



Back in Style

Brood Five Cicadas Come Alive with a Life-cycle Both Patient and Cynical

by David Heithaus



There are some pretty impressive numbers out there in the organismal hall of fame. Some can eat as much as 8,000 pounds per day while others go years without a bite. Some have life cycles that last less than a day while some stretch out 100 million years. The laziest can sleep over 20 hours per day while the spry indulge in barely 2. Among these numbers, two in particular made their mark on Gambier in June with the arrival of our very own brood of 17-year cicadas.

These insects boast two impressive statistics: one of the longest periods of synchronous development and one of nature's largest sets of mass emergence. Of these stats most folks appreciate one quite a bit more than the other. Guess which is which.

For those who missed out on the emergence this year, allow me to paint a picture of the little beasts that so graced us with their songs and innumerable discarded exoskeletons. There are three species of 17-year and four species of 13-year periodical cicadas. All belong to the genus *Magicicada* and while they have their differences they are largely similar in appearance. Adults range in size from 1 to 1.5 inches and feature black bodies, orange-red eyes and clear, red veined

wings. They differ in both size and appearance from annual "dog day" cicadas which tend to be larger and some shade of green.

Fun Fact: Cicada or Locust? Contrary to popular parlance, cicadas are not locusts. Cicadas of all stripes belong to the order Hemiptera whereas locusts are related to grasshoppers in the order Orthoptera.

On Brooding

So there's a lot of talk about broods/brooding and no it's not alluding to what teenagers do after a breakup. A brood refers to a group of cicadas that emerge at the same time in a given region. Broods V and VIII both grace OH at different times.

In the late 1800's numbers were assigned to 17 distinct broods with a 17-year cycle and 13 different broods with a 13-year life cycle. Several broods are known to have gone extinct and... to be honest... the whole thing seems pretty convenient and was never really adequately documented. Today we are perfectly happy with 15 broods: 12 17-year broods and 3 13-year broods.

Cicada nymphs (young) develop at a pon-

derous rate amongst the roots of the trees on which they began their life as eggs. They feed on the trees' xylem fluids to acquire energy for progressing through five discrete developmental stages, or instars. Following the amount of time it takes an infant to become a sul- len, jaded high school senior, the nymphs dig their way to the surface for the insect equivalent of a party at Caligula's. Above ground, the cicadas are all about shedding their coverings, eating, singing and... uh... mating.

Fun Fact: Cicada nymphs begin their journey to the surface when soil temperatures reach a steady 64 degrees Fahrenheit at a depth of around 8 inches. That's why they emerge earlier in their southern range.

Almost immediately after emerging, the nymphs migrate to nearby vegetation to begin the process of molting; their final transformation into adulthood and the source of pile upon pile of exuvia (shed exoskeletons) at the base of all those maple trees on campus.

Fun Fact: Ever look inside one of those cicada husks? The little white filaments are actually the animal's lungs! Cicadas and other arthropods can't breath until their new bodies harden up.

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A Kokosing Farewell... And Hello.

by Heather Doherty



Heather Doherty left her position as director at the BFEC in April to take a position with the Ohio Department of Natural Resources Scenic River program.

I grew up swimming in a small lake in central Michigan. There are embarrassing photos of my twin sister and me hysterically splashing each other, in the buff, at the age of 18 months. The smell of sand and leaves and dark, living water seems like something I have always known.

In middle and high school we lived next to a tributary of the Little Miami Scenic River in southwestern Ohio, shrieking when the melon-sized bull frogs we snuck up on finally jumped away, and tracing fossils of small creatures in the limestone bedrock slabs that bordered the water.

After college I lived in Utah, a place that might seem devoid of water, but I found its singular force, the Colorado River, and researched its many endangered fish species imperiled by dams. I investigated sewage pollution in creeks of mountainous North Carolina, and worked with a small community group and local governments to write a management plan for the urbanized Alum Creek watershed in Columbus.

I count myself incredibly fortunate for the ten years that followed employed at the Brown Family Environmental Center

(BFEC). In Knox County's rolling hills, our family found a warm community and beguiling nature. I was always impressed with the sense of pride that Knox County residents took in their corner of the world, for its natural beauty, and of course, the State Scenic Kokosing River that threads through it.

I was tasked with taking visitors and school groups to the river to explore for bottom-dwelling insects and bugs, the rare, colorful fish hiding in its riffles, bald eagles and mink. Though the job had its moments of stress, I never lost sight of what felt like amazing luck that I should earn a living taking people outside to learn and play in the river and beyond on the BFEC preserve. I am fortunate to have learned so much, including how to use my passion to get people excited about nature. At my going away party, I proclaimed that it was the best job I would ever leave.

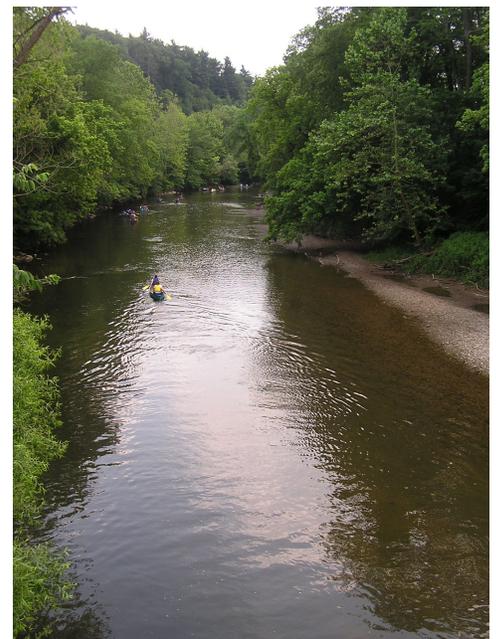
But I moved to Columbus in 2013 and felt the urge to not make the daily 100 mile round trip to the BFEC. An opportunity popped up to continue to follow water at the Ohio Department of Natural Resources in their Scenic River program, but not just any water – the State Scenic Kokosing River! As the central Ohio

manager of the scenic river program, I now keep watch on the four designated scenic rivers – the Big and Little Darby Creeks and the Olentangy, Kokosing, and Mohican Rivers. But for the record, the Kokosing will always be my home river, where I floated in the current for weightless relief during pregnancy and then took my small children to play.

While at the BFEC, I was quite proud to point out that the Kokosing was a scenic river, something special. With the oldest Scenic River program in the country, Ohio has designated just 14 scenic rivers since its inception in 1968.

The intent of the program is to protect the natural qualities of Ohio's finest streams for the benefit of wildlife and for surrounding communities. The rivers that have earned the designation have retained much of their original, natural character, including a forested corridor along the river's banks (or riparian zone) and minimal man-made alterations like dams and bridge crossings. When these conditions are present, it often leads to outstanding variety of wildlife in and next to the river, another key characteristic. Since scenic river designation is a cooperative venture, it also depends on support from local landowners, citizens and governments.

Scenic river staff work to protect these extraordinary rivers in a number of ways. Since forested riparian zones are so essential to maintaining river health, ODNR has acquired land and conservation easements along rivers. The terms of conservation easements can vary, but



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they typically signify that an existing land owner has agreed to maintain natural features (such as forest). The scenic river program manages 185 acres in conservation easements along the Kokosing River. On property here and along other scenic rivers, we pursue restoration projects, tree plantings and removal of invasive species. Scenic river staff also offer technical assistance to private land owners to enhance riparian areas or address erosion issues.



The scenic river program engages local citizens in learning about their scenic rivers through the Stream Quality Monitoring Project, or SQM. Volunteers sign up to visit a specific spot three times every season to sample its aquatic life as a gauge of the river's general health. Specifically, volunteers learn how to survey the macroinvertebrates, or insects and bugs, that live in the river bottom and form the base of the ecosystem's food web. More than 800 volunteers participate each year at more than 150 monitoring stations across the state, providing data that indicate trends and are used to spot pollution problems. Anyone interested in becoming a SQM volunteer in Central Ohio can contact Tiffany Taylor, central Ohio SQM coordinator, at tiffany.taylor@dnr.state.oh.us or (740) 513-0455.

In addition to the SQM Project, scenic river staff work to help residents learn about their river and how to care for it through educational programs, canoe floats and special events. ODNR also maintains excellent resources for boat access and amenities, including a state-wide interactive map, at paddle.ohiodnr.gov.

The Mohican and Kokosing Rivers are in the unusual position of having been designated as state scenic rivers *and* state water trails. Water trails are created by ODNR and local partners to establish river access points, identify hazards and to publish detailed maps. The Knox County Park District is an excellent local partner of the Kokosing and Mohican Water Trails. Ask the park district or the BFEC for hard copies of water trail maps, or visit paddle.ohiodnr.gov. Even if you don't intend to get out in a kayak or canoe, these are great spots to fish or simply cool off with a picnic and enjoy the scenery.

Having the opportunity to continue to work on and for the Kokosing River, plus give others the chance to experience its wonders, gives me great joy. One of those opportunities is coming up this fall - mark your calendars for the Kokosing River Rally on Saturday, September 17th. The Knox County Park District, City of Mount Vernon, Knox County Recycling & Litter Prevention, BFEC and ODNR will host festivities and a cleanup by foot and boat. See you on the water in September, if not sooner!

Contact Heather Doherty with scenic river questions at heather.doherty@dnr.state.oh.us.

The Eastern Bluebird

by Shane McGuire

If you ever find yourself walking along the trails at the Brown Family Environmental Center there is a good chance you might cross paths with the Eastern Bluebird. Bluebirds are one of Ohio's most beautiful birds and they are very easy to identify. Males have deep blue colored feathers on their head, wings, tail, and back. The feathers on their chests have a rusty brown coloration. Females look similar, but they have a more gray and they are not as colorful. Bluebirds are interesting because they are a secondary cavity nester, which means that they create their nest in cavities of trees but are not strong enough to peck their own holes so they are dependent on woodpeckers and other cavity creators for their nest sites.



Most people do not realize that the bluebird was on the verge of extinction and is one of conservation's true comeback stories. Between 1920 and 1970 there was a major drop in the bluebird population. They went from being as common as the robin to being so rare that birders thought the species would soon be extinct. Several factors played a role in the decline of bluebird populations: habitat loss and pesticide use which took away their food and the removal of dead trees which limited nesting sites. While these had a serious impact, even worse was the introduction of the House Sparrow and the European Starling. These two species are also cavity nesters and are both extremely competitive and aggressive taking over bluebird nests and killing adult bluebirds in their wake. With fewer places to nest one can imagine how populations could quickly drop.

In 1978 the North American Bluebird Society (NABS) was formed by birders concerned about the drastic decline. They built nesting boxes and installed them along trails in suitable habitat. They monitored these boxes and kept House Sparrows and starlings out so bluebirds could safely nest and raise their young. Data was recorded in order to track how many young were fledging. Once they saw they were having success, they educated the public and trained volunteers to create their own bluebird monitoring trails. The results were absolutely amazing and in a very short time the bluebird population rebounded and stabilized. Here, at the Brown Family Environmental Center, we have two bluebird trails that volunteers check several times per week. They do a great job making sure our bluebird population stays strong and healthy. If you do happen to find yourself walking our trails and see a bluebird, take the time to appreciate it and remember how they are a true comeback story.

Students Driving Sustainability

by Dani Huffman '19



Over the past year, Kenyon's Office of Green Initiatives (OGI) has led a number of successful sustainability efforts across campus and continues to change the attitudes of students and community members toward protecting our shared environment. The office is directed by Dave Heithaus and currently employs two student interns, Laura Langner '16 and Dani Huffman '19.

Recycling Done Right

The first project taken on by the OGI during the 2015-2016 academic year was a recycling inventory in the fall of 2015. The inventory entailed surveying the status and number of recycling bins across campus. While recycling had a presence at Kenyon during this time, the program lacked in the number of recycling bins on campus and in consistency between buildings. The end goal of this project was to see where recycling bins were needed and to then decide what would be the best allocation of our money in order to improve the program. One significant change in Kenyon's recycling program, that has already been implemented, is the addition of recycling bins for every room in the freshman dorms. Our goal is to ensure that anywhere waste is collected, campus can also recycle!

Going Neutral

The OGI then set its sights on getting President Decatur to sign Second Na-

ture's Carbon Commitment early in the spring semester. Students Matt Meyers '17 and Sarah Oleisky '16 helped fuel this event by presenting their case to the Board of Trustees in the spring of 2015. Their presentation recommended that Kenyon make a formal commitment to reduce its carbon footprint to zero and become an institutional climate action leader. Such a commitment can be accomplished through sustainable investments in energy and building practices, local carbon offsets and other carbon reduction practices such as carbon sequestration through sound land and timber management (at the BFEC!). In February of 2016, President Decatur signed Second Nature's Climate Leadership Statement, codifying that Kenyon will take a carbon emissions inventory and create a long-term carbon neutrality plan.

Living It

Along with the pledge to become carbon neutral, the OGI rolled out the Green Rooms and Green Lifestyles Certification Program for Kenyon students, faculty, and staff. Students had the opportunity to become "Green Room Certified" by filling out an online checklist of Green Objectives that they complete in their everyday lives on campus. Faculty and Staff had the similar opportunity to become "Green Lifestyle Certified" for the green actions they take in their offices and at home. The purpose of this project

was to get members of the Kenyon community to take ownership of their individual carbon footprints and recognize that simple everyday actions have a real impact on the world around us.

Next Steps

This summer the Office of Green Initiatives plans to take inventory of the college's carbon emissions over the past ten to fifteen years in order to start working on the college's carbon neutrality plan. This work will be done by interns Laura Langner '16 and Dani Huffman '19, who will be joined by Matt Meyers '17. Data will be compiled in many sectors of the college's operations, ranging from miles traveled by students who study abroad and fuel burned during athletic travel, to electricity purchased each month and solid waste produced each year. This research will provide a holistic view of how college operations are leaving a large carbon footprint, and help shape the strategy and timeline for reducing Kenyon's carbon footprint to zero; truly an audacious project.



Editor's Note: This article has been included in the summer newsletter not only to showcase the hard work and success of our students in driving sustainability at Kenyon but to stress how important the BFEC and other college green spaces are to the institution's overall commitment to being leaders in the face of climate change. While we work to reduce, develop responsibly and offset carbon on campus, the natural systems of the BFEC are quietly and efficiently doing their part to put carbon back to where it belongs.



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Once free from their kiddie clothes, the cicadas are soft and white (and delicious*) but their bodies quickly harden up and take on the familiar black shine.

Dressed to thrill, the male cicadas begin their chorus in the time-honored tradition of making noise until someone (something) is willing to mate with you in order to shut you up.

** Fun Fact: Mmm... good cicada.*

People around the world are bonkers for the delectable flavor of the cicada.

When you have to wait 13 to 17 years between servings, you better savor every bite. Cicadas are often compared to shellfish - I'm thinking paella!



A tender and delicious cicada emerges from it's nymph exoskeleton and into loud yet short-lived adulthood.

The song of the Cicada:

Cicadas are perhaps best known, positively or negatively, for their song. Each of the three species has a unique tune.

Perhaps the most obvious is that of *Magicicada septendecim* with their familiar "weeeee-whoaaa, wheee-whoaaa" or "Pharoh, Pharoh". The other two 17-year species combine a series of buzzes and clicks to attract mates.

Considering their size, the amount of sound an individual cicada can produce is remarkable- even more so because of how little energy it requires. In fact the US Navy- always big fans of lots of power- has helped shed light on exactly how cicadas manage this feat. While many singing insects do so through stridulation (rubbing one body part against an-

other) cicadas employ a different technique. A set of structures called tymbals are present on either side of a cicada's abdomen. Using microcomputed tomography (which will be on the final), engineers were able to image and computer model the cicada's tymbals in remarkable detail and in doing so, help reveal their function. Tymbals are comprised of a thin membrane attached to a number of thicker ribs. In order to make their signature sounds, a muscle pulls the ribs in and together releasing a sharp crack.

Another crack occurs when the ribs are released. By repeating this process 300 to 400 times per second, they create everyone's favorite rising and falling drone. The model further revealed that rather than acting independently of one another, the tymbals are synchronized to produce maximum sound at the exact same time- acting like two deafening speakers combining forces rather than just one.

Once mated, the female cicadas carve shallow grooves in their host tree's bark in order to deposit an egg mass. Though each egg mass is small, a female cicada will eventually lay hundreds of eggs in dozens of grooves. The eggs remain tucked away for six to ten weeks before the young hatch and begin to make their way towards the base of the tree. The less coordinated keep it simple and just fall. In any case, once there, the ant-like nymphs will burrow beneath the ground to begin the long... long... very long cycle... anew.

Unknown by their children, ma and pa cicada will end the party rock star style.

Having survived almost two decades beneath ground and a few weeks singing and cuddling in the trees, they return their carbon to the earth which in turn feeds the tree which in turn feeds their young. Ain't life grand?

Patience Pays

There are two popular hypotheses addressing the periodical cicadas' oddly specific lifecycle. The most frequently encountered posits that the prime number of years separating both 13 and 17 year cicadas evolved because it prevented predators from adopting generational periods that divided evenly to coincide with emergence. No predators were able to work periodical cicadas onto the long-term predictable menu. Another theory suggests that this life cycle was advantageous during glacial periods when smaller, more isolated populations were under higher selective pressure and thus it was

advantageous to avoid hybridizing between broods.

Fun fact: There's always someone who botches the plan. "Stragglers" are periodic cicadas that emerge early or late to the party. Most commonly they are off by one year but they have been known to arrive as many as four years early or late. Needless to say, without the ability to hide in numbers, stragglers likelihood of survival is somewhat lower than the rest of their brood.

Luck and cynicism

Mass emergence is slightly better understood. As the old saying goes, I don't have to run faster than the bear, I just have to run faster than you. In the instance of the cicada, a mass emergence creates a lot of targets to hide behind.

The principal is known as predator satiation. The general idea is a) that there aren't many predators actively looking for periodical cicadas and b) so many of them emerge that predators can't possibly eat them all. Add to that millions upon millions of eggs laid even at very high mortality rates and the populations manage to do quite nicely in the long run. This in my opinion may also lend itself to why periodical cicadas buzz around like the drunken uncles of the insect world and are so darn easy to catch. Their adaption plays to luck, not any complex predator avoidance behaviors or other defensive adaptations. They emerge, they sing, they breed (if lucky) and they die without a whole lot of thought. Again. Rockstars.

As summer heats up here in Gambier, the song of the cicadas has faded to little more than a shrill memory. When next they return I wonder what wonders they'll have missed here above while burrowing amongst the roots? I hope we have better jet packs by then.



See you in 17 years, buddy!

Calendar of Events

*All events are free, open to the public, and start from the BFEC Resource Center unless stated otherwise.
9781 Laymon Road, Gambier Ohio | 740-427-5050 | kerkhoffj@kenyon.edu | bfec.kenyon.edu*

CELEBRATE SUMMER!

FIREFLIES IN JULY Wednesday, July 13th 8:00pm—10:00pm
Brown Family Environmental Center 9781 Laymon Road, Gambier, Ohio 43022

Join BFEC staff for a tour of Ohio's best natural light show. Starting at the Franklin Miller Observatory, we will walk about half a mile down to Wolf Run Creek observing and discussing one of summer's oldest and cheapest thrills and some of the other things that come to life when the sun goes down.

Sunset is at 9 p.m. but come early to the Resource Center to enjoy s'mores and conversation. Camp fire starts at 8 p.m.

NATURE'S KEEPERS OUTDOOR ADVENTURE CAMP August 3 - 5 from
9:00am to 4:00pm
Brown Family Environmental Center 9781 Laymon Road, Gambier, Ohio 43022

Nature's Keepers day camp focuses on having fun while connecting with and learning about nature. This full day camp for children ages 8-11 will be held August 3-5 from 9 a.m.-4 p.m. daily and will feature hikes, crafts and Kokosing River tubing.

Registration is \$70 (\$60 for BFEC members) and is now OPEN! To register, visit bfec.kenyon.edu. The registration deadline is July 11. Please email kerkhoffj@kenyon.edu with any questions.

INTRODUCTION TO FLY FISHING Tuesday, September 13 from 7:00pm - 8:00pm
Brown Family Environmental Center 9781 Laymon Road, Gambier, Ohio 43022

Join local guide Graham Stokes for an introduction to the fundamentals of fly fishing and a discussion of how we can fly fish locally in the Kokosing and area ponds and lakes for bass. Also covered will be fly fishing elsewhere in Ohio including Mad River, Clear Creek and the Clear Fork of the Mohican River which are stocked with trout by ODNR. The course will include demonstration of fly fishing equipment and the basic casting stroke. This is classroom only and not a hands-on fishing class. All materials are provided. Participants will be eligible to register for a hands-on workshop later in September.

FAMILY HIKES WITH KNOX COUNTY PARKS
Various dates starting at 10:am

Explore Knox County's fabulous parks the 3rd Saturday of each month through October. Each hike will be at a different location. In case of rain, a special event will be held on the day of the hike at the House at Wolf Run Park. The House is just east of the park entrance on Yauger Rd.

For hike locations and more detail, please visit:

www.knoxcountyparks.org/



BFEC Nature Camps

Have fun while connecting with and learning about nature with hiking, creeking, games, art, and more.

For 8-11 year old children: Two sessions will be offered:

* July 5-9: held in partnership with SPI from 9am - noon daily. Cost is \$40, register at spisport.org.

* Aug 3-5: This camp will run from 9am - 4pm daily. Cost is \$70. Registration is now open; call 740-427-5050.

Thank You to..

Our Members *January-March*

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Our Volunteers

** In the office, on the trails and in the garden:*

Beth Waller, Terri & Jim Heironimus, Nancy Kephart, Brian Miller, Ray Heithaus, Sarah Goslee Reed, Keith Kitchen, Keith Robinson and the hundreds of students and community members that helped make 2016's Earth Day Festival and Earth Day Challenge the biggest and best yet!



Now is the time to join for 2016!
There are many reasons to give, including the satisfaction of knowing you're a part of critical education and conservation programs. Receive preferred access to events, a hard copy of our newsletters, and 10% discount on bird seed. Return the form below with your contribution or give online at support-bfec.kenyon.edu. Thank you!

Become a MEMBER

Membership level: Student ___ \$20 Individual ___ \$35 Name _____ ✂
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 My check, payable to Kenyon College, is enclosed Telephone _____
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Mail to: BFEC, P.O. Box 508, Gambier, Ohio 43022
Your donation is tax deductible as allowed by law. The Brown Family Environmental Center at Kenyon College is a 501c(3) organization.

Brown Family Environmental Center at Kenyon College

9781 Laymon Road, Gambier, Ohio 43022 ~ (740) 427-5050 ~ bfec.kenyon.edu



Our Mission

The BFEC at Kenyon College exists to engage Central Ohioans of all ages with nature, and to support the goals of Kenyon College by conserving the natural diversity of the Kokosing River valley and providing opportunities for education and research.

Our Staff

David Heithaus, interim director

Jill Kerkhoff, facilities & volunteer coordinator
Shane McGuire, land manager naturalist

Upcoming Events

Fireflies in July

July 13th | BFEC Resource Center/Franklin Miller Observatory | 8pm - 10pm

Nature's Keepers Outdoor Adventure Camp

August 3rd - 5th | BFEC Resource Center | 9am - 4pm

Introduction to Fly Fishing

September 13th | BFEC Resource Center | 7pm - 8pm

Family Hikes with the Knox County Parks District

3rd Saturdays | Various Locations | 10am

Brown Family Environmental Center
at Kenyon College
P.O. Box 508, Gambier, Ohio 43022



