a previously unnoticed lead that led to a significant discovery that was named Neuland, which mean "new land" or "virgin territory" in German. They discovered several large rooms that they named the Icefields Parkway, Moraine, Chandelier Wallroom, and the Columbia Icefield, and a dome that they named the Diplomacy Dome. They were able to survey 5,402 feet of total survey, with 2,885 feet of new survey and the rest resurvey of old problem surveys.

Max Wisshak Expedition to the Deep Seas Camp, November 14-21, 2015

Max led a 9-person expedition to the Deep Seas Camp in the Western Branch of Lechuguilla Cave to work on completing the South Winds and Southern Climbs quadrangles. They surveyed 800 feet in a narrow vertical fissure and boneyard maze located below the Tradewinds area that they named the Chimera Crevice. They also went back to the Neuland area to finish pushing leads in their spectacular 2014 discovery. This included a 200 foot aid climb that dead ended and which they named the Polar Circus as well as 900 feet of passage and borehole that they named the Quiet Crisis, which they found off the top of the Diplomacy Dome. They found more gypsum chandeliers in the area. While checking 70 leads during the expedition, they surveyed a total of 7,592 feet of passage, including 2,267 feet of resurvey of old problem surveys.

Blackness ahead in the Neuland area in the Southwest Branch of Lechuguilla Cave. Photo by Max Wisshak.

Derek Bristol Expedition to the Far West, September 17-24, 2016

Derek led a 6-person expedition to the Far West part of the western branch of Lechuguilla Cave. Pushing a highly decorated 6 to 8-foot-wide lead in the Boomtown area, they encountered a deep lake that continues off the south edge of the map, which they had to abandon until mitigating measures can be identified to cross the lake on a future expedition. An aid climb in the Oz area led to 360 feet of new survey. A second aid climb in Oz led to 1,045 feet of survey, with two domes and one pit lead left for a future expedition. One of the domes was in a large room and measured 200-foot high and was named the Nostril, which would place the top approximately 80 feet below the surface and about the same elevation as the airlock. In addition, the expedition surveyed 2,297 feet of mop-up

Red Tides, a new room discovered on the southern edge of the Western Borehole in Lechuguilla Cave. Photo by Dan Austin.

survey in the Keel Hall, Sanctuary, and the 1988 Room areas. They were able to eliminate 50 leads while adding an additional 13 leads. The results of the expedition included 4,402 feet of total survey; 3,730.5 feet of new survey and 671.6 feet of excluded survey. The expedition added 0.71 miles to the length of Lechuguilla Cave.

Dan Austin Expedition to Red Lakes Area, November 18, 2016

After obtaining a permit to investigate a tight lead on the south edge of the Western Borehole in the Red Lakes area, Dan Austin led a group of five cavers on a one-day push trip. All of the objectives for the trip centered around the Red Lakes area, between Oasis and Huapache Highway, which is located at the far western end of the Western Borehole in the Keel Hall quad (Quad I35). The main objective was to push a tight slot that appeared to open up beyond a constriction. That lead opened into a highly decorated chamber 100' x 80' in diameter with 30' high columns and dry pool basins that they named Red Tides. They left two climbing leads for a future return trip while surveying 288 feet in the new room. A nearby lead led to a new pool they named Goldmember Pool and produced 116 feet of survey. They left a lead con-

tinuing on the other side of the pool for a future expedition. Most of the 404' of survey accumulated during the 18-hour trip was in virgin passage.

John Lyles Expedition to the Far East, November 14-20, 2016

John led an expedition with six other cavers, including two German cavers, into the Far East of Lechuguilla Cave. They accomplished some resurvey work that was needed by the cartographer of the area, Pat Kambesis. The expedition brought together the three most active surveyors of the past decade in the Far East branch, John Lyles, Ron Miller, and Rich Sundquist. They worked in the very complex Outback area, mopping up and connecting in additional loops to nearby surveys. They also worked in and around Coral Seas area and in the Kachina Lakes area, which is close to but above the Grand Guadalupe Junction level. This proved fruitful as climbs were started that will need follow up during future expeditions. Resurvey on the route to the Generation X Room found an additional narrow inclined passage that continues. One team went to the far south end to Cochise Stronghold, and surveyed two small passages, both on the southwest edge of the cave. Finally, a new effort was started in the large area under the Ruby Chamber, along the main trail in the Wild Black Yonder area. The teams added 2,634.2 feet of new passage to the length of the cave, raising the total length of the Lechuguilla survey to 141.07 miles, or about 227 km. In addition, the German cavers brought multi-flash digital SLR setup and

Goldmember Pool, a new pool discovered on the southern edge of the Western Borehole in Lechuguilla Cave. Photo by Jennifer Foote.

photo-documented parts of the Outback that have never been captured via high-quality photography before.

The corrosion residue-covered horizontal pancake passages discovered at the top of the Neverland climb on 12/13/16 by Art Fortini's climbing expedition. They named the area Never-Never Land. Photo by Art Fortini.

Hazel Barton & Art Fortini Expedition to the West, December 11-17, 2016

Due to scheduling issues, Art's team joined Hazel's expedition to the west. Hazel went to an area along the Western Borehole that is located underneath the Chandelier Graveyard; where they mopped up numerous leads and resurveyed numerous problem surveys. Hazel's team surveyed 3,482 feet of new passage, while resurveying 6,196 feet of problem surveys. After Art's group mopped up some passage in the Fubar area on the first day of the expedition, his team spent the next three days continuing the overhanging climbing lead on the Treehouse/Neverland climb. Although the top started looking more and more like an alcove the higher they climbed, when they finally did reach the lip, they found wide, going, pancake type of passages that averages three-feet high with pillars everywhere and few visible walls. The area is covered in corrosion residue and has significant airflow. They surveyed 1,610 feet before they ran out of time in this significant new discovery. They left over 60 leads in this new area for a return expedition. Combined, Hazel's and Art's expeditions surveyed 1.03 miles of new cave, bringing the Lechuguilla Cave survey to 142.10 miles or 228.67 km. —ROD HORROCKS

Carlsbad Cavern Expedition Summaries, 2014-2016

Visited for over 100 years, Carlsbad Caverns still has leads that are being explored and surveyed.

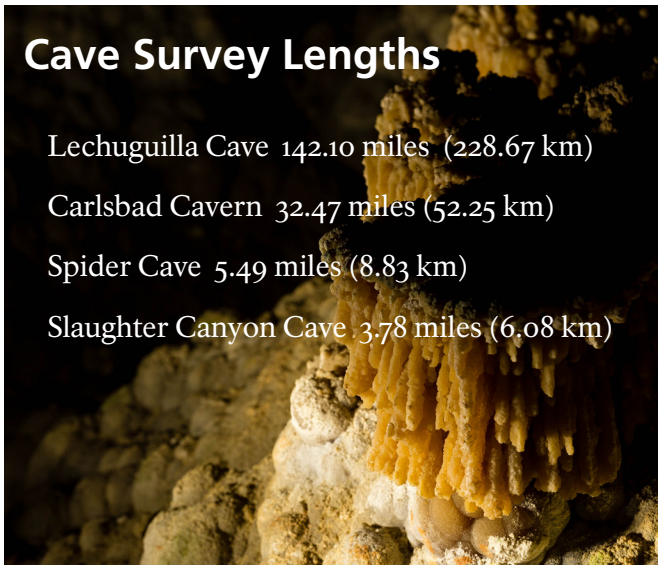
Derek Bristol led day trips to the Chocolate High & Guadalupe Sections, 12/30/15 – 1/2/16

Derek led a 6-person, 4-day expedition to the Guadalupe Room and Chocolate High Sections of Carlsbad Cavern. They were able to photo-document the Southern Splendor area, which had been lost for 23 years. They surveyed 2,500 feet of new cave in a series of deep pits on the east edge of the section and mopped up some leads near the Sand Room. In the Chocolate High area they surveyed some leads off the edge of the map and mopped up several other leads for 1,468 feet of survey. For the expedition, they were able to survey 3,968 feet of total survey, which includes 219 feet of redundant survey. The expedition added 0.71 miles to the length of Carlsbad Cavern, which brought the cave survey up to 32.35 miles.

Ed Klausner Led Day Trips to the Lower Cave area, September 29-October 4, 2016

Ed led a series of CRF organized day trips to mop up as many high leads as he could in the Lower Cave area of Carlsbad Cavern. Bringing a 22-foot folding ladder into the cave, he was able to check 37 leads. They surveyed some a short dis-

tance, while others could only be sketched because they were either too delicate, merely alcoves, or blocked by pools. A few couldn't be climbed without lead climbing with full vertical gear. Altogether, his teams were able to survey 865 feet of survey in 60 shots. This included 682 feet of new passage and 183 feet of redundant survey. The only leads left in Lower Cave are numerous difficult climbing leads. The expedition added 0.13 miles to the length of the Carlsbad Cavern survey, which brought the cave survey up to 32.47 miles. —ROD HORROCKS



The Mystery of the Colonel Boles Formation

Interpretive ranger Mannie Bemis contacted the Cave Resources Office in June 2016 about the many stories surrounding the Colonel Boles Formation in Lower Cave. These stories, mostly attributed to ranger lore, concern the natural breaks in several columns.

Some stories say the columns were broken on purpose, in order that rangers could remove the center section to illustrate the fact that columns do not, in fact, hold up the cave. Other stories include an epilogue, stating that after those crazy early days of the park, the column has since been repaired. Some say by glue, some claim other methods.

Cave Specialist Rod Horrocks removes the center piece of the Colonel Boles formation. NPS Photo.

While we know that Colonel Boles did indeed remove the center section of one of the columns to entertain his guests, there is no source stating that it was broken intentionally. Also, in talking to former Cave Specialist Dale Pate, he stated that the formation had not been repaired during his tenure at the park (1991-2011) and he had no knowledge of it ever being repaired.

To set some of these rumors to rest, Rod, Mannie, and Ellen headed down to Lower Cave on June 21st, 2016. They first determined that the columns were broken by settling as the underlying cave silt contracted. After putting down a nylon cloth so that they would not track mud onto the flowstone, they

were able to demonstrate that it had not been repaired, as Cave Specialist Rod Horrocks was easily able to remove the center piece. They also were able to document that both ends were natural breaks. Neither end was a manmade cut. Unfortunately, this piece has obviously been removed many times in the past. The lower break has been worn down to the point that it is no longer a clean break. Luckily it still balances quite well.

Now that it has been established and documented that both breaks are natural, and have not been repaired, there is no need to repeat this experiment. —ELLEN TRAUTNER

Interpretive Ranger Dustin Baker shines a light on the Iron Pool during a tour of Left Hand Tunnel. Photo by Cathryn Hoyt.

Iron Pool in Left Hand Tunnel

The Iron Pool in the Left Hand Tunnel in Carlsbad Cavern is an interesting mystery.

The current thought is that the greenish color in the Iron Pool is due to the Tyndall Effect, which refers to light being scattered by a very fine colloid that is in suspension in water. The green color is consistent with a colloidal suspension of iron. Geologist Carol Hill helped Douglass E. Caldwell collect an aquatic bacterium name *Leptothrix* sp. from the Iron Pool in 1969. This organism has the ability to oxidize iron.

Douglass published a paper in *Geomicrobiology* on this organism in 1980, where he stated that it is filamentous and is incased in an iron-containing hexagonal sheath, which covers the surface of the cells. The width of the hexagonal subunits are only 0.1 angstroms, with no iron observed within the subunits. It's also interesting that nearby pools are not the same green color, with only one moonmilk pool occasionally showing signs of going yellow. Geologist Michael Queen stated, "Why the two nearby pools are so different is particularly mysterious, perhaps we need to do some more testing." —ROD HORROCKS

The complexity of the the Big Room in Carlsbad Caverns will help test evolving ideas about what constitutes a cave chamber or passage. Results from the LIDAR survey of this, and other cave chambers around the world, will be presented in July, 2017, at the International Congress of Speleology in Sydney, Australia. Photo by Cathryn Hoyt.

LIDAR Survey of the Big Room in Carlsbad Cavern

Tim and Jane Allen, cavers from the United Kingdom, recently completed a LIDAR survey of the Big Room in Carlsbad Cavern. They were joined by fellow UK cavers Andy Eavis and Roo Walters in a project to make a detailed 3D map of the Big Room. The purpose of the survey was to calculate the volume of the Big Room, in order to determine where the Big Room ranks in the largest cave chambers in the world.

This survey is part of a 3-year project to visit all the world's largest chambers so that the first detailed comparison can be made of them, not only to assess which is the largest chamber, but also to find out more about their structure and how they were formed. "Previous estimates of size are largely informed guesswork," explained Roo Walters, who is responsible for collating the data into 3D models from which measurement can be made. "This equipment allows us to measure down to each square centimeter of the cave walls separately, which means a highly detailed and accurate model can be built."

The actual calculation for the size of the Big Room is 0.93 million cubic meters, which is 10% larger than the cavern previously thought to be the largest in the Americas: The Belize Room, in Belize. However, there is another contender, La Munenca, a large chamber in Mexico, that hasn't been revisited since it was discovered in 1989. The team will visit La Munenca in 2017. "What we discovered during this project," said team leader Tim Allen, "is that until we measure it, we just don't know." —ROD HORROCKS

Wildlife Handling SOP

On October 12, 2016, Superintendent Doug Neighbor reviewed and signed the Wildlife Handling SOP. The purpose of the SOP is to provide park employees with guidelines on how to deal with wildlife that are suspected of carrying rabies infection. A copy of SOP 16-02, "handling of Wildlife with Suspected Rabies Infection," can be found on the Shared Drive (S:) at: SOP's-Archived/2016/16-02.

We also hope to form a CAVE wildlife responder team comprised of volunteers from each park division. Training will be provided. More on this in a future newsletter. —LUIZ FLOREZ

Native Plant Revegetation

Revegetation Plots

In 2012 and 2013, Native Plant Revegetation plots were constructed at the Visitor Center and in Bat Cave Draw to restore the native plant landscape disturbed during remodeling and the demolition of the Bat Cave Draw parking lot. Follow-up herbicide treatments were necessary to keep exotic plants from taking over and to provide a chance for the native plant species to gain a foothold.

The Revegetation Plots located at the Visitor Center and Bat Cave Draw are considered a resounding success!

Hydro-seeding with native plant seed mix along Walnut Canyon Road, August 2012. This treatment helped revegetate several sites that had been burned through by the Loop Fire of 2011. NPS Photo.

Hydro-Seeding

Hydro-seeding was conducted on Walnut Canyon Road to restore native plant communities after the 2011 Loop Fire burned through the park. Approximately 21 acres (up to 25 feet in from the road shoulders) were seeded with a mixture of Plains bristlegrass, blue grama, green sprangletop, purple three-awn, and sideoats grama. Several sites, severely burned during the wildfire, were specifically targeted.

Follow-up studies conducted by the NPS Chihuahuan Desert Inventory and Monitoring Team in 2015 and 2016 indicate that the hydro-seeding project was an indubitable success.

Maintenance Required

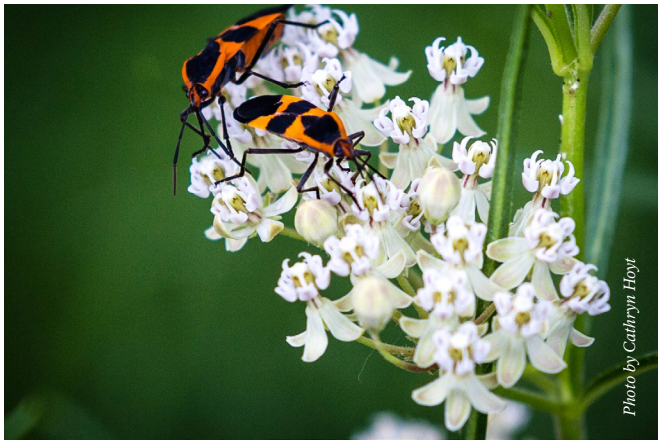
Lehmann lovegrass, field bindweed, bermuda grass, and King Ranch bluestem are exotic, invasive plant species that eagerly infest disturbed soils. To give the newly seeded and planted native plants a chance, follow-up exotic plant spot treatments (using herbicides) were required at the Visitor Center, Bat Cave Draw, and Walnut Canyon Road. Seven treatments total were conducted by Wildlands, Inc., during 2014, 2015, and 2016. CAVE Resources Management Division utilizes an integrated pest management approach when conducting these treatments. —LUIS FLOREZ

Johnsongrass Removal Project

As part of Bat Week festivities, CAVE held a Bat Weed Pull at Rattlesnake Springs on October 29, 2016. Four fearless souls—John Davis, John Mitchell, John Webber (Jaco)—led by Luis Florez, braved some early morning cold temperatures to yank out Johnsongrass (*Sorghum halepense*) from our desert oasis. Over 500 pounds (approximately 1/2 acre) of the invasive plant were removed from the site near the picnic area at Rattlesnake Springs.

John Webber, John Mitchell, and John Davis remove Johnsongrass from the Rattlesnake Springs picnic area during Bat Week. Photo by Luis Florez.

The impacts to native plant communities from these exotic, invasive plants are many. Exotic plants take over large areas and reduce the diversity of the native plant community. Cultural resources such as historic buildings and landscapes, can be damaged by exotic, invasive plants. Some of the exotics are poisonous to humans and to wildlife. Wildlife tend to re-locate to other areas where better habitat and food requirements can be found. Some exotic plants out-compete native plants for nutrients and moisture. Some annual exotic plants form thick monocultures and create fire hazards as they dry out each spring and fall. By a maintaing a balanced biodiversity of plants and animals, Rattlesnake Springs can remain one of the gems of the desert.—LUIZ FLORES



HABS of the CCC-Era Research Huts

Quarters 6 & 8, commonly called the Research Huts, are two CCC-era park buildings that have recently been used to house volunteers and researchers. Because they weren't in the park housing program, they had been deteriorating for some time, prompting the Superintendent to condemn them in early 2016. It was decided that a Historic American Building Survey (HABS) should be conducted on these two buildings before they are refurbished and then added to park housing, which would then make them eligible for on-going maintenance work. We worked closely with Julie McGillivray, from the IMR Santa Fe Historic Preservation Program, to put this project together. She wrote a Task Agreement and reached out to some of her contacts to find an interested party.

The University of Texas at Austin (UT) School of Architecture was chosen to conduct the HABS documentation due to their proximity to Carlsbad Caverns National Park, qualifications of its instructor, and because a class could be structured around the documentation; which would be an essential cost-saving measure since the park was providing the funding for the project. The class was led by Benjamin Ibarra. Professor Ibarra is a licensed architect and professor of architecture and historic preservation at UT.

In October of 2016, the School of Architecture brought a graphic documentation class with 13 graduate students to the park to conduct the initial survey. Over the course of three days, they finished the field work required to complete a HABS set of as-built drawings. A graduate research assistantship is now being used to complete the class drawings and make sure that everything meets HABS requirements by Spring of 2017. A completed HABS set includes a set of measured drawings, an overview of the history of each building, and photographs documenting the current conditions. Once this project is completed, the plan is to complete HABS of the remaining historic park structures, one to two each year for the near future.—ROD HORROCKS

Research Hut 8, a Pueblo Revival style structure in the Caverns Historic District, was the focus of a HABS documentation project conducted by the University of Texas School of Architecture. Photos by Cathryn Hoyt

Butterflies of Carlsbad Caverns National Park

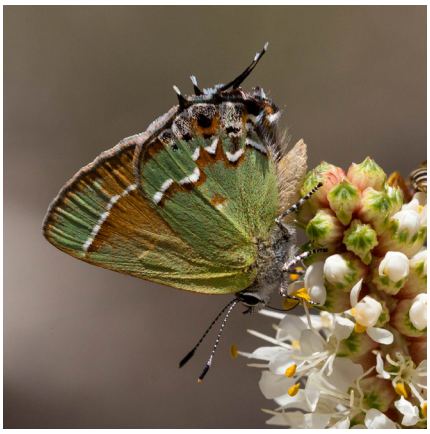
Photos and Text by Cathryn Hoyt

Black Swallowtail (*Papilio polyxenes*)

I enjoy butterflies. They're not only beautiful, but they also tell an important story about the ecological health of the landscape. In 2016, while working as a seasonal at CAVE, I began an informal survey of the parks butterflies. I was able to add four new butterflies to the list of 106 species published on the park website. Here are a few of the most common, rare, and new species documented during my survey.

Checkered White (*Pontia protodice*)

Sleepy Orange (*Abaeis nicippe*)



Juniper Hairstreak (*Callophrys gryneus*)

Reakirt's Blue (*Echinargus isola*)

Three species of sulphur butterflies (Sleepy Oranges, Mexican Yellow, and Clouded/ Orange Sulphurs) sip minerals from bloodsoaked earth near a recent deer kill.

Cyna Blue (*Zizula cyna*)

A tiny, rare blue easily identified by its habit of swaying from side to side when perched.

Fatal Metalmark (*Calephelis nemesis*)

Look for a glint of metallic silver on the wings of this small butterfly.

Variegated Fritillary (*Euptoieta claudia*)

These medium-sized butterflies are common in open fields and along roadsides in the late summer.

Definite Patch (*Chlosyne definita*)

A small, rare, and very local butterfly that appeared in abundance at CAVE during the late summer of 2016.

Painted Lady (*Vanessa cardui*)

Painted Ladys overwinter in the south and migrate north by the thousands in the spring.

Hackberry Emperor (*Asterocampa celtis*)

Hackberry Emperors rarely sip nectar, but will come to rotting fruit and fresh tree sap.

Monarch (*Danaus plexippus*)

Monarchs found here are important for genetic crossing of western and eastern populations of this migratory butterfly.

Arizona Powdered-Skipper (*Systasea zampa*)

This beautiful little skipper is one of 4 species new to the CAVE butterfly list in 2016.

Orange Skipperling (*Copaeodes aurantiaca*)

Small and very fast, Orange Skipperlings are fairly common in the grasses at Rattlesnake Springs.

Meet the Resources Staff

Rod Horrocks

Cave Specialist | rod_horrocks@nps.gov

Rod has a Master's of Science degree in Computer-Aided Cartography. Before the National Park Service he worked as an archaeological, paleontological, and geologic technician. He has worked as a Cave Management Specialist for the National Park Service for 24 years. He has worked at four parks, beginning with Timpanogos Cave National Monument (1992-1998), Great Basin National Park (1996-1998), Wind Cave National Park (1999-2015), and finally Carlsbad Cavern National Park, where he started in February of 2016. Carlsbad Caverns National Park was always Rod's dream job, from the day he got his first seasonal job at Timpanogos Cave. Rod's professional specialties are cave lighting design, digital cave cartography, cave surveying, fossil preparation, and cave restoration projects. Rod's hobbies are drawing cave maps, surveying caves, art work, research projects, writing, and reading. He has been married to Loura for 28 years and has two kids (Charla and Matt).

Ellen Trautner

Cave Technician | ellen_trautner@nps.gov

Ellen is a Cave Technician and has worked in the Cave Resources Office since June. She issues back country cave permits, coordinates volunteers, conducts monitoring and restoration work, assists researchers, manages data, surveys and explores, monitors weather stations, and works on various other projects. Her collateral duty is safety, and she's currently the chairperson of the Employee Safety Committee.

Prior to this position, Ellen did a detail for Cave Resources in the fall of 2015 to help with the cave lighting project, and worked in Interpretation since 2010, doing a detail as an education technician in spring 2015. She's also worked as an environmental educator for two years at Cuyahoga Valley National Park in Ohio, where she's from. She has a Master's degree in Parks and Resource Management.

When she's not working, Ellen enjoys spending time with her husband, Foz. They enjoy traveling, hiking, scuba diving, and caving. They have two cats and assorted turtles. Ellen loves to visit her two little nieces, bake pies, try new recipes, read, and sew. Her favorite season is fall, and her favorite author is J.R.R. Tolkien.

Sam Denman

Museum Technician | Sam_Denman_nps.gov

Sam has been the museum technician here at CAVE since mid-year 2010. He is learning more about the job and the cultural resources of the park all the time. He began his NPS life in 2003 at Grand Canyon on the trail crew after being honorably discharged from the military. He was on the trail crew for almost two years. Sam's first permanent NPS job was at the Back Country Information Center on the South Rim of GRCA.

Sam obtained a degree in Anthropology with a minor in history from NAU in Flagstaff, Arizona in 1998.

Sam was born in Titusville, Florida and lived there until the age of 11. Much of his family is still there. Sam remembers watching many shuttle launches while camping across the Indian River from Cape Canaveral/Kennedy Space Center. You can't camp there anymore.

Sam enjoys living in downtown Carlsbad near the Pecos River. Rivers are sacred to him. When he's not working he enjoys spending time with his two Boston terriers, Guadalupe and Katie. He also enjoys hiking, camping and especially going on adventure motorcycle trips around the southwest. One of Sam's favorite books is *Kon Tiki* by Thor Heyerdahl.

Luis Florez

NEPA Compliance Officer and
Exotic Plant Management Coordinator
luis_florez@nps.gov

Luis Florez is the NEPA Compliance Officer and Exotic Plant Management Coordinator. In 2000, he transferred from the Bureau of Land Management, to begin his career with the NPS as an Exotic Plant Management Specialist. He is located in the town office. He earned his Bachelor of Science degree in Agricultural Biology, minor in Range Science and certification in Pest Management from New Mexico State University. In his spare time, he is pursuing a Masters in Education degree from Eastern New Mexico University.

Recent Publications

The following is a partial list of recently published articles that pertain to Carlsbad Caverns National Park.

Barksdale, V., M. Newell, and K.L. Duran. 2015. Nuclear intergenic DNA sequence divergence in a Texas dwarf mistletoe (*Arceuthobium divaricatum*) population. *Bios*, 86(2):47–52.

Błachowicz, T., and V. Andreychouk. 2015. Quantitative estimation of 3D cave networks complexity using random walk analysis. *Landform Analysis* 29.

Decker, D.D., V.J. Polyak, and Y. Asmerom. 2016. Depth and timing of calcite spar and "spar cave" genesis: Implications for landscape evolution studies. *Geological Society of America Special Papers* 516:103–111.

Fish, E.B. 2016. Recent water quality trends in Guadalupe Mountains National Park, Texas. *Texas Journal of Agriculture and Natural Resources* 4:20–22.

Geluso, K.N., and K. Geluso. 2015. Distribution and natural history of Nelson's pocket mouse (*Chaetodipus nelsoni*) in the Guadalupe Mountains in Southeastern New Mexico. Museum of Texas Tech University.

Ghosh, S., N. Kuisiene, and N. Cheeptham. 2016. The cave microbiome as a source for drug discovery: reality or pipe dream? *Biochemical Pharmacology*. Corrected proof. Online 17 November 2016.

Griswold, T., J.D. Herndon, and V.H. Gonzalez. 2015. First record of the orchid bee genus *Eufriesea* Cockerell (Hymenoptera: Apidae: Euglossini) in the United States. *Zootaxa* 3957(3):342–346.

Hamm, P.S., N.A. Caimi, D.E. Northup, E.W. Valdez, D.C. Buecher, C.A. Dunlap, D.P. Labeda, S. Lueschow, and A. Porras-Alfaro. 2016. Western bats as a reservoir of novel *Streptomyces* species with antifungal activity. *Applied and Environmental Microbiology* AEM-03057. Accepted manuscript, online 16 December 2016.

Hurd, G.S., C. Kerans, S. Fullmer, and X. Janson. 2016. Large-scale inflections in slope angle below the shelf break: A first order control on the stratigraphic architecture of carbonate slopes: Cutoff Formation, Guadalupe Mountains National Park, West Texas, USA. *Journal of Sedimentary Research*,86(4): 336–362.

Ivanov, A., M. Nestell, and G. Nestell. 2015. Middle Permian fish microremains from the Early Capitanian of the Guadalupe Mountains, West Texas, USA. *Micropalentology* 61(4–5):301–312.

Jones, D.S., L. Polerecky, S. Galdenzi, B.A. Dempsey, and J.L. Macalady. 2015. Fate of sulfide in the Frasassi cave system and implications for sulfuric acid speleogenesis. *Chemical Geology* 410:21–27.

Jones, D.S., and J.L. Macalady. 2016. The snotty and the stringy: Energy for subsurface life in caves. In *Their World: A Diversity of Microbial Environments*, pp. 203–224. Springer International Publishing.

Kirby, M.E. 2016. Climate science: Water's past revisited to predict its future. *Nature* 532:44–45.

Kloepper, L.N., M. Linnenschmidt, Z. Blowers, B. Branstetter, J. Ralston, and J.A. Simmons. 2016. Estimating colony sizes of emerging bats using acoustic recordings. *Royal Society Open Science*, 3(3):160022.

Kooser, A., J.C. Kimble, J.M. Young, D.C. Buecher, E.W. Valdez, A. Porras-Alfaro, and D.E. Northup. 2015. External microbiota of western United States bats: Does it matter where you are from? *bioRxiv*: 017319. Preprint. Not peer-reviewed.

Krysl, L.J., and F.C. Bryant. 2016. Food habits and dietary overlap of elk and mule deer in Guadalupe Mountains National Park, Texas.*Texas Journal of Agriculture and Natural Resources*. 14:84–90.

Lonsinger, R.C., R.M. Schweizer, J.P. Pollinger, R.K. Wayne, and G.W. Roemer. 2015. Fine-scale genetic structure of the ringtail (*Bassariscus astutus*) in a Sky Island mountain range. *Journal of Mammalogy*, 96(2):257–268.

Lyles, J.T.M., and D.G. Davis. 2016. A brief history of exploration in Lechuguilla Cave in New Mexico, USA. *Boletín geológico y minero* 127(1):111–129.

Marlowe, E. 2016. *Natural and technological wonders: Embracing modernity at Carlsbad Caverns National Park* (Doctoral dissertation, Drew University).

Melim, L.A., D.E. Northup, P.J. Boston, and M.N. Spilde. 2016. Preservation of fossil microbes and biofilm in cave pool carbonates and comparison to other microbial carbonate environments. *Palaios* 31(4):177–189.

Merson, M., L.C. Allen, P.L. Cox, and N.I. Hristov. 2016. Roving with a Digital Visual Library: Increased learning opportunities at Carlsbad Caverns National Park. *Journal of Interpretation Research* 21(1). (Online journal)

O'Shea, T.J., P.M. Cryan, D.T. Hayman, R.K. Plowright, and D.G. Streicker. 2016. Multiple mortality events in bats: a global review. *Mammal Review* 46(3):175–190.

Pawlowski, A.C., W. Wang, K. Koteva, H.A. Barton, A.G. McArthur, and G.D. Wright. 2016. A diverse intrinsic antibiotic resistome from a cave bacterium. *Nature Communications* 7:13803.

Polyak, V.J., P.P. Provencio, and Y. Asmerom. 2016. U-Pb dating of speleogenetic dolomite: A new sulfuric acid speleogenesis chronometer. *International Journal of Speleology*, 45:103–109.

Railsback, L. B., G.A. Brook, B.B. Ellwood, F. Liang, H. Cheng, and R.L. Edwards. 2015. A record of wet glacial stages and dry interglacial stages over the last 560 kyr from a standing massive stalagmite in Carlsbad Cavern, New Mexico, USA. *Palaeogeography, Palaeoclimatology, Palaeoecology* (438):256–266.

Reynolds, H.T., H.A. Barton, and J.C. Slot. 2016. Phylogenomic analysis supports a recent change in nitrate assimilation in the white-nose syndrome pathogen, *Pseudogymnoascus destructans*. *Fungal Ecology* 23:20–29.

Reynolds, H.T., T. Ingersoll, and H.A. Barton. 2015. Modeling the environmental growth of *Pseudogymnoascus destructans* and its impact on the white-nose syndrome epidemic. *Journal of Wildlife Diseases* 51(2):318–331.

Sonntag, G. 2015. An analysis of microbial involvement in biospeleogenesis within Lechuguilla Cave system. Honores Research Project 165. University of Akron, Ohio. http://ideaexchange.uakron.edu/honors_research_projects/165.

Thompson, J.R., E. Petsios, E.H. Davidson, E.M. Erkenbrack, F. Gao, and D.J. Bottjer. 2015. Reorganization of sea urchin gene regulatory networks at least 268 million years ago as revealed by oldest fossil cidaroid echinoid. *Scientific Reports* 5:15541.

Voorhees, K.J., 2016. *Anatomy, dimensions, and significance of the penultimate Yates tepee-shelf crest complex, G25 Hairpin HFS, Guadalupe Mountains, New Mexico and Texas* (Doctoral dissertation, University of Texas at Austin).

Weckstein, J.D., K.P. Johnson, J.D. Murdoch, J.K. Krejca, D.M. Takiya, G. Veni, J.R. Reddell, and S.J. Taylor. 2016. Comparative phylogeography of two codistributed subgenera of cave crickets (Orthoptera: Rhaphidophoridae: *Ceuthophilus* spp.). *Journal of Biogeography* 43(7):1450–1463.

Wiederholt, R., L. López-Hoffman, C. Svancara, G. McCracken, W. Thogmartin, J.E. Diffendorfer, B. Mattson, K. Bagstad, P. Cryan, A. Russell, and D. Semmens. 2015. Optimizing conservation strategies for Mexican free-tailed bats: a population viability and ecosystem services approach. *Biodiversity and Conservation* 24(1):63–82.

Williams-Guillén, K., E. Olimpi, B. Maas, P.J. Taylor, and R. Arlettaz. 2016. Bats in the anthropogenic matrix: challenges and opportunities for the conservation of Chiroptera and their ecosystem services in agricultural landscapes. In *Bats in the Anthropocene: Conservation of Bats in a Changing World* pp. 151–186. Springer International Publishing.

Winter, A.S., J.C. Kimble, J.M. Young, D.C. Buecher, E.W. Valdez, J.J. Hathaway, A. Porras-Alfaro, K.J. Read, and D.E. Northup. 2016. External bacterial diversity on bats in the southwestern United States: Changes in bacterial community structure above and below ground. *PeerJ Preprints*, 4, p.e2493v1.

Zhang, G., X. Zhang, D. Li, J. Farquhar, S. Shen, X. Chen, and Y. Shen. 2015. Widespread shoaling of sulfidic waters linked to the end-Guadalupian (Permian) mass extinction. *Geology*, 43(12):1091–1094.

Ellen Trautner enjoys the chandeliers in Lechuguilla Cave. Photo by Tim Fogg.

National Park Service
U.S. Department of the Interior

Carlsbad Caverns National Park
Resources Stewardship and Sciences Division
3225 National Parks Hwy
Carlsbad, NM 88220