



ATBI QUARTERLY

Great Smoky Mountains National Park, Great Smoky Mountains Association, Friends of the Smokies, and Discover Life in America

Sifting Litter in the Great Smoky Mountains

Victoria Bayless and Chris Carlton



Jeanie Hitten

Chris Carlton and Victoria Bayless collecting.

Eight DLIA scientists and 16 volunteers gathered during the week of 27 July - 2 August 2004 to conduct the first ever Forest Litter Blitz. The objective of this event was not to pick up trash in the forest but rather to harvest the diversity of small organisms that inhabit the organic layer on the forest floor, including leaves, twigs, and other woody debris (e.g., rotten logs). A diverse microcosm of tiny invertebrates exists within this layer of moldy, decomposing organic debris, including beetles, springtails, mites, land snails, pseudo-scorpions, millipedes, centipedes, and many other, mostly lesser-known, creatures. Isolating these tiny organisms requires sifting the litter into sample bags and using a technique called Berlese extraction.

Volunteers and scientists dispersed each morning armed with specially designed sifters built by members of our Louisiana State Arthropod Museum lab or DLIA volunteer Will Merritt (thanks Will). They returned at the end of each day tired and dirty with precious bags of dirt. Several different Berlese Funnel devices were used to warm and dry the samples and drive the organisms into waiting containers of preservative. We appreciate Ernie Bernard's generosity in loaning us equipment from his lab at the University of Tennessee, and the assistance of Tommy Allen of the Philadelphia Academy of Natural Sciences and Park Curator Adriean Mayor in transporting and setting up additional funnels. During the latter part of the week, volunteers and scientists entertained themselves by sorting the various organisms taxonomically for distribution to specialists. Commonly overheard comments included: "What is THIS?" and "Its so cute!" Highlights of the week's fieldwork included Alexey Tishechkin's solo backpacking expedition to Thunderhead Mountain where he collected three large samples in one of the more difficult areas to access. Chris Carlton and Janet Ciegler had an exciting encounter with a big rattlesnake that cicada expert Carlton initially misidentified as a really BIG cicada. Rattlesnakes and cicadas both buzz, right?



Chris Carlton

Endomychus biguttatus, a fungus beetle.

In total, we collected 36 litter samples that we estimate will yield approximately 3,000 arthropod specimens. We immediately picked out the beetles and those are being processed at our lab at LSU. We also set aside small fractions of litter for cellular slime mold cultures and sorted small snails for DLIA scientist Dan Dourson. Analysis of the samples is ongoing but significant initial discoveries include a "new to science" species of the ground beetle genus *Anillinus* and the discovery of a specimen of undescribed snail that probably will be designated as a paratype when formally described. The new *Anillinus* are in addition to the five species of *Anillinus* already known from the Park, four of which are themselves very recently described. Organisms extracted but not sorted from the samples were deposited with Adriean Mayor for further sorting and distribution to interested scientists or identification in-house. A significant achievement of the event was filling important distributional gaps from the west and southwest parts of the Park.

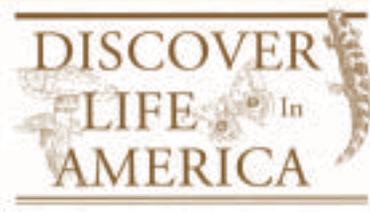


Jeanie Hitten

Chris Carlton showing specimens to Park visitors.

We enjoyed interacting with Park visitors outside Sugarlands Visitor Center by first luring them to us using displays of large showy beetles and beautiful scanned images and photographs of the tiny organisms found in this habitat; then we showed them the real thing, often 2 mm or less in length. They liked the photographs better! We also demonstrated the finer points of litter sifting, which the children seemed to intuitively understand and appreciate. While parents often wrinkle their noses at our insect collecting activities, the children are fascinated at the diversity of cool and neat stuff that lives beneath our feet in the GSMNP.

Victoria Bayless, vmosele@lsu.edu and Chris Carlton, ccarl@lsu.edu
Louisiana State Arthropod Museum - <http://www.agctr.lsu.edu/arthropodmuseum>
Louisiana State University



President's Corner

Peter White

Exploring and sampling for biodiversity: Another way we can lead!

Assistant Superintendent Phil Francis said it as well as anyone at last year's Annual Meeting of DLIA: "How many species are there? That reminds me of the question they frequently get at Mammoth Cave National Park: How many miles of unexplored cave are there?" In this short essay I'll tell you a bit about why it is so hard to estimate the number of species and how we are approaching this in the ATBI.

From the beginning, our Science Plan recognized two threads for collecting and observing: Traditional and Structured. Traditional collecting and observing is the open ended exploration that taxonomists do so well. Based on years of training and experience, they have a sense of where to go to get the most return (in our case, new species) for the effort. As important as those efforts are, they are difficult to repeat or assess in terms of completeness. Also, different taxonomists rightly select different places to wander, so building an understanding within a particular part of the landscape is less possible.

Enter structured sampling. This is a purposeful organization of the observations against the factors that we know influence the distribution of species: temperature, moisture, soil resources, and disturbance history. These factors allow us also to phrase hypotheses (how different are the soil fungi of logged and old-growth forest, for instance) and build an ecological model of the patterns of diversity. Chuck Parker, USGS entomologist, has carried out a pilot project on biodiversity reference plots that are teaching us how best to incorporate this kind of work.

And now for some deeper thought. We know that the number of species has a complex relation to the scale of the observations. That is why it is so hard to "guesstimate" the number of species in a particular area. You can't list species in several separate areas and then compare the lists to extrapolate! Scale is a pretty nebulous concept to most people, so let me break it into its two components: grain and extent. Grain is the size of a unit observation - one sample, one plot. Think of the graininess of a picture or your computer screen. Extent is the total area over which observations are made - think of the total size of a picture on your computer screen. So, one might have a sample consisting of one square meter grain (the area sampled) and 100 meter extent (the distance over which several one square meter observations were made). We could apply this to time, too: the grain would be, for example, one hour of observing birds at one spot and the extent would be the span of time (e.g. one week) over which several observations were made. The grain is one hour and the extent is one week.

Well, as you might imagine, the number of species observed at a given total effort varies with the grain and extent of the sample. Increasing extent - sampling more days, more places - usually builds species numbers faster than increasing grain. Add to this the interesting wrinkle that different species groups respond to grain and extent differently.

By incorporating structured sampling and by analyzing the effect of grain and extent, we are dropping an anchor that will put us in a leadership position in global biodiversity studies. Chuck's pilot project has much to teach us. Stay tuned for the results.



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Note to Readers

The ATBI Quarterly newsletter is now available in color on our website. To sign up for notification of when the next issue is online, go to www.dlia.org/atbi/press/quarterly.html. We will keep your name in our general database, but will not send a hard copy of the newsletter to you. This will save us some money in printing and mailing -- and save a tree too!

If you wish to continue to receive the Quarterly by mail, please consider sending a donation of \$10 to Discover Life in America and mail it to Friends of Great Smoky Mountains National Park, P.O. Box 5650, Sevierville, TN 37864-9902.

Note to Authors

We welcome brief articles, reports, and images from researchers, educators, and volunteers. Text files should be no longer than 600 words for a double page spread, and for a single page, 250 to 300 words, with one image of about 3" x 5". Fewer words allow more space for images. Send photos as high resolution color JPG files. The deadline for the Winter issue is January 10, 2005.

Ruthanne Mitchell, ATBI Quarterly Newsletter Coordinator
cwmitchell@ntown.com

Discover Life in America Annual Appeal:
We invite you, our ATBI Quarterly readership, to use the enclosed self-mailer to make a financial contribution for 2004. You will be helping preserve the wondrous diversity of creatures of the the Smokies! Thank you to our supporter who have already made generous donations.



Chris Corlison

Syntomium sp., a staphylinid beetle.

The Natural History Collection of Great Smoky Mountains National Park

Adrieen Mayor

Nestled in a corner of the basement in the Sugarlands Visitor Center, the Natural History Collection of Great Smoky Mountains National Park is a resource known to few Park visitors, but used by researchers from around the world interested in studying the plant and animal diversity of the southern Appalachian Mountains. The collection originated in the fall of 1934, with the arrival of Arthur Stupka, the first Park biologist. Today, the collection includes more than 100,000 preserved specimens representing the remarkable diversity of plants and animals that is the hallmark of the Smokies. It is among the largest of natural history collections representing southern Appalachian biodiversity.

Early efforts at documenting diversity in the Park were focused mainly on plants and larger vertebrates, such as mammals, reptiles, and birds. This is reflected in the collection database, with 11,178 plant records and 3,199 vertebrate records. Many of the early records predate the formation of the Park, and are of historical interest because they were made in areas now covered by Fontana Lake. More recently, in cooperation with Discover Life in America, the Park has embarked on an All Taxa Biodiversity Inventory (ATBI) to discover and document all life within its boundaries, from bacteria to bears. The ATBI has shifted the emphasis of the Natural History Collection from plants and vertebrates to less well-known groups such as algae, fungi, lichens, and eumycetozoa, as well as to invertebrate groups such as snails, millipedes, centipedes, spiders, mites, ticks, scorpions, pseudoscorpions, opilionids, and insects. The astounding diversity of this last group is reflected in the collection database with more than 20,000 insect records!

The National Park Service is committed to preserving this Natural History Collection. The current aim of the collection is to include at least a small series of preserved representatives of all life in the Park. This presents many challenges as the collection grows and expands. The most critical of these is the need for additional space to house the thousands of specimens being accessioned and cataloged as a result of the efforts made by researchers from around the world to complete the first successful ATBI!

The specimen collection is a permanent record of a small portion of Southern Appalachian Biodiversity. The Natural History Collection will, and does, have many uses, some unique and unpredictable. The collection is used by research scientists, interpretive staff developing programs for the enjoyment and education of visitors, and by Park administrators and policy makers, allowing them to make informed decisions regarding the protection of fragile resources through an understanding of the distribution and phenology of these resources. This collection also serves as a repository for specimens which will be available for future analysis using advanced means to gain trend data for tracking pollutants, genetic differences (both spatial and temporal), and infestations by parasites and microorganisms, to name just a few. For those interested in the topic of museum collections, I would urge you to read "The Value of Museum Collections for Research and Society" by A. V. Suarez and N. D. Tsutsui in *BioScience* magazine (January 2004). Some of the examples in this article of how natural history collections are used will be a surprise.



Jeanie Hiltien

First steps in preparing specimens for the collection.



Jeanie Hiltien

Janet Ciegler identifying beetles.



Jeanie Hiltien

Curator Adrieen Mayor reaches for a box of specimens among the many to be processed.

Adrieen Mayor, Museum Curator
Great Smoky Mountains National Park
Adrieen_Mayor@nps.gov

Editors Note: Adrieen will offer a tour of the collection during the ATBI Annual Conference, December 7-10.

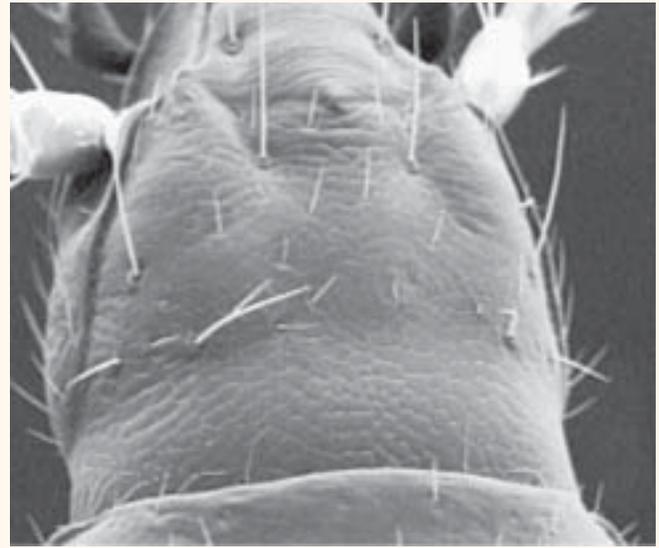
Litter Blitz 2004: New Discoveries from Thunderhead Mountain and Elsewhere

Alexey Tishechkin



Reproduced with permission from Sokolov et al., 2004

Scanning electron micrograph of *Anillinus* ground beetle, dorsal view.



Reproduced with permission from Sokolov et al., 2004

Detail of *Anillinus* head. Note complete absence of eyes.

One of the notable events during the Litter Blitz was a mini-expedition to Thunderhead Mountain. This is the highest mountain in the western half of the Park and apparently an area of at least some endemism for small invertebrates with limited dispersal capabilities. A carabid beetle, *Trechus tonitru* Barr, is known from nowhere else but the summit of Thunderhead Mountain. Collecting this species, only one of numerous *Trechus* species not collected recently during the ATBI, along with filling gaps in our coverage for the Park highlands, were the major reasons for a two-day hike and overnight stay at the Spence Field shelter.

The expedition was quite successful and the tough, five-mile hike back with a 60 pound-load of sifted litter paid off well. Numerous specimens of *Trechus* were collected and our suspicions that Thunderhead Mountain could harbor disjunct, yet undiscovered populations of other specialized soil and litter beetles turned out to be true (e.g., blind carabids of the genus *Anillinus*). Four samples were collected on the NC and TN sides of the summit of Thunderhead as follows: along the Appalachian Trail; half a mile east of it; and upper Jenkins Ridge Trail. They yielded among other beetles, three species of *Anillinus*, all of which may be new, even considering the recently described species by Sokolov et al. (2004)! Obviously, resolution of the diversity within this genus is far from being complete, even for apparently well-collected areas, as we thought the Smokies were by now. In

addition to these “Thunderhead” *Anillinus* species, a new species for the Park (possibly also undescribed) was discovered in leaf litter at the entrance to Gregory Cave in the Cades Cove area. Also, numerous specimens from multiple localities were collected to find another dubious *Anillinus* (either an undescribed species or a subspecies of the recently described *A. langdoni*), known previously only from three specimens.

The first results of processing and sorting other Litter Blitz 2004-collected beetles are also providing more exciting records. In the blind flightless leiodid beetle genus *Catopocerus*, only one of the five eastern species was originally known from the Park. Recent collecting and identification of some other ATBI material confirmed the previously suspected presence of another *Catopocerus* species and presence of a possibly undescribed species in the central highlands. We also strongly suspect discovery of undescribed species in another specialized forest litter beetle genus, the aleocharine staphylinid genus *Geostiba*. According to Gusarov’s (2002) revisionary paper, this genus includes numerous, narrowly localized, highland species in the southern Appalachians. Five of them are known from the Park, all in central and eastern parts of it (i.e., Clingman’s Dome, Mount LeConte, Snake Den Ridge and Balsam Mountain areas). Numerous specimens of *Geostiba* were collected in the western areas, at and around Thunderhead Mountain, and some other new localities. These and numerous other forest litter specimens are waiting for processing and identification, and new discoveries seem to be just around the corner for litter fauna students.

Alexey Tishechkin
Louisiana State University
atishe1@lsu.edu



ATBI's in Tennessee State Parks

LinnAnn Welch

For the past year, Tennessee State Parks have been making progress establishing an ATBI program statewide. Thanks to direction from Discover Life in America and the Great Smoky Mountains National Park staff, there are now more than 15 state parks at some level of ATBI development. In August, 70 people representing universities, parks, and other groups met at Montgomery Bell State Park for a conference to develop protocols for standardizing research at all 54 parks. However, in some instances, such as in small cedar glade parks and other unique sites, some modifications of the standard protocols will be necessary. A steering committee comprised of a dozen professors from several disciplines and a couple of park staff is reviewing protocol ideas for acceptance from all interested academics.

Tennessee Department of Environment and Conservation Deputy Commissioner Jim Fyke opened the conference with words of support from himself and other state park leaders. Other speakers included Discover Life in America staff, Jeanie Hilten and Chuck Cooper, Rickie White of NatureServe/Nature Conservancy, and Smoky Mountain biologists Becky Nichols and Chuck Parker. Claude Bailey of the Tennessee Division of Natural Heritage explained collecting permits required for study in parks and how their division inventories rare species.

Several parks have been working on preliminary studies and developing test plots to inventory plants. Montgomery Bell State Park and Henry Horton State Park have served as pilot parks where staff and central office biologists have been experimenting with plot sizes and GPS technology to see how it all fits together. Belmont University is involved with the Montgomery Bell studies and Page Middle School has inventoried trees in some plots at Henry Horton. Other parks, such as Pinson Mounds State Archaeological Area, have begun an ATBI with individual studies. At Pinson, Freed-Hardeman and Union Universities have been conducting bat and other mammal studies. Work is also beginning at Panther Creek, Edgar Evins, Big Cypress Tree, and numerous East Tennessee parks. Cleveland State is working with the eastern parks and Volunteer State Community College is working in Middle Tennessee State Parks. Tennessee Tech will be working at Edgar Evins and Burgess Falls State Natural Area. Austin Peay State University has provided much technical support and will be involved at parks such as Montgomery Bell or Dunbar Cave. Other colleges or universities supporting this project include Carson-Newman, UT Martin, Lincoln Memorial, University of the South at Sewanee, Walters State, Cumberland University, Vanderbilt, and many others. We welcome suggestions and participation from other ATBI scientists and resource managers.

LinnAnn Welch
Biologist, Tennessee State Parks
LinnAnnWelch@state.tn.us
www.state.tn.us/environment/parks



Panther Creek State Park on Cherokee Reservoir.

Tennessee State Parks



Henry Horton State Park.

Tennessee State Parks



Pinson Mounds State Archaeological Area.

Tennessee State Parks

Invitation to Attend the ATBI Annual Conference

December 7-10, 2004

Jeanie Hilten

We hope you will plan to attend the **Eighth All Taxa Biodiversity Inventory Conference** at the Glenstone Lodge in Gatlinburg, Tennessee with general sessions Wednesday, Dec. 8 - Friday, Dec. 10 (DLIA Board meeting Saturday, Dec. 11). This unique gathering of scientists, educators, Park staff, students, and volunteers will highlight the exciting projects of the ATBI in the past year. For more information, including a call for presentations and a current agenda, go to www.dlia.org.

We are most fortunate to have as our keynote speaker, oceanographer and explorer **Dr. Sylvia Earle** (<http://www.literati.net/Earle/index.htm>), who will speak on Friday, December 10. General sessions will cover new species discoveries in Great Smoky Mountains National Park, expansion of the inventory to other parks, DLIA grant reports, Bio-Quests and Trail Surveys, education and volunteer action, reports from on-going programs and future inventory plans.

On Tuesday, December 7 there will be two pre-conference workshops: a "Database/GIS" session in the morning and a "Collaboration Between ATBIs" meeting in the afternoon. The database class will be a practical, hands-on workshop covering database methods and various programs, using GPS in field work, and more topics to help researchers. For details, please contact Chuck Cooper, 865-436-4756 or Chuck@dlia.org. "Collaboration Between ATBIs" is a follow-up to last year's meeting and will cover ways parks and reserves can coordinate efforts for funding, taxonomy, and other matters. Contact Keith Langdon, 865-436-1705 or Keith_Langdon@nps.gov.

This will be the third year to showcase the photography and art of the ATBI through our "**Documenting Life**" exhibit. Images from the high resolution scanner, macro- and micro-photography, and artwork will be on display at the Glenstone from December 7-10. For more information, contact Rebecca Shiflett, rpshiflettphoto@usit.net.

Be ready to do your holiday shopping at the "**Bids for Biodiversity**" silent auction! There will be all sorts of great gift items and you'll feel good helping the ATBI through your purchase. We welcome donations of crafts, books, pictures, jewelry, and other nice things for the auction. To donate, please contact Anne Ramsden, 865-430-4756 or Anne@dlia.org

Jeanie Hilten
Discover Life in America
jeanie@dlia.org

ATBI/DLIA Annual Conference Keynote Speaker: Dr. Sylvia Earle

Marine biologist Sylvia Earle, "Explorer in Residence" at the National Geographic Society and a *Time* magazine "Hero for the Planet", is a pioneer in ocean



research methods and conservation efforts. A leader of more than 50 expeditions totaling more than 6,000 hours underwater, Dr. Earle pushed the limits of SCUBA diving and helped guide development of deep sea submersible crafts for scientific surveys.

Dr. Earle's passion for the ocean and its creatures began at an early age. "I was swept off my feet by a wave when I was three and have been in love with the sea ever since," Earle relates. "I was lured into the sea by the creatures who live there...strange and wonderful forms of life that occur only underwater. It was and is irresistible."

After obtaining her master's degree in botany from Duke University, Earle explored the Gulf of Mexico to study algae, a project she still follows, with more than 20,000 samples collected. Earle also received her doctorate from Duke, and then conducted research at the Radcliffe Institute, Farlow Herbarium at Harvard University, and the California Academy of Sciences. She became closely involved with the technology of undersea exploration and in 1970, she and four other oceanographers lived in an underwater chamber for 14 days (the Tektite II Project) to study ocean habitats. In the 1980's, Dr. Earle and engineer Graham Hawkes designed the submersible *Deep Rover*, which continues to explore depths to 3,000 feet. Earle works with international scientists on ways to send underwater crafts to 36,000 feet and beyond.

Today, Dr. Earle advocates for development of technology to aid marine research and for education about preservation of the fragile ecosystems of the world's oceans. She is the author of more than 125 scientific and popular publications, including the books *Wild Ocean*, *Sea Change*, *Dive*, and, for young people, *Hello, Fish*.

In 1957, Sylvia Earle lived in Great Smoky Mountains National Park—where the rocks tell a story of ancient oceans! Welcome back, Dr. Earle!

<http://www.literati.net/Earle/index.htm>

http://www.nationalgeographic.com/council/eir/bio_earle.html



Eighth All Taxa Biodiversity Inventory Annual Conference

December 7-10, 2004 The Glenstone Lodge—Gatlinburg, Tennessee

The National Park Service, Friends of the Smokies, Great Smoky Mountains Association, and Discover Life in America

TENTATIVE AGENDA (Please visit www.dlia.org)

Tuesday, December 7

8:00am—noon: Database/GIS Workshop
1:00pm—4:00pm: “Collaboration Between ATBIs” meeting

Wednesday, December 8

8:00am—9:00am: Continental Breakfast, Conference Registration and Check-In
9:00am—9:30am: Welcome from the DLIA Board and Great Smoky Mountains National Park
9:30am—10:30am: General Sessions
10:30am—10:45am: Break, Refreshments
10:45am—12:30pm: General Sessions
12:30pm—1:30pm: Lunch (on your own)
1:30pm—3:30pm: General Sessions
3:30 pm—4:30pm: Poster Sessions and refreshments

Thursday, December 9

8:00am—9:00:am Continental Breakfast
9:00am—10:30am: General Sessions
10:30am—10:45am: Break, Refreshments
10:45am—12:30pm: General Sessions
12:30pm—1:30pm: Lunch (on your own)
1:30pm—4:30pm: General Sessions
6:00pm—7:00pm: Social with hors d’oeuvres, “Bids for Biodiversity” Silent Auction
7:00pm Silent Auction Closes

Friday, December 10

General sessions
Keynote speaker Dr. Sylvia Earle
Luncheon

Saturday, December 11

9:00am—12:00pm: Discover Life in America Board Meeting at Sugarlands Training Room

REGISTRATION FORM:

Name: _____

Affiliation: _____

Address: _____

City: _____ State ____ Zip: _____

Phone: _____

E-Mail: _____

Workshop Registration (Dec. 7 - free of charge)

Database/GIS _____

Collaboration Between ATBI’s _____

Meeting Registration (Dec. 8 - 10)

\$50 (non-student) _____

\$25 (student) _____

Total Enclosed _____

Please write check and mail form to:

Discover Life in America

1314 Cherokee Orchard Rd.

Gatlinburg, TN 37738

Yes! I’d like to donate an item for the “Bids for Biodiversity” Silent Auction!

Contact Anne Ramsden, 865-430-4756 or anne@dlia.org

Item, description, suggested value:

A Note from the Park Superintendent

Dale Ditmanson



Long before I learned that I would be coming to the Smokies I was well aware of the All Taxa Biodiversity Inventory that is being undertaken here. The ATBI has captured the imagination of managers throughout the National Park Service and is being

watched with keen interest across the country.

Since arriving here about six months ago I have had the opportunity to meet a sizable number of the key participants in the ATBI and have been impressed by their vision and devotion to helping us learn more about what makes the complex ecosystems at the Smokies tick. In addition, I have spent as much time as possible out in the Park and have encountered a number of the scientists, along with the students and volunteers who provide the “eyes and legs” of the ATBI effort. In each chance encounter I have learned new and totally unexpected things about the Park and have found the enthusiasm of both teachers and students to be infectious.

So because of the ATBI, and for many other reasons, personal and professional, I look forward



to my years as part of the Park’s Management Team. I am looking forward with anticipation to the ATBI/DLIA December meeting as an opportunity to learn more about the ATBI’s findings as well as a chance to meet many more of those dedicated professionals, students, and volunteers who are making it happen.

Dale Ditmanson
Great Smoky Mountains National Park
Dale_Ditmanson@nps.gov



www.dlia.org



Girl with insect collection at the Leaf Litter Blitz.

Jeanie Hillen



Alexey Tishechkin sifting cave litter.

Jeanie Hillen



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