

ATBI QUARTERLY

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

"Sub-visible" Biodiversity in Great Smoky Mountains National Park

Seán O'Connell

The year 2002 was successful for the Microbe Hunters from Western Carolina University. Three undergraduates, one graduate student, and 65 students enrolled in my General Ecology and General Microbiology classes helped me begin to investigate bacteria and archaea in Great Smoky Mountains National Park. We have explored nine locations including forested ecosystems, streams, and a cave. Thus far we have described 28 bacterial species and seven archaeal species – all of which are new to the Park and many of which will prove to be new to science. We have isolated 200 bacteria which will soon be identified.

Bacteria are the dominant prokaryotes in most ecosystems, are easier to cultivate in the lab than archaea, and have been better described. We plan to establish a baseline for bacteria in the Park that includes biogeography, seasonality, and temporal parameters that control which species might be found at one time or location. Kristina Reid, an undergraduate, has led much of our bacterial work, and to date, she has gathered evidence from cultivated microorganisms suggesting that bacterial communities differ between an old growth forest (Albright Grove), a second growth forest affected by chestnut blight (Cataloochee), and a second growth forest that was logged (Purchase Knob). Soil chemistry, tree species distribution, and other factors support our findings. We plan to investigate archaeal communities and make other measurements from these locations soon.

Thirty-two microbiology students working with soil and water samples from the Deep Creek and Kephart Prong areas each cultivated and isolated a bacterial species last fall. In a very short time all of these students became amateur molecular biologists and generated DNA sequences that helped them to identify the species they had nurtured. Since prokaryotes are not identifiable using morphological features, modern techniques like DNA sequence analysis has

been used to revolutionize our understanding of prokaryotic diversity. We have learned that we know less than 1% of all microbial species in natural environments, but we have also learned of an entirely novel group of organisms, the archaea.

Two ongoing projects include bacteria from very different environments: a stream system and a cave. In the former, a graduate student, Henry Angelopoulos, has been examining the bacteria of Beech Flats Prong upstream and downstream from Route 441, which is supported by roadfill material from the Anakeesta geologic formation. This stream has been shown to be impacted by mineral leachate and acidic and toxic metal byproducts. Aquatic life such as plants, insects, and fish are affected, as are bacteria; however, they recover further downstream. Future applications of Henry's work include using microbial communities as monitoring agents in environmentally compromised locations. The other interesting location is Gregory Cave, near the entrance to Cades Cove. Kristina has been joined by another undergraduate, Kim Lowery, to investigate the bacterial populations in sediment and water from throughout the cave. We are discovering that bacterial distributions in the cave differ by location (e.g., near entrance versus back of cave, sediment versus water) and that microorganisms that colonize meat placed in the cave differ based on location. Kim's senior thesis project will unravel the latter story this spring.

The last news from the prokaryote front is the most fascinating; that of the discovery of unique archaeal species in GSMNP.



Scanning electron micrograph of a rumen microbial assemblage including the largest cell, a protist, with a fungal spore attached to it and dozens of bacteria affixed to its underside. The image is 40 microns in width and is representative of microbes associated with animal digestive tracts. It is used with permission by Mel Yokoyama and Mario A. Cobos.

We have known about archaea for a very short time – perhaps 25 years – yet they are very different from bacteria. DNA techniques have determined that archaea comprise the third Domain of life and subsequent work has proven that these single-celled organisms are unique. Archaea are thought of as extremophiles – organisms "loving" harsh conditions such as temperature or pH extremes, high salt concentrations, and places without oxygen. Thanks to much hard work by Gina Parise, an undergraduate, we have discovered archaea in an environment that no one else has thought to look before – winter soils in a high elevation forest. Her work has yielded seven unknown species. We are doing further work to describe these species and hope to be the first researchers in the world to get these never-before-cultivated organisms to grow. This new year leads off with much excitement and promise for the Microbe Hunters; we are glad to be a part of the ATBI and plan on participating in multi-taxa work in the near future.

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Note to our Readers:

The ATBI Quarterly is now available on-line and in color on our website, www.discoverlifeinamerica.org. If you no longer wish to receive the Quarterly in the mail, please contact Jeanie Hilten, jeanie@dlia.org or 865-430-4752.

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 money in printing and mailing.

If you wish to continue to receive the Quarterly by post, please consider sending a donation of \$10 to DLIA and mail to Emily Jones, c/o Friends of the Smokies, P.O. Box 5650, Sevierville, TN 37864-5650.

A Note from the Park's Acting Superintendent

Phil Francis

Back in the early days of the Park's ATBI, there was much debate and discussion among a relatively small group of people who strongly believed in the prospects of inventorying all forms of life in the Smokies. As anyone might imagine, each of us had an opinion as to how to proceed. Some decided to leave the project, while others were determined and optimistic about the chances of success. Others brought leadership to the group and raised hopes that one day we might have to employ the so called "stop rules", meaning that we had reached a successful end. Frank Harris brought leadership and optimism that enabled our group of dreamers to move forward. He gained the respect of his colleagues and we listened as Frank talked quietly about the possibilities. Soon he was elected to be Chair of the Discover Life in America non-profit organization that is our partner in making this project possible.

The ATBI has moved from concept to reality. Hundreds of new species and thousands of new Park records have been discovered. Fund-raising has been very difficult, yet DLIA has continued to move forward and make progress. Annual meetings of ATBI participants are occurring each year and science-based education is at an all-time high in the Smokies. Also, between \$45,000

and \$100,000 has been distributed annually to visiting scientists.

During all of this activity, Frank changed jobs, moving from the UT campus out to Oak Ridge where he served as the Associate Laboratory Director for Biological and Environmental Science for UT-Battelle, which is responsible for operating Oak Ridge National Laboratory. Despite the enormous challenges of his new job, Frank has spent a considerable amount of time ensuring that DLIA and the ATBI were succeeding. He did this because he truly cares about the project and about the Smokies. I know that Frank, time and again, reached into his own pocket to fund DLIA activities.

Frank, I want to thank you for your friendship and your dedication to the Park, and although you are stepping down as chairman, we all look forward to your continued involvement on the Board. Your work with DLIA and the ATBI has awakened some new possibilities and excitement in us. Thanks to your imagination and hard work, we may finally better understand biodiversity in the Smokies and how to ensure that it's always here.

Phil Francis, Acting Superintendent
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Development Corner

Emily Jones

Giving to Discover Life in America for the 1st quarter of 2003 was up 96% and I anticipate a great deal of growth in the 2nd Quarter as well. With this good news, I am sorry to have to say goodbye.

DLIA does not have resources for a second staff position for a full year, so I will be saying goodbye and thank you to everyone for the opportunity to work on this great project. My husband, Eric, and I have enjoyed meeting each and every one of you. There are so many special people working on the ATBI or in partnership with the National Park Service, who we will miss and will always consider Friends.

Because space is limited, it is impossible to name each one. But I would like to thank a few volunteers and staff who have made our experience so special. A special thanks to Frank Harris for his leadership and sup-

port, to Rebecca Shiflett for her enthusiasm and passion for the project, to Judy Dulin, Paul Super, Susan Sachs and Michelle Prysby for translating this great scientific exploration into programs that inspire the next generation, and to Bill Lucey for opening his heart and his business to protect biodiversity in GSMNP. I would also like to thank Jim and Ellie Burbank, Jim Lowe, and a special thanks to Judy Collins and Meryl Rose whose friendship is so appreciated. I could not leave without thanking Jeanie Hilten, Keith Langdon, Becky Nichols, and Phil Francis for teaching me so much, and a big warm hug to all the scientists of the ATBI. I wish the ATBI every success. I hope that DLIA will prosper and flourish and that the DLIA Board, along with the Park Service will find a way to develop significant resources for this work. Thanks for letting me be a small part of it.

The Scorpion and Pseudoscorpions of the Smokies

Edward C. Clebsch and James Cokendolpher

The arachnids consist of a dozen taxonomic groupings, or orders; two with many species worldwide (the mites and ticks with about 48,000 and the spiders with about 37,000), and ten others in which the number of species ranges from 20 to about 6,000. Worldwide, the scorpions number 1,279 species and the pseudoscorpions 3,239. To date, one scorpion and about 14 pseudoscorpion species are known from the Smokies.

How are these animals similar and different? The similarities, beyond those shared by all arachnids, lie in the segmented bodies, four pairs of legs, very large pincers (pedipalps), chewing mouthparts (chelicerae), simple eyes, and production of venom. They are orders of magnitude different in size! A giant pseudoscorpion might be 1 cm long, whereas our one scorpion is about 5 cm long, complete with segmented tail and stinger (both of which the pseudoscorpions lack). The venom delivery system is very different, being in the stinger at the end of the segmented tail in the scorpion, but at the end of one or both fingers of the pincers in most pseudoscorpions. Obviously, the prey items differ in size and other characteristics for the two groups of organisms. Pseudoscorpions use their venom to narcotize prey (springtails, mites, and any other small, soft-bodied creatures), after which they hold it in their pedipalps, and puncture and inject enzyme-laden saliva into it. A powerful sucking stomach ingests the liquefied body contents of their prey.

Where do scorpions and pseudoscorpions live? Our scorpion species seems to prefer the litter and rotting logs of warmer, drier habitats in the Smokies—south to west facing slopes at low to mid-elevations. Pseudoscorpions are most abundant in litter, numbering up to 500 per square meter in some localities. They occur at all elevations in the

Smokies, from grasslands in Cades Cove to spruce-fir forests on Clingmans Dome.

How do you capture these animals? For scorpions—by the tail. Quickly and carefully! When disturbed, they usually assume a defensive posture, with their tails curled up and the stinger at the ready. A quick grab with thumb and forefinger on either side of the tail and stinger and—*voila!* Now what???? Drop it to release it, or collect it with forceps or a stick and vial. To find pseudoscorpions, place leaf litter, rotting wood, or loose bark into a pan that has the bottom replaced with 1/4 to 1/2 inch mesh hardware cloth. Small organisms can then be sifted into a nested pan or onto a light colored surface. Pseudoscorpions typically assume a defensive posture and probably won't start their regal crawl for 10-15 minutes. Under a strong hand lens or dissecting microscope you can see that their bodies are studded with many long and delicate hairs that are sensitive to touch, even from the slightest air movement. Be patient. One might scuttle away, crawl-fish-style, or defensively snap its appendages so tight against its body that it resembles a speck of dirt or leaf.



The scorpion, *Vaejovis carolinianus*

James Cokendolpher



A pseudoscorpion, *Parachernes virginica*

James Cokendolpher

The search for pseudoscorpions in the Smokies is just beginning, and we're confident that this group will mirror others in the ATBI—many new park records and even species new to science. Join the hunt!

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Note: To conduct research in the Park, a collecting permit is required. Refer to the online application for your scientific collecting permit at <http://science.nature.nps.gov/research>.

DLIA Grant Program Awards \$50,000 to ATBI Researchers

Jeanie Hilten

Grant money supplied by the Friends of Great Smoky Mountains National Park and Great Smoky Mountains Association is supporting All Taxa Biodiversity Inventory research in the Park for the 2003 season. Dr. John Morse, Discover Life in America Board member and Science Committee Co-Chair, assisted by Tammy Morton, administered the ATBI grant program. The review panel included scientist members of the DLIA Board. Twenty-nine proposals were submitted for a total of \$114,027 requested for the \$50,000 budgeted for this year. The granted proposals' executive summaries soon will be on the Discover Life web site: www.discoverlifeinamerica.org

Fifteen proposals were funded for a total of \$49,934. The research will delve into a variety of life forms in the Park, from aphids to myxomycetes, and several studies include examining little known habitats and threatened plant communities. Again, some of the projects involve young people, volunteers, and teachers participating in scientific research. Many proposals build upon previous and on-going work, and all are coordinated with the Discover Life in America Science Plan.

Grant recipients will present written and oral reports of results to date at the December 3-5, 2003 annual meeting of the ATBI, with final reports by 1 May 2004. Also, information will be submitted to the new ATBI website database.

DLIA hopes to obtain additional sources of financial support in order to encourage the tremendous amount of research needed to complete the ATBI. Individuals and organizations interested in assisting with the funding of future ATBI research please contact Emily Jones at Friends of Great Smoky Mountains National Park, 865-453-2428.

Congratulations to these scientists for their selection:

- Richard Baird, Mississippi State University: Microfungi of the American Beech and Fraser Fir Forests in GSMNP
Paul Bartels, Warren Wilson College: Tardigrade Inventory, 2003-2004
Charles Bartlett, University of Delaware: Planthopper and Leafhopper Diversity of GSMNP
Victoria Bayless, Louisiana State University: Beetle Blitz, 2003—Intensive Sampling and Identification of Coleoptera in GSMNP
Christopher Carlton, Louisiana State University: The Beetle TWIG Year 3: Identifying the Catch
Edward DeWalt, Illinois Natural History Survey: Summer Adult EPT Assemblage of Southwestern GSMNP Drainages
Colin Favret, David J. Voegtlin, and Loy R. Phillippe, Illinois Natural History Survey: Survey of the Aphids of Great Smoky Mountains National Park
Mary Ann Feist, Loy R. Phillippe, and Dan Busemeyer, Illinois Natural History Survey: Searching for New Park Records of Vascular Plants and Lichens in GSMNP
Sean O'Connell, Western Carolina University: Bacterial Bio-Blitz in Twelve ATBI Plots, GSMNP
Michelle Prysby, Great Smoky Mountains Institute at Tremont: ATBI Teacher Assistant for Citizen Science

- Michael Pogue, Smithsonian Institution: Noctuidae of Great Smoky Mountains National Park
Gary Steck and Bruce Sutton, Florida Dept. of Agriculture and Consumer Services: Tephritid Flies of Great Smoky Mountains National Park
Steven Stephenson, Fairmont State College: Biodiversity Studies of Myxomycetes
Tor Tønsberg, University of Bergen, Norway: Discovery of Lichens in Great Smoky Mountains National Park
Mark Wetzel, Illinois Natural History Survey: Continuing Inventory of Freshwater Oligochaeta at Selected Sites in GSMNP



Nancy Lowe's
Illustration

Beetle Blitz 2003 Victoria Bayless

With the assistance of Discover Life in America, the National Park Service, and Coleoptera TWIG leader Dr. Chris Carlton, the beetle collecting event of the year - "Beetle Blitz 2003" - will be held at the Park July 17-20. This event will involve organized collecting on both the North Carolina and Tennessee sides of the Park. The Blitz is just one of the many bioquests coordinated with Discover Life in America and the National Park Service and Taxonomic Working Group (TWIG) leaders. The mission of these bioquests is to gather specialists together, collect as many species and/or records as possible in a short time, identify as much as possible as rapidly as possible (including "on-site" sorting) with the assistance of local volunteers, and share this information with fellow researchers and the public. This year's Beetle Blitz will focus on taxonomic groups that have been inadequately investigated (i.e., incompletely represented on our list). We will be light trapping, sifting litter, and conducting other more individualized collecting techniques for some of the target groups to complement the Park's Malaise and pitfall sampling. Some of the groups we need work on are listed below, but specialists of all groups are welcome.

Staphylinidae
Scydmaenidae
Ptiliidae
Hydrophilidae

See the current list at <http://www.agctr.lsu.edu/arthropodmuseum/smokieschecklist.htm>

The benefits of attending the Blitz include camaraderie with other coleopterists, fun, free lodging/camping facilities, and last but not least, assisting in an important event in the quest of documenting the varied life forms of one of our most biodiverse parks in the U.S. If you are interested in participating in this year's Blitz and want more information, please contact: Victoria Bayless <vmosele@lsu.edu> (225) 578-1838 or Chris Carlton <ccarl@lsu.edu> (225) 578-0425.

Victoria Moseley Bayless
Curator, Louisiana State Arthropod Museum

Can a Small Lady Beetle Save the Majestic Hemlock?

Paris Lambdin and Jerome Grant

Eastern hemlock is an important component of the forests in Great Smoky Mountains National Park, providing not only a variety of unique habitats, but contributing to the beauty and aesthetics of the region. Approximately 3,820 acres of eastern hemlock within the Park are now being threatened by the hemlock woolly adelgid, *Adelges tsugae*, an invasive exotic pest accidentally introduced from China. Since its discovery in 1985 in Connecticut, this insect pest has greatly impacted eastern hemlocks in at least 12 eastern states from Tennessee to southern New England damaging up to 80% of the hemlock stands in infested areas. The prolific females protect their eggs in a distinctive cottony egg sac and have two generations per year. Feeding damage in the form of sap extraction results in needles becoming chlorotic and dropping prematurely, limb die-back, and eventually death of the tree. The loss of this native tree would have devastating aesthetic and environmental ramifications to the region.

Although no native natural enemies of the hemlock woolly adelgid are known in our forests, mass releases and establishment of an exotic lady beetle, *Pseudoscymnus tsugae*, may provide the answer for regulating populations of this pest. This lady beetle greatly impacts the hemlock woolly adelgid in its native country; thus, researchers suggest releasing these natural enemies before pest numbers increase to damaging levels. Because these lady beetles feed specifically on this adelgid, they do not pose a danger to any native species within the region. Great Smoky Mountains National Park, Discover Life in America, and the University of Tennessee initiated two research projects in 2002 to assess the survival and impact of lady beetles released to control populations of the adelgid, and to evaluate the diversity of insect species associated with eastern hemlock in non-infested areas.

During the summer of 2002, mass releases of this lady beetle (ca. 27,118) were conducted at nine infested sites by the National Park Service and U.S. Forest Service. A survey for the lady beetle was initiated in the fall to begin assessing the establishment of this biological control agent. The trees onto which the releases were made as

well as four trees in each of the four cardinal directions radiating out from the release tree were evaluated monthly using beat sheets. We found the adult beetles on the release tree at four of the nine release sites. While promising, more long-term evaluations will be necessary.

Base-line data on insect diversity at four sites within eastern hemlock dominated habitats will allow future researchers to fully assess the impact of this exotic adelgid on the native insect fauna. In 2002, we identified 203 species representing 46 families in nine insect orders. Species range from those that depend upon hemlock as a primary feeding source to those that are transients in the area. Various feeding guilds, including scavengers, foliage feeders, predators, and parasitoids, are represented. In addition to the commonly observed species such as the hemlock looper and the hemlock scale, several uncommon species were observed. For example, the predator beetle, *Sphaeroderus stenostomus*, that feeds on snails on the cool moist forest floor underneath hemlocks, a lady beetle, *Psyllobora vigintimaculata*, that feeds on mold that aggregates on hemlock branches, and the rarely observed beetle, *Necrophilus pettiti*, found in decaying organic matter represent the diversity of the species associated with eastern hemlock.

Can this small lady beetle save the majestic hemlock? It is certainly too early to tell, as biological control agents generally require several years before significant pest reductions are noticeable. Unfortunately, several new infestations of hemlock woolly adelgid have recently been discovered, but additional releases of the lady beetles are scheduled for 2003. Given the limited alternative management strategies, the lives of many hemlocks and the health of our forests depends to a large degree on a small, introduced lady beetle. Who knows, maybe future generations will be able to continue to enjoy the majestic hemlock.

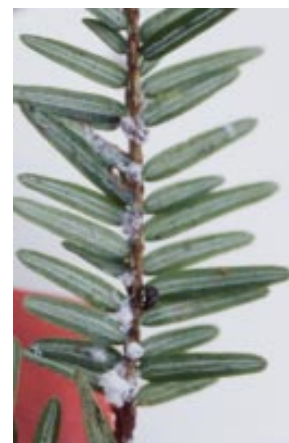
We wish to thank DLIA and the National Park Service for their support and assistance in these projects. This project could not have been successfully conducted without the technical assistance and support of Dave Paulsen and Lee Buck (Department of Entomology & Plant Pathology, Univ. of Tennessee).



Lady beetle, *Pseudoscymnus tsugae*, released to control the hemlock woolly adelgid. Photo by Jeff Guenther



Beating branches: Dave Paulsen and Lee Buck observing insects collected on beat sheets.



Hemlock woolly adelgid on terminal branches of eastern hemlock.

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Susan Sachs

Two students from Cherokee High School use aspirators to collect small snail specimens.

Snail Searches: How Students Contribute to the ATBI

Susan Sachs

At the Appalachian Highlands Science Learning Center at Purchase Knob, Science Coordinator Paul Super and I have the task of figuring out how best to integrate scientific research and education. Along with Michelle Prysby at the Great Smoky Mountains Institute at Tremont, we work to mesh the needs of both the scientific and educational communities. One notable case study is the involvement of students in the snail inventory because of the many levels of involvement it affords. Last year in North Carolina, student groups were responsible for collecting 66 snails representing 14 genera. Dr. Dan Dourson identified two new state and Park records and is investigating 31 possible new county records.

6th Grade Field Trip Unit

Snails make excellent tools for studying soil ecology. In 2002, thanks to the efforts of Friends of Great Smoky Mountains National Park, we received a \$7,500 grant for the Learning Center to create a 6th grade field trip unit. The North Carolina Curriculum Standards require 6th graders to study soils and food chains. Our new field trip has students using leaf litter sifters and aspirators to examine the soil organisms. In particular, students are instructed to carefully examine the duff for snails, especially the smaller snails that often escape the eyes of those of us with challenged vision. While telling the story of snails, we also are able to cover the critical issue of air pollution and how acid deposition causes calcium to leech from the soil, which in turn may be affecting snail populations with a ripple effect throughout the food chain.

Trailside Inventories with Various Groups

Snail inventories make great projects for people looking to contribute a couple of hours to the ATBI. We get calls from a variety of groups with limited time in the Park, ranging from summer camps to college classes. Trailside inventories offer an exceptional

way to meet their needs without requiring a specialized skill base. Snail searches nearly always result in finding at least a few specimens, even in the winter months, and information gathered from the work of these groups allows us to assemble valuable information about the distribution of snail species.

Upward Bound Math and Science

Snails lend themselves to more complex research projects as well. In the summer of 2002, one of the groups from Upward Bound Math and Science sponsored by Western Carolina University focused their six-week research project on snail populations at various elevations in the Smokies. They were examining the assertion that snail populations at higher elevations are less diverse than those at lower elevations. Their fieldwork showed that the least diverse of their five sites was at Purchase Knob and the most diverse was at Newfound Gap, a site higher in elevation. They felt their work was inconclusive and encouraged more research in this area.

Cherokee High School Partnership

Snails have provided opportunities for winter education - a difficult time of year to keep students involved in the ATBI. One of the groups that has worked the most intensively with snails is the Forestry class at Cherokee High School on the Qualla Boundary. We met weekly during the winter, and when the conditions were not conducive to outdoor research, snails provided productive investigations. Last winter, the students assisted in developing the beginnings of an interactive key and developed their own set of logical sorting criteria. The end product of this project will be a field guide to the most common species of snails in our area of the Park.

Haywood Community College

The snail inventory is also providing an avenue to teach GIS mapping. The GIS class at Haywood Community College is creating distribution maps of the snails found in North Carolina, as well as assisting in other Park projects this spring. It is a valuable skill for the students to input and manipulate GIS data and will allow us to offer a new angle of involvement as subsequent groups assist us in ground truthing the maps generated.

We did not anticipate the diverse educational applications of looking at snails. Certainly there are other taxa in the Park with equal or greater potential. If you are a researcher who thinks your area of study may provide such educational opportunities please contact Susan Sachs or Paul Super at Purchase Knob (828) 926-6251 or Michelle Prysby at Tremont (865) 448-9250.

Susan Sachs, Education Coordinator
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Volunteers Needed to Scan ATBI Images

If you have an interest in scanning specimens on DLIA's high resolution scanner, please contact Jeanie Hilten or Keith Langdon. We need people who are familiar with computers, the process of scanning, and can also handle and prepare delicate plants and small arthropods. These detailed images are extremely important for conveying the beauty of what we are finding as well as showing distinctive properties for identification. Large prints of the organisms can be made, as was done for the December, 2002 Annual Conference. More exhibits are planned at galleries and libraries. We will also put scans on the website and in the Quarterly newsletter. Scientists who have extra specimens for scanning should send them to Keith Langdon at Twin Creeks, 1314 Cherokee Orchard Rd., Gatlinburg, TN 37738.

What is your favorite ATBI critter?



We'd like to know your votes for some of the most unique "charismatic micro-fauna" that have been discovered as new Park records or species new to science. What organisms do you think are most intriguing? Which are most beautiful? Who is the "yuckiest"? In order to convey the fascination of the All Taxa Biodiversity Inventory to Park visitors, it is important to dramatically show images of the life forms—many of which are small and inconspicuous—and to tell their stories in a compelling way. Great Smoky Mountains Association is working with the Education Committee of DLIA to develop possible products—such as "water bear" plush toys—to sell in Visitor Centers. They would have a tag or wrapper that would give fun facts about the critter and also more about the ATBI project.

So, send us your candidates for weirdest, cutest, slimiest, fiercest organisms. Their images might wind up on a "Discovered in the Smokes" poster, or become part of a science kit or toy.

New web and database host for DLIA and ATBI

The Southern Appalachian Information Node (SAIN), a part of the National Biological Information Infrastructure (NBII) is the new host for Discover Life in America's website (www.discoverlifeinamerica.org) as well as for the All Taxa Biodiversity Inventory database. NBII is congressionally mandated to disseminate information about natural resources to the public and to scientists. DLIA, Park, and SAIN staff are working together on the website in order to integrate many components: species pages, database lists with georeferenced data, maps, information about all the Partners involved, education pages with curricula, and ways to "Join the Adventure" through donations, research, or volunteering. Many thanks to Norm Johnson and Luciana Musetti of Ohio State University for establishing the framework of the website!

TAXON	Species New to Science	Species New to Park
Archaea	7	0
Bacteria	13	22
Protozoans	0	10
Microsporidia	1	4
Slime molds	14	110
Algae	42	329
Plants	0	13
Fungi	3	49
Lichens	8	69
Nematomorpha (hair worms)	1	4
Nematodes (round worms)	1	2
Tardigrades (water bears)	3	39
Arachnids (spiders, mites, ticks)	39	482
Crustaceans (copepods, crayfish, etc)	25	6
Millipedes	1	2
Paupods	8	40
Symphylans	3	1
Collembola (springtails)	36	92
Protura	4	3
Diplura	0	1
Microcoryphia	1	1
Ephemeroptera (mayflies)	4	0
Odonata (dragonflies, damselflies)	0	19
Blattodea (cockroaches)	0	1
Plecoptera (stoneflies)	3	4
Homoptera (hoppers)	0	32
Coleoptera (beetles)	12	400
Neuroptera, Megaloptera (fishflies, lacewings, etc.)	0	12
Hymenoptera (bees, wasps, ants)	20	60
Mecoptera (scorpionflies)	1	1
Siphonaptera (fleas)	1	0
Diptera (flies)	50	152
Trichoptera (caddisflies)	10	62
Lepidoptera (moths, butterflies, skippers)	61	659
Molluscs	3	22
Annelids (segmented worms)	4	34
Vertebrates	0	3
TOTALS	379	2740

Becky Nichols, Park Entomologist

Calendar of Events

The 2003 season is full of interesting new projects, special events, and on-going ATBI research. To participate, contact the persons listed with the activities below. Also note that there are quite a few scientists who have particular requests. For more detailed information about studies underway and about DLIA's different volunteer "project teams", contact Jeanie Hilten, 865-430-4752 or jeanie@dlia.org. To assist with community outreach, fundraising, and development please contact Emily Jones, 865-453-2428 or fotsej@bellsouth.net.

Please note there have been some changes since the last calendar.

Saturday, May 31, 9:00am-4:00pm: Fern Foray. This trail survey will be in the Greenbrier area. Contact Dr. Patricia Cox, University of Tennessee, pcox@utk.edu

Saturday, June 14, 10:00am-4:00pm: Smoky Mountain Field School, "Wondrous Diversity—Surveying Life in GSMNP." Indoor and field sessions led by Jeanie Hilten and DLIA volunteers. Meet Sugarlands Training Room. To register call 865-974-0150.

Sunday June 15 - Friday June 20, Tennessee Geographic Alliance "Toolkit of Skills" Teacher Workshop. Great Smoky Mountains Institute at Tremont. Contact Kurt Butefish, University of Tennessee, or Michelle Prysby, GSMIT, michelle@gsmmit.org

Saturday, June 21, 9:00am-4:00pm: Fern Foray. This trail survey will be on the north shore of Fontana Lake ("Road to Nowhere"). Contact Dr. Patricia Cox, University of Tennessee, pcox@utk.edu

Saturday, July 12, 9:00am-4:00pm: Fern Foray. This trail survey will be at Purchase Knob (Appalachian Highlands Science Learning Center). Contact Dr. Patricia Cox, University of Tennessee, pcox@utk.edu

Thursday, July 17 - Sunday morning July 20: Beetle Blitz. Coleopterists from around the nation will participate, with the help of trained volunteers, teachers, and students. (Contact Jeanie). Interested scientists contact Victoria M. Bayless of the Louisiana State Arthropod Museum at 225-578-1838 or vmoese@lsu.edu

Thursday, July 31 - Sunday morning August 3: High Country Quest. We are interested in surveying for a variety of taxa, including slime molds, snails, flies, soil and aquatic insects, and a **Fern Foray**. We will concentrate on upper elevation ecosystems such as beech gaps, balds, and spruce-fir forests. Volunteers, especially those who can hike to the high country and stay overnight, contact Jeanie. Interested scientists please contact Tom Rogers, trogers@rollinscorp.com

Friday, September 12 - Sunday, September 14: Citizen Science for Teachers. Great Smoky Mountains Institute at Tremont. Contact Michelle Prysby, michelle@gsmmit.org

Monday December 1 - Saturday December 6, 2003: 7th ATBI Conference and associated meetings. Gatlinburg, TN. Contact Jeanie Hilten or Emily Jones to assist with the planning committee. We hope to organize meetings at the beginning of the week for parks and preserves inter-

Discover Life in America "Wish List"

Have something that we could use? Contact Jeanie Hilten about donating any of the following items:

- Medium size freezer and a small refrigerator for storing insects and other specimens
- Card tables for extra work surfaces at the ATBI houses
- File cabinet
- Laser jet printer for making labels
- White plastic pans for sorting insects
- Field guides to insects, spiders, etc.
- Hand lenses
- Any field equipment: sweep nets, beat sheets, forceps, etc..
- Powerpoint-type projector
- Whatever else might come in handy!



Correction to photograph which appeared in our winter newsletter on page 6. There was an error in the identification.

The scanned image we labeled as an owlfly is an antlion, in the family Myrmeleontidae. It is *Dendroleon obsoletus* (Say). According to Ollie Flint, they aren't really abundant, but are fairly ubiquitous and have a different life habit from most other antlions. They live in tree holes and rock faces.

Photo Gallery



Jeanie Hilten

Jim Lowe attended Volunteer I training class



Susan Sochs

Cherokee High School students conducting snail research



Jeanie Hilten

Steve Higdon collected algae