Singing Insects of the Chicago Region

A Guide to Crickets, Katydid, Grasshoppers and Cicadas with Audible Displays

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Introduction

When people think of singing animals, birds come first to mind. We welcome the warmth of spring and all of its associated sensory impressions. Among these, bird songs stand out as the sounds we most enjoy. Bird songs are displays with particular biological functions, however, and as those functions are completed for the year the birds become quiet. Fortunately for those of us who love the sounds of the out-of-doors, as the birds fade out the singing insects are well into their crescendo.

I long had been fascinated by insect songs, but as a vertebrate ecologist did not have a very good handle on sources of information about singing insects. That changed as I began to find university websites devoted to these groups. First I found the University of Michigan cicada website (http://insects.ummmz.lsa.umich.edu/fauna/Michigan_Cicadas/Michigan/Index.html). I was pleased to find, as I listened to the recordings posted there, that I recognized and could distinguish the songs of several species.

Then I found the incredible resource of the Singing Insects of North America website (SINA: http://entomology.ifas.ufl.edu/walker/buzz/). That site brings together details about the continent’s crickets and katydids. My focused study began as I went through those species accounts, noting those whose ranges fell into the Chicago area.

Other published resources came to my attention, and appeared in print, as my studies continued. The most accessible and attractive of these was the book and its enclosed CD of insect song recordings, The Songs of Insects by Lang Elliott and Wil Hershberger (2007, now out of print). Hershberger continues to add species to their website (http://songsofinsects.com/). Other sources are listed at the end of this publication.

These resources are national in scope, and as my fieldwork and its associated wonders and frustrations accumulated, I realized that I was assembling a set of locally focused information that might be of interest to others. I presented an introduction to our local singing insects at the regional Wild Things conference in Chicago in early 2007, and was pleased at the size of the audience. I knew that sooner or later I would need to provide the information in a digestible form. For a while I thought that it would take a long time for me to learn enough to share through any kind of formal publication, but we live in a day when the flexibility of digital documents and on-line resources makes available a range of options. Therefore I have drafted this document, understanding that it will continue to grow and to be revised annually. Doing so has the significant advantage that I can hope to get readers’ tips, additional information, and alerts to necessary corrections that need to be made. Contact me via e-mail at wildlifer@aol.com.

I retain copyrights and literary rights to this document, its text and photographs, and the original data summaries from which it was derived. Therefore, please contact me if you wish to make use of those things.

Geographic Extent. The Chicago region is defined here as a 22-county area extending from southeastern Wisconsin, through northeast Illinois and northwest Indiana to Berrien County, Michigan (Fig. 1, next page). These counties provide an area large enough to permit tracking of range changes, mainly northward shifts, which clearly are taking place in several species. The east-west gradient of forest to prairie is represented, as is a wide range of soil types, which has proven to be significant. Finally, a number of species have ranges with their edges within this region, and there are enough counties in the study area to trace those edges.
As with the seasonal information, these clocks are based on current knowledge and are subject to revision.

Size of the insect is given in a graphic form, a red bar with range of sizes in millimeters from various sources in the literature. The bar has the same length (on the printed page) as the midpoint of that range.

Range information for each species takes the form of an outline version of the map in Fig. 1, with solid dots representing recent observations of the species in the indicated counties, and open dots representing historical records, usually from 30 or more years ago. This is necessary, as changes in habitats (most notably, wetlands) have resulted in some species becoming less common or possibly absent from areas where they once were found.

Methods of Study. Usually of course we find singing insects when we hear males singing. Some of us are old enough that we have lost the higher range of our hearing, and need to use other ways to find them. These include keeping our eyes open, sweep netting, and using hearing aids. The SongFinder is one example of the last which I have found helpful (if expensive) in that it allows the user to select how much to lower the pitch frequency, and also allows binaural hearing and thus helps in locating the singer. You can learn more about this device at the website: http://hearbirdsgain.com/

Species Near the Edge of Their Ranges. As I traveled through the 22-county region, it became clear that some species are near the edge of their range, as populations showed clines, mainly in the North-South direction. Species diminishing from south to north include the tinkling ground cricket, confused ground cricket, spring trig, jumping bush cricket, broad-winged tree cricket, Nebraska conehead, round-tipped conehead, common true katydid, lyric cicada, and swamp cicada. All of these have their northern boundary within the region. Species diminishing from north to south are the broad-winged bush katydid and dog day cicada. Both extend to the south end of the region in small numbers, but may not reach much farther. My notes from past years suggest that in Marshall County, toward the southern end of the region, dog day cicada numbers may vary considerably from year to year, though I have heard many in some years. In addition there are two species that are abundant throughout the region, but whose mapped ranges extend only down to central Indiana and Illinois. The sword-bearing conehead and striped ground cricket should be watched for
changes, as they potentially could be pushed northward by global climate change trends. Populations of these edge species are not uniformly distributed. For instance, there are large areas in McHenry County where common true katydids are few or none, and the same is true of dog day cicadas in Pulaski and Starke Counties.

Range Extensions. Some of the species mentioned in the last section are actively extending their ranges. This is clearest for the jumping bush cricket, whose numbers have increased dramatically in DuPage County, for example, since 2006. Others are well north of their ranges as they were known decades ago, and I will continue to monitor their populations and seek the northernmost individuals to track continuing changes that may be taking place.

Population Conservation Concerns. A number of species once described as common or at least present in the region have resisted my attempts to find them. Most of these are wetland katydids. I have yet to find the slender conehead, I have only one location for the stripe-faced meadow katydid, and have not found the marsh conehead outside the Indiana Dunes area.

Scott Namestnik and Michael Homoya in Indiana have drafted a standard for endangered and threatened plant species that might be translatable to singing insects: “To be listed as Endangered, there must be one to five occurrences of the plant statewide. Plant species with six to 10 known occurrences are listed as Threatened. Rare species are those with 11-20 known occurrences statewide. Watch List species include those that were previously on the Endangered, Threatened, and Rare list but that have been removed, often because enough occurrences to surpass the Rare category exist.” Roger Hedge points out that judgments need to be made as to which “occurrences” truly are separate or might be portions of connected populations. Listing for animals in Indiana is less quantitative, and is based more on the judgments of specialists. In Illinois the standards likewise are not quantitative, and are based on terms such as “low populations.”

This study does not focus on any complete state, but rather on a few counties in each of four states. Its results therefore should not be the sole basis for determining species of conservation concern. It can, however, narrow the focus, pointing to species that might be regarded as candidates for consideration. In addition to the species mentioned above, some others with few sites to date are the melodious ground cricket, sphagnum ground cricket, northern mole cricket, prairie meadow katydid, dusky-faced meadow katydid, and prairie cicada. There are others that I have not found in many places yet, but expect to do so and thus do not mention here.

The current Indiana list contains some species of interest to this study (status indicated): sprinkled grasshopper (“sprinkled locust”) rare, prairie meadow katydid rare, slightly musical conehead (“a katydid”) rare, Nebraska conehead (“a katydid”) rare, spotted-wing grasshopper (“green desert grasshopper”) rare, orange-winged grasshopper rare, bunchgrass grasshopper (“bunch grass locust”) threatened, longhorn band-winged grasshopper (“sand locust”) rare, seaside grasshopper (“the dune locust”) threatened. Some of these in fact I have found to be locally abundant in the region: slightly musical conehead, Nebraska conehead and seaside grasshopper.

Conservative Species. Some of the singing insects are locally common, but occur only in narrowly defined habitats. This is clearest in the sphagnum ground cricket, which lives only in sphagnum bogs. The melodious ground cricket seems to be a similar case. Its occurrence in Indiana Dunes State Park (Porter County), and Warren Dunes and Warren Woods State Parks (Berrien County, Michigan) appears limited to swampy woodlands with an abundance of decaying wood. The northern mole cricket likewise is found in a limited number of wetland edges, but whether this is the result of habitat limitation is unclear. Finally, the prairie cicada appears to be limited to remnant prairies, but is capable of persisting on just a few acres. This invites experimentation with introducing the species to high-quality restored prairies.

Dispersal Ability. At the other end of the spectrum are species that are abundant and widely distributed. These appear to be species that are tolerant of disturbance, or perhaps adapted to disturbed ecosystems, and so can thrive in agricultural, residential, or degraded environments. They also are good at dispersing, either because they can travel long distances or because they are so abundant that population pressure pushes some of their number outward. I found an example of this on the extensive grounds of a hospital in Mishawaka, Indiana. This hospital was opened in 2010, and a mix of native prairie plants was established around it. Early season species that had become established there provide examples of those that are quick to disperse into new habitats: spring and/or fall field cricket (I was there during the seasonal transition between the two),
striped ground cricket, Allard’s ground cricket, Roe-ssel’s katydid, sword-bearing conehead, and Carolina grasshopper. No doubt other, later season species could be added to this list.

Acknowledgements. Without the resources provided by others, this project would not have been possible. Among all the authors and researchers whose work I have read, I must single out a few. I’ll begin with Tom Walker, professor emeritus at the University of Florida, whose Singing Insects of North America website is unmatched particularly for the more obscure species not covered elsewhere in the general literature. I also should mention Marla Garrison, whose guide to the damselflies of our region (http://fieldguides.fieldmuseum.org/guides/guide/388) was the impetus that nudged me into getting started on this draft. The Forest Preserve District of DuPage County’s natural resources team, notably Scott Meister, Tom Velat and Rachel Reklau, provided abundant support in my work on our preserves. I also need to mention our botanists, Scott Kobal and “emeritus” Wayne Lampa, whose definition and mapping of ecosystem units placed a habitat context around my fieldwork. Fellow nature blogger and outstanding Indiana field botanist Scott Namestnik has been a great collaborator on the Roe-sel’s katydid range extension study, hosted me in my St. Joseph County evening survey, introduced me to Springfield Fen, and has provided a variety of observations in northwest Indiana. As singing insects grow in interest among students of natural history, more projects and studies are emerging. One of these, the New York Cricket Crawl, is a monitoring project led by Sam Droege (http://www.discoverlife.org/cricket/).

Beginning in 2012, as I extended the study outside DuPage County, I needed to obtain permits and support from others. This expansion of the study placed me in contact with many people who helped with information, permitting, and other support. All were critical to my progress, and so the following list is in no particular order other than roughly alphabetical: Nina Baki (Forest Preserve District of Will County), Greg Behm, C. Michael Moomey, and Saki Villa-lobos (Illinois Department of Natural Resources); Brad Bumgardner (Indiana Dunes State Park), Nancy Collins (dedicated student and promoter of all things tree cricket), Bill Glass and Renee Thakali (Midewin National Tallgrass Prairie), Karl Gnaedinger (The Nature Conservancy in Illinois), Ralph Grundel and Sam Droege (U.S. Geological Survey), Dave Guritz and Judy Strohm (Forest Preserve District of Kendall County), Roger Hedge (Indiana Department of Natural Resources), Wil Hershberger (who continues to expand the Songs of Insects website, and came out to exchange ideas and pick up some live insects for photographing and recording at his studio), Scott Holaday (who welcomed me onto his Marshall County property); Jeff Holland, John T. shukle, and Alyssa Collins of Purdue University’s entomology department, Dale Huizenga (Kankakee River Valley Forest Preserve District), Stacy L.Iwanicki (Illinois Department of Natural Resources), Michaele Klingerman and Evie Kirkwood (St. Joseph County Parks), Joy Marburger (Indiana Dunes National Lakeshore), Scott Meister, Tom Velat and Rachel Reklau (Forest Preserve District of DuPage County), Kelly L. Neal (Illinois Nature Preserves Commission), Gino Nearns (Purdue University entomologist who helped me study the insect collection there), Gideon Ney (a University of Missouri graduate student who has taught me much about coneheads; we share a renewed frustration at our inability to find slender coneheads) and his colleague Nathan Harness, Lisa Rainsong (a correspondent and sounding board who has provided interesting information from the Cleveland area and perspectives on various aspects of singing insect studies) and her partner Wendy Partridge; John Shuey, Stuart B. Orr, Stephanie Frische and Brian Dugan (The Nature Conservancy in Indiana), Kathleen Soler (Chicago Park District, leader of an effort to establish a singing insects monitoring program), Gary Strang (who helped with early season fieldwork in 2016), Mark Swanson (for information on some grasshoppers), Laurel Symes (who generously has shared her results, clearing up much of my confusion regarding nigricornis group tree crickets), and Jerry Ziegler (The Nature Conservancy in Wisconsin). As you can see it’s a long list, and I very much hope I have remembered everyone.
The Singing Insects

Many insects communicate by producing vibrations. Some of these, for example, use the vascular systems of plants to carry signals that we could never hope to hear unaided.

In this document I am focusing on insects that produce auditory displays that people can hear. That doesn’t mean all people can hear them, however. As I rise through my 60’s I find my ability to hear the highest pitches gradually diminishing. I can no longer hear the songs of the small meadow katydids (*Conocephalus* spp.). Children can hear them, and young adults whose hearing remains undamaged, so those species need to be included here.

The singing insects fall into four groups: crickets, katydids, grasshoppers and cicadas. One fact that interests me and perhaps you is that the katydids, despite their apparent similarity to grasshoppers in their body, leg, and wing shape, are in fact more closely related to the crickets. That relationship is shown by the long, threadlike antennae shared by crickets and katydids, in contrast to the thicker stubby grasshopper antennae. More relevant to this document is the fact that both crickets and katydids produce sounds by rubbing together rasping structures on the two wings. The few grasshoppers that sing either rattle their wings in flight (crepitation), or rub the legs against the wings (stridulation). The crickets, katydids and grasshoppers all belong to the same insect order, Orthoptera. The cicadas are in a separate order, Homoptera. They produce sounds in a completely different way, by vibrating drumhead-like membranes on the sides of their bodies.

Only adult males sing. The point of the singing is to attract females for mating. Therefore it is very important that the songs be distinct enough that the females can recognize those produced by males of their species. This principle has some interesting corollaries. First, the singing insects need not be as visually distinctive as, say, butterflies or dragonflies which identify their kind by seeing color patterns or shapes. A consequence of this is that there are many pairs and clusters of sibling species in all the major groups of singing insects. Sibling species are reproductively separate, but to our eyes appear to be identical or nearly so.

Another consequence of female identification of male song is that, in a few cases, they can make distinctions that we cannot, at least not without help (for example, differences in song pulse rate). Examples of this occur in both crickets and katydids.

Once mating has occurred the females lay eggs. In most crickets and katydids the egg stage is the wintering stage. Eggs hatch in spring, and the development of nymphs takes time, which explains why most singing insects do not reach maturity until July or August. Cicada eggs may hatch in the same season they are laid, the nymphs tunneling into the ground and taking years to develop by sucking sap from plant roots. Some species then emerge in the spring, others in the summer. A few crickets, katydids and grasshoppers overwinter as nymphs or adults; their cases will be taken up later.
Crickets
Superfamily Grylloidea

Technically the crickets are separated from katydids in having feet with three rather than four segments. Informally we see that katydids generally resemble grasshoppers but with long, threadlike antennae. Crickets do not resemble grasshoppers. They appear to have wings flat on their backs in contrast with the roof-like positioning of katydid wings.

Song production involves the rubbing of a toothed, file-like structure on one wing against a plectrum, a hardened vein on the edge of the other wing (Mhatre 2012). The wing size, shape and venation are balanced in such a way as to produce the pleasant tones characteristic of cricket songs (a single dominant frequency is what we hear, rather than the often discordant mix of frequencies characteristic of other singing insects’ buzzing or droning sounds). The wing structure of a field cricket is such that the same pitch is produced regardless of temperature (the vibration of a particular portion of the wing, the harp cell, produces the sound). In tree crickets, the entire wing is involved, with different portions dominating at different temperatures, so the pitch can vary with temperature (the wing vibrations slow down as the temperature drops, and this change brings different parts of the wing into play).

Males often provide treats to females who respond to their songs. In the ground crickets, females typically chew at certain spines on the males’ feet when mating. Tree cricket males have a gland on the dorsal abdomen just behind the bases of the wings that produces a secretion the females consume. Crickets may lay their eggs in the soil or in plant tissues. Most spend the winter in this form, though there are exceptions such as the spring field crickets that overwinter as nymphs. Cricket nymphs develop through several stages, or instars, molting the old exoskeleton and expanding into a new one for each graduation between instars. Only the adults may have fully developed wings, though these sometimes may be short and appear to be undeveloped in some crickets.

Our crickets are mainly vegetarians and scavengers. None are exclusively predatory. This broad dietary range raises the ecological question of how so many species manage to coexist in local communities. The ground crickets are a case in point. Open areas often have Allard’s, striped, and variegated ground crickets together, joined sometimes by Carolina ground crickets. Wooded areas often have confused, spotted, and Carolina ground crickets, sometimes joined by melodious ground crickets. Tinkling ground crickets prefer dry woodland edges, but often spill into the woodland or open areas on either side, joining those respective groups. Microhabitat variation in soil moisture and texture may account for some of this overlap, but it also may be an example of potential competition being suppressed by other factors which keep numbers low, resulting in “functional redundancy” (a recent interesting case study and discussion in Scheffer et al. 2015). Possibilities here include parasitism and resource limitation, the latter demonstrated for tropical forest floor crickets by Szinwelski et al. (2015).

Our crickets are in two families, Gryllotalpidae (the mole crickets) and Gryllidae (all the rest). It is useful, therefore, to look at how the Gryllidae further are separated into subfamilies, as is done in the following scheme.

Family Gryllidae

Subfamily Gryllinae (field crickets: local species include the spring and fall field crickets, the northern wood cricket, and the Japanese burrowing cricket).

Subfamily Eneopterinae (bush crickets: our local species is the jumping bush cricket)

Subfamily Nemobiinae (ground crickets: local species include Allard’s, striped, spotted, tinkling, gray, Carolina, Cuban, melodious, confused, sphagnum and variegated ground crickets).

Subfamily Oecanthinae (tree crickets: local species include the two-spotted, Davis’s, Forbes’s, four-spotted, snowy, broad-winged, pine, and narrow-winged tree crickets).

Subfamily Trigonidiinae (sword-tail crickets: local species include Say’s, spring and handsome trigs).

Family Gryllotalpidae (mole crickets: the northern mole cricket is our only representative).
This is the common late season species of large black cricket in our area. The habitat of this species is broader than that for the spring field cricket, extending into mowed lawns. Around homes they are more likely to sing from close to the building, however.

**Season.** Eggs overwinter in the ground and hatch in spring. Nymphs mature in July. As indicated in the spring field cricket account, numbers of singing field crickets build again after the middle of July (see graph, below; fall field crickets first heard singing on dates ranging from 9 to 30 July across the years, at a DuPage County site where the spring species is absent). There are no days in July when neither species is singing. Numbers of singers peak by the end of August, and hold high densities for at least a month. They sing until the growing cold and frost silences them; last observed song dates have ranged 16 October-8 November in different years.

**Similar Species.** The only other large black cricket in our area is the spring field cricket, but it is a sibling species so similar to the fall field cricket that it can be distinguished only by the season in which it is active. Morphologically and by song, the two are identical. The northern wood cricket is smaller, and its season finishes before the fall field crickets begin.

**Song.** The fall field cricket produces moderately high-pitched, fairly loud chirps, at 5 kHz well within the hearing range of most people, each chirp a bundle of 3-5 notes that lasts about a quarter second. The chirps are produced at a rate of 1 per second or as many as 3-4 per second in hot temperatures. The song is indistinguishable to the ear from that of the spring field cricket. Fall field cricket song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/489a.htm) and at the Songs of Insects website (http://songsofinsects.com/crickets/spring-and-fall-field-crickets).

Photos: Female, above left, distinguished by the long hypodermic-like ovipositor extending from end of abdomen. Male, below, lacks this structure.
This is our common early season large black cricket. Spring field crickets prefer open, dry to mesic habitats with mixes of tall grasses and forbs, and are most abundant in areas with a mix of shrubs, grasses and forbs. They are not in lawns as a rule, but rarely can be found there as well, if the lawn is adjacent to good habitat or especially if the mowing leaves the grass relatively high. This is not a species of wetlands or woodlands.

They are common throughout our area and widely distributed in their habitat, but their slightly more limited habitat breadth, as described above, places them in fewer locations than the fall field cricket (map, below right). The apparent explanation of the spring field cricket’s more limited habitat range is that its overwintering requirements are more stringent, as the nymphs need better protection than the eggs of the fall field cricket.

**Season.** Eggs hatch in the same season they are laid. The small crickets overwinter, and complete their growth in early spring. They begin singing in May, though the starting date has been observed to vary in different years from May 5-31 in DuPage County. The transition to its sibling species, the fall field cricket (whose song is identical to the ear), is not demarcated by a period with none singing, but the second half of July brings minimal singing (see fall field cricket) and so is taken to be the transition time between the two sibling species. This assumption is supported by the fact that middle to late July is when fall field crickets begin to sing in areas lacking spring field crickets.

**Similar Species.** The only other large black cricket in our area is the fall field cricket, but it is a sibling species so similar to the spring field cricket that it can be distinguished only by the season in which it is active. Morphologically and by song, the two are identical. The northern wood cricket has a broad seasonal overlap with the spring field cricket, but lives in forests where the canopy cover is greater than the spring field cricket’s tolerance. It is slightly smaller, the head is narrower in proportion, and the pronotum is widest at the posterior end, at the anterior end in the spring field cricket.

**Song.** The spring field cricket produces moderately high-pitched, fairly loud chirps, at 5 kHz well within the hearing range of most people, each chirp a bundle of 3-5 notes that lasts about a quarter second. The chirps are produced at a rate of 1 per second or as many as 3-4 per second in hot temperatures. Spring and fall field cricket songs are indistinguishable. See the northern wood cricket account. Spring field cricket song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/488a.htm) and at the Songs of Insects website (http://songsofinsects.com/crickets/spring-and-fall-field-crickets).
Northern Wood Cricket (Gryllus vernalis)

This is a forest-dwelling member of the field cricket group. My first encounter with this species was in southern Indiana at the Hills of Gold Bioblitz in May, 2015. My time that spring was limited, but I found some singing in June in Pulaski County at the Winamac State Fish and Wildlife Area. I have not seen one yet, and so am going by information from references and the sound recordings I have made. The above photo is of one of the Pulaski County singer locations.

Season. This is an early season cricket, as the name *veralis* suggests. I heard them in mid-May in Johnson County, Indiana, and on June 13 in Pulaski County. In 2016 I found them on 3 June along the Marquette Trail in Lake County, Indiana, and on 28 June at the Kankakee Sands nature preserve in Illinois. Alexander (1957) said *veralis* matures 1-2 weeks before *veletis* in southern Ohio. The time information in the above graphics thus is subject to future revision, and the day clock data come from my southern Indiana observations.

Similar Species. This ground dwelling cricket is black, but smaller than the spring field cricket. The pronotum is widest at its posterior end, the opposite of the spring field cricket. Season overlap with that species is large, but there apparently is none with the fall field cricket. Habitat also distinguishes the northern wood cricket, a species of forest floor leaf litter, while the spring field cricket is found in open, grassy areas. The song also is different.

Song. The song is similar to that of the spring field cricket, consisting of separate chirps. When I compare recordings of crickets made in wooded vs. open grassland areas, I find a consistent difference, but it is opposite what is expected from literature to date. Presumed northern wood cricket songs in the Chicago region have 1.44 fewer chirps per second at a given temperature than presumed spring field cricket songs. Part of the explanation of this discrepancy may lie in the fact that previous studies of northern wood crickets all have been made in the overlap zone between northern and southern (*G. fultoni*) wood crickets. Jang and Gerhardt (2005) found differences in *fultoni* songs between populations sympatric with *veralis* and allopatric populations. They did not measure *veralis* songs north of the overlap zone. Neither did Alexander (1957). Thus my measurements apparently are the only ones from the zone where *veralis* is allopatric to *fultoni*, and given the potential flexibility of songs in these species, it is possible that they indeed have a lower chirp rate than *veletis* in the Chicago region. Northern wood cricket song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/470a.htm) and in my blog at https://natureinquiries.wordpress.com/2015/06/18/northern-wood-crickets/
On September 19-20, 2014, at the Bendix Woods bioblitz in St. Joseph County, I found a population of Japanese burrowing crickets (Velarifictorus micado) in gravel parking lot dividers in the most heavily used portion of the park. This species had not been on my hypothetical list of singing insects in the region, as they never had been documented here and range maps placed them in southern Indiana, but not in the northern half of the state. I have to question how they came to be in this place. While it is true that this introduced Asian species is expanding its range outward from its starting point in Alabama (probably the port of Mobile), the population at Bendix Woods appears to be surrounded by habitats inappropriate for the species. It is, perhaps tellingly, adjacent to the park’s maintenance area. The founders of this cricket population may have been brought in with landscaping materials or plants transported from farther south. There are, however, so many of them, spread over several of those gravel divides, that they almost certainly have been building their numbers over at least a couple years, demonstrating their ability to survive our winters. That suggests that it is only a matter of time before they become widespread in the region. In 2016 I found them abundant in parks and residential areas throughout Indianapolis, and heard 1-2 individuals at Midewin National Tallgrass Prairie (near a railroad siding) and in the LaSalle Fish and Wildlife Area (near a parking lot).

Season. Bendix Woods is farther north than any site shown for the species in the Singing Insects of North America website. The full singing season at this latitude therefore remains to be determined. At Bendix Woods they were singing at least from mid-morning to 4:00 p.m. In Indianapolis they still were singing at dusk.

Similar Species. This ground dwelling cricket is the size of a field cricket, but instead of being all black, has a pattern of cream colored lines and blotches as illustrated in the photos. The individual shown was obtained only by digging several inches into the gravel at Bendix Woods, and so this cricket may not often come up into the open. The eastern striped cricket can be similarly marked, but is a smaller surface-dwelling species (see Hypotheticals list).

Song. The song consists of fairly loud chirps, 2-4 per second, with the musical quality of the spring and fall field crickets but with a simpler, level tone and more rapidly produced at a given temperature. There is also a less musical sound, lower pitched, again with a level tone, about 1 per second, and introduced with a very brief, high-pitched note. Japanese burrowing cricket song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/551a.htm) and at the Songs of Insects website (http://www.songsofinsects.com/crickets/japanese-burrowing-cricket).
Jumping Bush Cricket (Orocharis saltator)

Thomas Walker, in a 1969 review of the genus, showed this species extending no farther north than the latitude of Indianapolis in either Indiana or Illinois. As the range map indicates, they have extended their range well into our region since then. They occur in residential neighborhoods but also in forested areas, and are abundant and conspicuous enough that they would not have been missed in the past. Their population has increased noticeably in DuPage County and expanded northward in recent years (see map). The northernmost locations in Kendall, Kane, DuPage and Cook Counties in 2016 (green stars on range map; yellow stars for 2015, red stars for 2014) form a diagonal line that suggests Indiana is the source of the northeast Illinois crickets, but they also are established in Peoria, Illinois, so that may not be the case. Their advance still is rapid in the western part of the region, but appears to have stalled out in northern Cook County.

They have been observed laying eggs in dead tree twigs, and consuming tender leaves, flowers and fruits according to the literature.

Season. I have heard them singing as early as July 27 and as late as November 18. Their singing peaks in the first hour after sunset and then continues intermittently through the night. Later in the season on cooler days they may begin at mid-afternoon, and may continue to mid-morning.

Similar Species. This cricket’s presence usually is indicated by the song, which points to a location lower than it actually is, apparently in part because tree foliage reflects the sound downward. They typically sing at least 10 feet up in trees, on the trunk most of the time., and seem to prefer trees with vines that apparently provide hiding places. That location, along with their relatively large size and angular appearance (though they are difficult to locate and see), distinguishes them from other local species. Lisa Rainsong reports that Cleveland-area jumping bush crickets are easier to find, as they often are actively moving on branches and foliage.

Song. The song could be described as fairly loud, brief burry high-pitched chirps or very short trills, about 1 per second or 1 per 2 seconds, at 5 kHz well within the hearing range of most people. There is a noticeable variation in pitch among the individuals singing in the same place at the same time. Jumping bush cricket song recordings can be found at the Singing Insects of North America website (http://entnemdept.uitl.edu/walker/buzz/686a.htm) and at the Songs of Insects website (http://songsofinsects.com/crickets/jumping-bush-cricket).

Photos: This female jumping bush cricket was dislodged from the bark of a tree and fell onto the honeysuckle leaves.
Allard’s Ground Cricket (*Allonemobius allardi*)

Like the other ground crickets, Allard’s is heard more than seen. Often found in lawns, Allard’s ground cricket is more abundant in open areas of taller grasses, and is frequent along grassy sections of our recreational trails. This is not a forest species, though it can turn up in small open areas surrounded by forest. Occasionally it occurs in small remote parking lot islands.

**Season.** Singing begins in July in our area, with first song dates ranging 5-22 July. Generally a few sing into November, with last song dates over the years ranging November 5 to December 1. The earliest noted singing time was 7:30 a.m., latest 9:30 p.m.

**Similar Species.** The ground crickets are very similar in appearance, with even genera distinguished by fine details of the spines of the feet, ovipositors and other microscopic characters. All are small and brown. See the discussion under tinkling ground cricket.

**Song.** Incessant, separate quick very high-pitched notes (6 kHz) that sound like 4-6 per second but sonographs show twice that rate. The notes sound more separate than those of what here are called trills. There are fairly frequent, brief pauses. Especially later in the season, the notes sometimes may be more widely spaced, but the pauses distinguish such songs from those of tinkling ground crickets. Allard’s ground cricket songs and photos can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/539a.htm) and at the Songs of Insects website (http://songsofinsects.com/crickets/allards-ground-cricket).
Striped Ground Cricket (Allonemobius fasciatus)

The striped ground cricket is our common lawn ground cricket. It lives in open grassy areas, and is common along grassy sections of trails (in moist shaded lawns they may be replaced by variegated ground crickets). Thanks to their extreme abundance, high dispersal ability and association with relatively disturbed habitats, striped ground crickets could be regarded as our weedi-est cricket species. They usually are out of sight. This species’ range map has been marked with a southern boundary around the Indianapolis area, and so that edge conceivably could shift north-ward into the Chicago region as climate change proceeds. This will be difficult to discern, however, because it probably will be followed by the northern boundary of the southern ground cricket, whose song is practically identical.

**Season.** Like the other ground crickets these usually begin singing in July, noted first dates ranging 29 June–24 July. They are among the latest of our singing insects, along with other ground crickets, with observed latest song dates ranging November 5–19. They sing day and night, the earliest local noted singing time 5:30 a.m., latest 3:45 a.m.

**Similar Species.** The ground crickets are very similar in appearance, with even genera distinguished by fine details of the spines of the feet, ovipositors and other microscopic characters. All are small and brown. The striped ground cricket is somewhat exceptional in having several stripes on the top of its head, run-

The song consists of separate brief rough buzzes, continuously produced at 2 to 3 per second. It is low enough in pitch to hear easily, with most of the buzz’s sound range below 7 kHz. The striped ground cricket’s songs and photos can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/543a.htm) and at the Songs of Insects website (http://songsofinsects.com/crickets/striped-ground-cricket).

Photos: Female, above. Ground crickets occasionally climb up into vegetation, as in the striped ground cricket female above right, or as forced by flooding, as in the male, below right.
Gray Ground Cricket (Allonemobius griseus)

This is a sand soil species, best known from the Great Lakes dunes (typical habitat in photo, right). It also has been found inland in sandy areas, though these records need to be confirmed because the variegated ground cricket has a similar song and was not as well known in the past.

**Season.** Across the region, song dates have ranged 30 July-5 October. In 2012 they were not yet singing at Illinois Beach State Park on August 7, but were singing by August 28. They stop singing at dusk.

**Similar Species.** The ground crickets are very similar in appearance, with even genera distinguished by fine details of the spines of the feet, ovipositors and other microscopic characters. All are small and most are brown, though this one is grayer than the others as its name suggests, and has distinctive head striping and (at least in the female) wing spotting patterns.

**Song.** The song is a trill that comes close to seeming composed of discrete notes, like those of allardi, but is much more rapid (at least twice as fast; allardi singing nearby confirm this). There are brief pauses interrupting the trill at intervals that are regular in some individuals, but vary greatly in others. The recordings I have made of these crickets all have peak frequencies in the 8-9 kHz range. The most similar song is that of the sphagnum ground cricket, with which the gray ground cricket has no habitat overlap. Also, where the habitat is borderline, the song pattern needs to be attended to rule out variegated ground cricket. The gray ground cricket’s song has abrupt rather than crescendo starts, and breaks that are momentary rather than lasting several seconds. Recordings of the gray ground cricket’s song can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/523a.htm) and in my blog at http://natureinquiries.wordpress.com/2013/12/30/sound-ideas-gray-ground-cricket/
Spotted ground crickets prefer closed-canopy forests or woodlands with some accumulations of leaf litter, where forest floor vegetation is sparse. The soil needs to be well drained yet moist. Most commonly this seems to mean soils heavy in sand or gravel, but hillsides with denser soils sometimes have spotted ground crickets, too. I have found them in several of DuPage County’s clay-soil woodlands, and ultimately expect to find them in every county in the region.

**Season.** Observed song dates for this species have ranged July 26–November 15 in the region. So far I have heard them from mid-morning through the afternoon. I do not know whether they continue into the night.

**Similar Species.** The mottled, spotted pattern especially of the female spotted ground cricket’s abdomen is a source of the name. The yellowish rims around the compound eyes are a prominent distinguishing feature of this generally brown species.

**Song.** The main challenge here is to distinguish the spotted and Carolina ground cricket songs. Both species have continuous, pulsing songs, but in spotted ground crickets the regular pulses break into steady, non-pulsing sections much less often than Carolina ground crickets. The spotted ground cricket’s sound is rougher, grittier, and I would not describe it as a purr. The frequent non-pulsing portions of the Carolina ground cricket’s song have a distinctive purring quality, and the pulses are not as regular, often accelerating from brief to longer pulses. Finally, study of sonographs reveals that the spotted ground cricket actually has minute pauses between the pulses, in contrast with the Carolina ground cricket’s more continuous sound production. When a Carolina ground cricket stops singing, it usually does so at the end of a non-pulsing purr. Spotted ground crickets end abruptly at the end of a series of pulses. Recordings of the spotted ground cricket’s song can be found at the Singing Insects of North America website (http://entomology.ifas.ufl.edu/walker/buzz/540a.htm) and in my blog at https://natureinquiries.wordpress.com/2015/10/09/spotted-ground-cricket/
Tinkling ground crickets are a species of woods edges and open dry woodlands. They can be expected in any sand-soil woodland in the region. When present with the confused ground cricket, the latter is more abundant in the more shaded forest interior with the deeper leaf litter, while the tinkling ground cricket is more to be found in the edges and openings. Where woods give way to open areas, tinkling ground crickets may be found in close proximity to Allard’s ground crickets. The tinkling ground crickets in the southern part of the region in Indiana are unusual in their willingness to venture away from woodlands into meadows, corn and especially soybean fields, though it is the rare individual that wanders more than 100m from the edge of the woods. Nevertheless, choruses of tinkling ground crickets can be heard in such open areas in the latter part of the season.

**Similar Species.** Alexander and Thomas (1959) regarded allardi, tinnulus and fasciatus as being very closely related, but distinguishable by the intensity of head striping as well as by song. The stripes are bright and sharp on fasciatus; faint to nonexistent in tinnulus, which also has pale, reddish tones especially on top of the head; and stripes present in allardi, but not as bright and sharp as in fasciatus. There also are differences in ovipositor length and stridulatory vein size and teeth. Howard and Furth (1986) described the striped’s “head with dark longitudinal stripes from base onto vertex between eyes.” Tinnulus: “General coloration lighter (than A. allardi, A. fasciatus, …), yellow or orange (especially head, legs, tegmen); without distinct stripes on head, rarely with faint indication of non-bristled striped areas (only between eyes)...lateralmost edge or crease...of male tegmen very light (white).” Allardi’s head they described as having stripes indistinct at the base but distinct apically, between the eyes.

**Season.** Over the years, song dates in the region have ranged July 20-October 20. Early in the season they don’t start to sing until mid-morning, but by the second week of August they can be heard throughout the 24 hours.

**Song.** The song consists of high pitched (7 kHz) individual notes, like those of Allard’s ground cricket but distinctly slower (1/3 to ½ as rapidly produced) at a given temperature. It often is rendered “tink-tink-tink...” The song is uninterrupted, lacking the frequent breaks characteristic of Allard’s ground cricket (this is especially helpful late in the season, when allardi often slows down). Tinkling ground cricket song recordings and photos can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/530a.htm) and at the Songs of Insects website (http://songsofinsects.com/crickets/tinkling-ground-cricket).
Carolina Ground Cricket (Eunemobius carolinus)

We have three common ground crickets in our area. The striped ground cricket is typical of mowed lawns, Allard’s ground cricket reaches its peak abundance in open areas with taller herbaceous vegetation, and the Carolina ground cricket spans a broad habitat range, from wet and mesic areas with dense herbaceous vegetation to woodlands. Like the others it occurs in residential neighborhoods, but usually will be found around bushes or in dense herbaceous plantings. In woods it need not be in ground cover as long as there is some leaf litter and the soil is wet to moist.

Season. Observed first song dates have ranged 1-27 July. Usually this is among the latest of our singing insects, with observed last song dates ranging 14 November-1 December in different years. Heard as early as 8:00 a.m., as late as 3:45 a.m.

Similar Species. The ground crickets are very similar in appearance, with even genera distinguished by fine details of the spines of the feet, ovipositors and other microscopic characters. All are small and brown. The Carolina ground cricket female is somewhat distinctive in having a relatively short ovipositor, as is evident in these photos.

Song. A continuous, irregularly pulsed drone, purr or trill with periods when the pulsing vanishes into a steady purr. It is low enough in pitch to be heard by most, at 6 kHz. The spotted ground cricket song is similar in quality, but has rapid rhythmic pulsations, a grittier quality, and usually lacks the non-pulsing sections. Carolina ground cricket song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/533a.htm) and at the Songs of Insects website (http://songsofinsects.com/crickets/carolina-ground-cricket).
Confused Ground Cricket (Eunemobius confusus)

We are near the northern limit of this species’ range according to the literature. It certainly is much less common than some of our other ground crickets. The Kenosha County record in the range map was a single small group of confused ground crickets at the New Munster State Wildlife Area in the southern part of the county. This species prefers dry forest areas with little or no herbaceous vegetation, just leaf litter, but seems to like the litter relatively deep. Sometimes a few individuals sing from pockets of litter in prairies or meadows a short distance out from the forest edge. Later in the season as the forest becomes very dry, confused ground crickets may approach wetter areas in the woods. They are not to be expected in every forest, and are not a species of residential neighborhoods. When they occur with tinkling ground crickets, as at Indiana Dunes National Lakeshore, they are found more in the deeper litter and shade of woodland interiors, while the tinkling ground crickets are more at the edges.

Season. First song dates have ranged 12 July-2 August, last dates usually in September or early October (latest, 12 October). They sing from first light until dusk, not singing at night.

Similar Species. The ground crickets are very similar in appearance, with even genera distinguished by fine details of the spines of the feet, ovipositors and other microscopic characters. All are small and brown. The confused ground cricket is distinguished from the others in being blacker than most, and having all-white palps extending from the front of the head.

Song. Under ideal conditions, the song is heard as chirps, trills or buzzes about a second long with stuttering notes in the 1-second space between. Usually, though, the stuttering notes are faint and not readily heard so it sounds like 1 second on, 1 second off. The pitch is low enough to be heard easily, at 6 kHz. Confused ground cricket song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/538a.htm) and at the Songs of Insects website (http://songsofinsects.com/crickets/confused-ground-cricket).

Photos: Male, top; female, above and right.
One highlight of the 2012 field season was finding melodious ground crickets at Indiana Dunes State Park. This species has not been documented in many places, and it apparently is idiosyncratic in its habitat choice. Thomas and Alexander’s (1957) first description of the species provides much of what has been published about it, at least in the North. They characterized it as a marsh species, but their more detailed site descriptions often, if not usually, place it among woody plants. “The majority of our specimens of *melodius* were secured by tearing apart a soggy, decayed log, honey-combed with insect burrows, about 20 feet from the marsh proper.” At Indiana Dunes State Park I found abundant melodious ground crickets in the forest south of the Great Marsh, and extending well into that marsh, the State Park portion of which is better described as a shrub swamp. That forest is low and wet, with depressions and many rotting logs. Singing males often were associated with those logs, though not always. In 2013 I found melodious ground crickets at two locations in Berrien County, Warren Dunes and Warren Woods State Parks. In 2016 I heard a single individual at Tippecanoe River State Park in Fulton County. That was somewhat late in the season, so I will want to get a better idea of the population status there, but it opens the possibility that this cricket may occur in other bottomland riparian forests in the region. Though all of these habitats are wet forests or shrub swamps, Lisa Rainsong has recorded what sound like melodious ground crickets in other wet habitats in the Cleveland area. Confirmation of that identification may reveal a broader habitat breadth at least across the northern portion of this species’ range.

**Similar Species.** Physically this insect is very similar to *E. carolinus*; the female has a much longer ovipositor, and the male has many more teeth on the stridulatory vein of his wing, which can only be determined through a microscope. Song and habitat are the main way to distinguish this species (see song description).

**Season.** I have found them singing on 18 August to 9 September. That last date seems solid, but they probably begin earlier.

**Song.** The song is a steady musical trill, similar in speed to that of Say’s trig (which can occur in the same habitat), but lower in pitch, lacking the trig’s “silvery” tone, and without the trig’s frequent brief pauses or breaks. Melodious ground cricket song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/534a.htm).
Cuban Ground Cricket (Neonemobius cubensis)

This has been known mainly as a southern species, in the longitude range of the Chicago region not documented north of Tennessee. However, Lisa Rainsong has found them to be common in the Cleveland area, and so I was alerted to the possibility that they might appear in the Chicago region. In 2016 I found a population of tiny ground crickets that appear to belong to this species, near the southern boundary of the region at Gar Creek Forest Preserve in Kankakee County. A significant behavioral difference within the genus is that the variegated ground cricket stays out of sight during the day, at least early in the season, buried in gravel or in cracks or holes in the soil surface, but the Cuban ground cricket commonly wanders over the surface. At Gar Creek I have seen several males crossing the trail during the day. The habitat was shaded woodland near a ditch with flowing water.

**Similar Species.** I have obtained permission to remove a couple of the crickets from the preserve in 2017. At this point I have photos that appear to narrow down the crickets to this species. They key to Neonemobius, including the uneven-length spurs on the hind tibias, are all black and have white palps with black end segments. Sphagnum ground crickets only occur in sphagnum moss in bogs. Variegated ground crickets are multicolored, and the endmost palp segments are pale with dark tips.

**Season.** I first found these crickets on September 15, and made recordings that fit Cuban ground cricket parameters as late as October 11. They were singing at least late morning to late afternoon.

**Song.** A complicating factor is that the song is nearly identical to that of the variegated ground cricket: a high-pitched trill that builds in volume from a weak start, holds for several seconds, and then ends abruptly, with a space of a few seconds before being repeated. Recordings made at Gar Creek, where I have seen both species, fall into two groups: higher pitched with lower pulse rate (7.8 kHz and above, 40 pulses/second or below) and lower pitched with higher pulse rate (8.2 kHz and below, 45 pulses/second and above). Both groups show an increase in pitch (dominant frequency) with temperature, and the latter group, which for now I am regarding as Cuban ground crickets, also show an increase in pulse rate with temperature. The pulse rates are consistent with what others have documented in the Cuban ground cricket. The dominant frequency generally is higher than the 7.0-7.5 kHz typical of Cuban ground crickets, but I made a recording of a captive individual of that species which had a dominant frequency of 7.7 kHz and a pulse rate of 46. Cuban ground cricket recordings can be found at the Singing Insects of North America website (http://entomology.ifas.ufl.edu/walker/buzz/537a.htm).
Sphagnum Ground Cricket (*Neonemobius palustris*)

This distinctive species is an extreme habitat specialist, and apparently does not occur at all apart from a sphagnum moss substrate. That habitat is extremely limited in northeast Illinois and northwest Indiana. There is none in DuPage County, and only one site (Rutland bog, on private property) in Kane County, for example. The sphagnum ground cricket can occur in large numbers in sites such as Lucy Lake Nature Preserve in Walworth County, Volo Bog in Lake County, Illinois, and Pinhook Bog in the Indiana Dunes National Lakeshore. In the drought of 2012 they retreated to pockets of sphagnum that remained well saturated with water.

**Season.** They were singing when I found them at Mud Lake Bog in Berrien County on 23 August 2015, and in Walworth County on 16 September 2015.

**Similar Species.** The ground crickets are very similar in appearance, with even genera distinguished by fine details of the spines of the feet, ovipositors and other microscopic characters. All are small and brown. Apart from the association with sphagnum moss, mature male sphagnum ground crickets have more black in their coloration, and are smaller in body size (less than 9 mm.) than some of the other species. Immature individuals and females may have much brown, however.

**Song.** The song is a very high-pitched (9 kHz) trill, lower in volume and feebler than the similar songs of the gray ground cricket and Say’s trig. In the habitat the overlapping individuals make it sound continuous, but most observers describe the individual songs as around 10 seconds long, with significant breaks between. The pitch is much higher than that of Say’s trig. It has an abrupt start, unlike the variegated ground cricket. Sphagnum ground cricket song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/524a.htm) and at the Songs of Insects website (http://songsofinsects.com/crickets/sphagnum-ground-cricket).

Photos: Male, top.; female, right; nymph, above. Females and nymphs show more brown, especially red-brown on the head, than do adult males.
Variegated Ground Cricket (Neonemobius variegatus)

The variegated ground cricket’s song superficially resembles those of other fast-trilling ground crickets, and Say’s trigs. That similarity, and the cricket’s relative inaccessibility in holes in the ground such as cracks and earthworm tunnels, may explain why there are so few mentions of it in the literature. I have found it in shaded lawns, portions of prairies and meadows in damp soils close to water, and sometimes forests. It has proven to be widely distributed in the region.

Season. Usually singing begins in the last week of July, and continues into November. Songs can be heard morning into the night. The only time I have seen them come out in the open during daylight hours was on October 11, 2016, when nighttime temperatures may have been too low to support nocturnal activity.

Similar Species. It is small, with a 9mm maximum length, and it is distinctively patterned. There are several horizontal bands of color across the head: dark brown on the back, alternating red-brown and yellow-tan stripes on the top, red-brown on the top of the front, and black on the lower front. The palps are white with tan tips. The pronotum is black or very dark brown with tiny white dots. The legs are mottled in light and dark brown. The abdomen is dark. No other species has this combination of features. Photos of males, left column, female below. Say’s trigs sing from elevated perches. See Cuban ground cricket.

Song. The typical song is a rapid trill with a weak beginning, a crescendo, and a hold at full volume for 10 or more seconds (rarely more than 45 seconds) before an abrupt end. It usually lacks the abrupt “chuwee” start common in Say’s trig. Trigs usually sing from elevated perches, variegated ground crickets always from the soil. There is a quiet time between songs of 5 seconds or more in variegatus, sometimes 15 seconds or more. If there is a momentary pause, the song may resume at full volume without the crescendo. Such a start also is common early in the season. Cuban ground crickets have a nearly identical pattern, but variegatus usually have higher-pitched songs (dominant frequency 8.0 kHz or above) than those of cubensis (8.0 kHz or lower, but there is an overlap zone of 7.8-8.2 kHz), and a lower pulse rate (below 40/second, cubensis 45 or higher). Sound recordings are posted in my blog: https://natureinquiries.wordpress.com/2015/01/16/sound-ideas-variegated-and-cuban-ground-crickets/
Two-spotted tree crickets are fairly common in woodland edges and residential neighborhoods with woody plants. Males sing from trees and bushes. On several occasions I have found males singing at small circular holes they apparently chewed in the centers of larger leaves, positioning their wings above the holes.

**Season.** First song dates have ranged 12 July-2 August. I have heard them as late as November 2. They sing at night, beginning at dusk, peaking in the second hour after sunset, then continuing intermittently to at least 5:00 a.m. Late in the season they may sing at mid-day.

**Similar Species.** The elongated shape is shared with other tree crickets. Other species lack the two-spotted female’s large dark wing spots that give the species its name. The dark red-brown head and thorax are distinctive.

**Song.** Two-spotted tree cricket songs are variable-length, dissonant trills, 1 second to 7 seconds or longer duration. Intervals between trills can be very short or longer, but when longer usually are filled by a stuttering sound. That variability of trill length and spacing is a key identification feature, especially in comparison to the narrow-winged tree cricket. Early in the season their song seems more discordant, frantic or strained than those of our other tree-dwelling tree crickets (narrow-winged and Davis’s), but that quality diminishes and becomes more tone-like as the season progresses. At 3.5 kHz, the pitch of their song sounds higher than those of Davis’s and snowy tree crickets, but close to that of the narrow-winged. Song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/601a.htm) and at the Songs of Insects website (http://songsofinsects.com/crickets/two-spotted-tree-cricket).
This species poses some challenges. Davis’s tree cricket is more strictly arboreal than the others. It lives up in the tree canopies, and its song is easily lost in the general nighttime clamor of all the singing insects. They do, however, sometimes sing from shorter trees out from the forest edge, or climb down into the lower branches of large trees. They also occur in the scattered trees of parks and residential neighborhoods. In a remote forested area in southern Indiana this was the dominant singing species on a cool evening in September, and they likely are common in our forests as well.

Season. My limited observations have ranged August 13 - October 1. I have heard them singing in the first hour to the third hour after sunset.

Similar Species. I never have seen one apart from the specimens illustrated here, and so must rely on information from others. The narrow wings rule out two woodland species, the snowy and broad-winged tree crickets. This is a pale insect, which separates it from the two-spotted tree crickets with their dark heads and thoraces, and the female’s large wing spots. The orange-brown cap characteristic of the narrow-winged tree cricket reportedly is absent in Davis’s tree cricket. The dark spot on the basal antenna segment is straight (photo, right), lacking the hook evident in the narrow-winged.

Song. The song is a long continuous trill, lower in pitch (2.5 kHz) than those of the other tree-dwelling cricket songs at the same temperature. Occasionally the trill may be interrupted briefly, but not so often that one would confuse it with the song of a narrow-winged or two-spotted tree cricket (the other tree-dwelling species with interrupted trills). Davis’s tree cricket song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/590a.htm) and at the Songs of Insects website (http://songsofinsects.com/crickets/daviss-tree-cricket).
Forbes’s Tree Cricket (Oecanthus forbesi)

Forbes’s tree cricket has a sibling species, the black-horned tree cricket (O. nigricornis), but recent research by Laurel Symes (2013) revealed a transition zone between the two species in Ohio, with only Forbes’s occurring in the Chicago region.

This species usually is found in areas with mostly tall forbs. Vines and woody plants also may be present, but not necessarily tall grasses. Males sing up in the tops of meadow plants on warm days, lower when cooler. Females lay eggs in woody stems.

**Season.** Noted first songs have ranged August 15-September 5, and last song dates September 30-November 4.

**Similar Species.** The elongated shape is shared with other tree crickets. The black leg segments, black antenna ends, broad dark zones down the ventral center of the abdomen, and (often, not always) a narrow black stripe down the center of the pronotum, are distinguishing characteristics. These insects are highly variable in the amount of dark pigmentation they show. Even the patterns of spots on the basal two antenna segments, once regarded as important in tree cricket identification, are highly variable in this species (see photos). Blacker individuals are more common in Indiana than in the Illinois portion of the region.

**Song.** The song is a long, loud, moderately high pitched (3.5 kHz) trill. At a given temperature, Forbes’s tree crickets have faster pulse rates than their relatives, but this difference becomes less reliable at lower temperatures (Symes 2013). Pulse rate determination is done from recordings in a computer. Forbes’s tree cricket songs and photos can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/594a.htm). An excellent site for tree crickets generally is http://oecanthinae.com/index2.html.

The female in the top photo shows the darker colors displayed by some individuals, while the male represents the pale end of the range. An intermediate pattern is represented in the photo above right. The two photos to the lower right show the range of antennal spot patterns. In the larger basal antenna segments, the pairs of spots may be partly obscured by diffuse pigment as on the left, or may be sharply defined as on the right. The outer spot is oval or comma-shaped rather than circular, however. On the second segment there is a clear separation between the two marks, comparable to the width of the inner mark. Center right, a female laying a line of eggs in a woody stem, producing a 3-inch scar line. She has arched her body to bring her ovipositor into the stem at a right angle.
Well distributed and common locally, the snowy tree cricket prefers low woody vegetation, open areas (including residential yards with bushes) and forest edges. As the season progresses, snowy tree crickets also may move into meadows.

**Season.** Males usually begin singing in mid-July and continue into October. Local observed first song dates have ranged July 7-August 1, and last dates September 27-November 2. The song typically begins around sunset (peaking 1-2 hours after sunset), then continues intermittently, noted as late as 5:30 a.m. when there was significant light. Later in the season (October) they often sing during the day.

**Similar Species.** This is a pale tree cricket, with wings wider than most. The spots on the basal antenna segments are round, rather than short lines or curves (photo). The broad-winged tree cricket has even wider wings, and has raspberry colors around the bases of the antennae instead of the orange-brown typical of the snowy tree cricket.

**Song.** The snowy tree cricket’s song consists of smooth, rhythmic, high-pitched chirps (3 kHz). It is famous for its chirping rate increasing or decreasing as the temperature goes up and down (though this is common among singing insects, it is more easily observed in this species). One formula is to count the chirps in 13 seconds and add 40 to get the temperature in degrees Fahrenheit. Movie sound tracks often incorporate snowy tree cricket recordings to convey a calm nighttime mood.

Snowy tree cricket song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/585a.htm) and at the Songs of Insects website (http://songsofinsects.com/crickets/snowy-tree-cricket). An excellent site for tree crickets generally is http://oecanthinae.com/index2.html.

I have posted a recording at http://natureinquiries.wordpress.com/2014/01/13/sound-ideas-an-odd-trio/
The broad-winged tree cricket occurs in the woodland understory, and occasionally in patches of woody shrubs or coarse herbaceous plants away from the edge of the trees. This species has extended its range well north since Hebard’s 1934 Illinois study, which did not place it north of the state’s midpoint. I have found it throughout DuPage County in appropriate habitat, often in large numbers. In 2007 I found it at Wyalusing State Park, Wisconsin, at the junction of the Wisconsin and Mississippi Rivers; on the other hand I did not find it at Governor Dodge State Park in south central Wisconsin, so it may have extended into that state only along the Mississippi River. Red stars on the map mark the northernmost locations I have found to date in the Chicago region, bringing them within 1.5 miles of the southern borders of McHenry and Lake Counties. According to Blatchley (1920), females lay eggs in the pith of vines and other plant stems.

**Season.** This is the latest tree cricket, and perhaps the latest singing insect generally, to begin singing. First observed song dates have ranged 22 August-24 September, and last song dates 1 October-16 November. Population density varies considerably from year to year, perhaps a consequence of its recent northward range extension.

**Similar Species.** This is our largest tree cricket (though not a huge insect as the photos show). The extremely wide wings and raspberry coloration around the face and bases of the antennae distinguish this species from all other tree crickets in the region.

**Song.** The broad-winged tree cricket’s song is a beautiful long, slow, bell-like trill of the same pitch (3 kHz) and tonal quality as the notes of the snowy tree cricket. Broad-winged tree cricket song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/592a.htm) and at the Songs of Insects website (http://songsofinsects.com/crickets/broad-winged-tree-cricket). An excellent site for tree crickets generally is http://oecanthinae.com/index2.html.
Narrow-winged Tree Cricket (Oecanthus niveus)

The narrow-winged tree cricket is common throughout our area, and like the broad-winged tree cricket has a more northern range than the literature indicates. Expect it in deciduous forests, and in residential neighborhoods with trees and bushes. Males sing from elevated perches in trees, bushes and associated herbaceous plants.

**Season.** This species’ singing season starts later than those of many singing insects. First observed song dates have ranged August 6-27, usually in the earlier part of that span. Last song dates have ranged September 2-November 2.

**Similar Species.** The narrow wings rule out two woodland species, the snowy and broad-winged tree crickets. The orange-brown cap contrasting with an otherwise pale insect is the best distinguishing feature for the narrow-wing. Two-spotted tree crickets have dark heads and thoraxes, and the female two-spotted have the large wing spots. Davis’s tree cricket lacks the narrow-wing’s cap, and the line on the basal antenna segment is straight rather than hooked.

**Song.** The narrow-winged tree cricket’s song consists of short trills as does that of the two-spotted tree cricket, but their tone is not so discordant or strained as in the latter species, at least early in the season. The trill length and the spaces between trills are very consistent in the narrow-wing, forming a regular rhythm, unlike the variable rhythm nearly always present in the two-spotted’s song. Also, the intervals between trills always are distinct, longer than the brief pauses most characteristic of the two-spotted tree cricket’s song. The two-spotted’s song can contain some longer pauses, but the narrow-wing’s pauses do not contain the stutters that usually fill the longer two-spotted pauses. Also, the narrow-wing’s trills seldom exceed 6 seconds, the two-spotted’s frequently do. Narrow-winged trills often have a “chuwee” beginning lacking in the two-spotted. There is some overlap in the two species’ singing seasons, but the two-spotted tree cricket dominates the earlier air waves (July) while the narrow-wing is the one you probably are hearing later in the season (September-October). Care is needed, however, as the strained or discordant quality of the two-spotted tree cricket converges on the more soothing quality of the narrow-winged as the season progresses. Starting in September, the lengths and spacing of the trills or notes becomes the surest distinguishing factor. Narrow-winged tree cricket song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/584a.htm) and at the Songs of Insects website (http://songsofinsects.com/crickets/narrow-winged-tree-cricket). An excellent site for tree crickets generally is http://oecanthinae.com/index2.html.

Photos. Above, male. Right, spots on basal antenna segments, and below, female.
The pine tree cricket associates strictly with coniferous tree species. Though they are limited to conifers, they apparently are excellent dispersers, as I found them common at Fermilab in widely separated groves of spruces, cedars and pines. Nancy Collins has observed them on herbaceous vegetation early in the season, which could be an important dispersal time. I expect to find them in Lake County, Indiana, to fill out the region map.

Season. Pine tree crickets sing until frost, mainly at night though they can begin during the afternoon, especially later in the season. They begin as early as late July.

Similar Species. This beautifully marked tree cricket is a magnificent match to its habitat, as the above photo shows. No other tree cricket has this habitat association in the region, nor this color pattern.

Song. Their song is a high-pitched (around 3 kHz), continuous trilling tone, but the absence of resonating surfaces in conifer foliage limits the volume. A chorus of many individuals is unmistakable, however, once one learns to recognize it. Pine tree cricket song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/587a.htm) and at the Songs of Insects website (http://songsofinsects.com/crickets/pine-tree-cricket). An excellent site for tree crickets generally is http://oecanthinae.com/
This species shares our meadows and prairies with the Forbes’s tree cricket. It seems to have a stronger association with herbaceous plants, most commonly found on grasses and fine-stemmed, soft herbaceous plants, and seldom in trees. Queen Anne’s lace was reported as popular for oviposition at a New York site, with occasional use of asters, small goldenrods, and common ragweeds.

**Season.** Members of this species begin singing in August, and continue into October. I have found them as early as August 6 and as late as September 26, but I expect to find them earlier and later than these dates.

**Similar Species.** While this cricket is consistently pale, so too are some Forbes’s tree crickets. Patterns of spots on the basal two antenna segments help to identify members of this species. In particular the well-separated smaller, rounder outside spots on the basal antennal segments (see photo, lower right ) are characteristic.

**Song.** Continuous high-pitched (4 kHz) trilling may be indistinguishable (to the ear) between this and other meadow-dwelling tree cricket species. However, it has a distinctly lower pulse rate than the others at 40/second at 25C, and so its presence can be established through sound recordings. Four-spotted tree cricket song recordings can be found at the Songs of Insects website (http://songsofinsects.com/crickets/four-spotted-tree-cricket) and at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/582a.htm). An excellent site for tree crickets generally is http://oecanthinae.com/index2.html.
Say’s Trig (Anaxipha exigua)

I first found these small crickets climbing in large numbers in the tall grasses around the dam at Blackwell Forest Preserve’s McKee Marsh in 2007. They can occur in upland woods, but are more abundant in low wet areas. I have found them in isolated shrubs in areas with little or no herbaceous growth, but they are more abundant when plants are denser.

**Season.** Males sing beginning in late July or early August. First song dates have ranged 18 July-6 August. Last song dates have ranged through October.

**Similar Species.** Say’s trig, like the ground crickets, is small, usually hidden, and not seen nearly as often as it is heard. It is tan with the end of the abdomen black, distinctive darker stripes forming a V on the face. The paler overall color and dark facial stripes below (in front of) the eyes readily distinguish this species. The photos show a short-winged female (above), a male (right) and a long-winged female (lower right). The spring trig has an all dark head, an earlier season (the possibility of overlap in early July needs to be sorted out), and a different habitat of mesic meadows and prairies.

**Song.** The song is a rapid, high-pitched trill, the pulses too fast to count (on the order of 40 per second). The tone, which has been described as “silvery,” has a beautiful quality. The long trill usually begins with a distinctive, abrupt “chuwee…” Usually the male sings from a perch elevated above the ground, though his exact location can be difficult to place. The song is audible to most people at 7 kHz, and fairly loud when the male finds a good song perch (though usually the song is not as loud as those of most ground crickets). The song of the handsome trig is composed of sharper pulses that seem to have a clicking or percussive attack. Occasionally, Say’s trigs produce a song composed of short trills rhythmically alternating with spaces, the pattern resembling that of the confused ground cricket (habitat different, however).

Say’s trig’s song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/616a.htm) and at the Songs of Insects website (http://songsofinsects.com/crickets/says-trig).
Spring Trig (Anaxipha vernalis)

This is a relatively southern, early season species of mesic to moist, grassy prairies and meadows. It was first formally described by Walker and Funk (2014). I found it common in the restored prairie at Connor Prairie near Indianapolis during a bio-blitz there in June 2013. Later I heard scattered individuals in Fulton County on June 24, and realized that some puzzling records from earlier years place it in DuPage and Kane Counties as well, though as few widely scattered individuals. The species appears to have a rapid decline in density in the region from south to north, but more early season survey work will be needed to clarify this. Lisa Rainsong also has noted a thinning of spring trigs northward in the Cleveland area.

**Season.** My few observations in the region sketch this species’ season between mid-May and mid-July, but this needs to be refined. At Connor Prairie it sang from early to mid-morning, was quiet through the middle of the day, then resumed in the late afternoon or early evening. At Goose Pond in southern Indiana in 2016 the pattern was much the same, but a very few individuals continued to sing through the mid-day, and the late afternoon increase tailed off considerably at dusk.

**Similar Species.** Physically the spring trig resembles Say’s trig. In addition to the habitat and season difference, spring trigs have all dark heads in contrast to the Say’s trig’s paler head with diagonal darker stripes. Say’s trig has a dark stripe on the femur that is lacking in the spring trig.

**Song.** The song is, to the ear, much like Say’s trig’s “silvery trill” with a “chuuwee” start. Trills were shorter at mid-day than at other times at Goose Pond, sometimes lasting only 5 seconds. Recordings I made at Connor Prairie (at 61°F) had a peak frequency of 5.2kHz (a little lower in pitch than Say’s trig), with 36 pulses/second. A recording at Goose Pond (at 73°F) had a peak frequency of 5.6kHz and 43 pulses/second.

Spring trig song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/632a.htm), and a sound recording in my blog at http://natureinquiries.wordpress.com/2013/11/18/sound-ideas-trigs/
**Handsome Trig (Phyllopalpus pulchellus)**

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So far I have found handsome trigs only in Indiana and at one site in southern Cook County. They have been described as an edge species, and that has been true so far in my own observations. All have been close to wetland areas, where woody shrubs may or may not be mixed with denser herbaceous vegetation. Their numbers in the region have been low and their distribution spotty.

**Season.** My limited observations so far have ranged between 11 August and 24 September.

**Similar Species.** This tiny cricket’s black, red-brown and yellow color pattern is distinctive.

**Song.** Their songs are of the same pattern (rhythm and speed) and pitch as the widespread and common Say’s trig, an irregular or broken trill around 7 kHz, but each pulse seems to begin with a mechanical click. This appears in the sonogram (above right) as a very narrow pulse compared to those of other trigs (see the link to my blog post). Handsome trig song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/641a.htm) and at the Songs of Insects website (http://songsofinsects.com/crickets/handsome-trig). I also have posted a recording in my blog: http://natureinquiries.wordpress.com/2013/11/18/sound-ideas-trigs/
**Northern Mole Cricket (Neocurtilla hexadactyla)**

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Northern mole crickets have proven to be relatively elusive in the study region, though I was encouraged by additional populations I found in 2015 and 2016. I first found them at Houghton Lake, the Nature Conservancy site in Marshall County, where their deep chirping came from wet prairie areas within the site’s lake plain. Some were singing by mid-afternoon, though more sang after dark. That first impression was somewhat misleading, as subsequent discoveries all have been at night. My only Illinois locations to date are Midewin National Tallgrass Prairie in Will County, and Illinois Beach State Park, but the closure of most public sites at sunset has limited my ability to search other counties. According to information in the Singing Insects of North America website, mole crickets eat both animal and plant matter. Females lay eggs in their tunnels and stay with them, but it is not known whether they actively protect them. They overwinter as nymphs, and may need two years to mature. The places I have found them have been wetland edges or wet prairies that do not seem unusual enough to explain why these crickets are as limited in their distribution as they seem to be.

**Season.** Limited observations so far have ranged from 19 July to 14 September.

**Similar Species.** This is our largest cricket by far, reaching 2.5 inches in length. The front legs are modified for digging, resembling those of a mole. They normally remain out of sight in their tunnels, but if seen could not be mistaken for anything else.

**Song.** The song is a very low-pitched (2 kHz), deep rhythmic chirp that could be rendered “warg warg warg…” The chirps are produced at a rate of 1-3 per second. Northern mole cricket songs and photos can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/351a.htm) and at the Songs of Insects website (http://songsofinsects.com/crickets/northern-mole-cricket). I have posted a recording at http://natureinquiries.wordpress.com/2014/01/13/sound-ideas-an-odd-trio/
Katydids
Family Tettigoniidae

Technically the katydids are separated from crickets in having feet with four rather than three segments. In our informal practice we see that katydids generally resemble grasshoppers but with long, threadlike antennae instead of the grasshoppers’ short stubby ones. Though the antennae and song production are more similar to those of crickets than grasshoppers, they may have evolved their singing behavior separately (Gwynne 2001).

Like the crickets, most katydids spend the winter in the egg form. In some species, eggs may range 1–3 years in dormancy before hatching, apparently a way of dealing with environmental variation between years (Gwynne 2001). The predaceous katydids (Roesel’s katydid and the protean shieldback) are exceptions. Katydid nymphs likewise develop through several stages, or instars, molting the old exoskeleton and expanding into a new one for each graduation between instars. Only the adults may have fully developed wings, though these sometimes may be short and appear to be undeveloped in some individuals.

During courtship there often is antennal contact, fencing-like, between male and female. Practically all katydids include courtship feeding (*Microcentrum* an exception), the males providing females with a nutritious mass called a spermatophylax (Gwynne 2001). The female consumes the spermatophylax while fertilization is taking place, which protects the sperm and enhances offspring survival.

The predaceous katydids are predators and scavengers. Otherwise, our katydids are vegetarians (especially *Phaneropterinae*) or omnivores. Coneheads (*Neoconocephalus*) mainly eat seeds (Gangwere 1965). Katydids in turn are preyed upon by birds and mammals, and are the targets of insect predators and parasites including horsehair worms, wasps and flies. The horsehair worms get into katydids that consume other insects containing the immature worms. Wasps and flies home in on singing males. Here I am following the systematic scheme on the Singing Insects of North America website, as it is the most comprehensive and up-to-date compendium for the entire group and is so accessible. It places all our katydids in family Tettigoniidae. Our species then fall into five subfamilies. There are enough species that I expand the following scheme down to the genus level for clarity.

Subfamily Conocephalinae (meadow katydids: two genera included locally).

- **Genus *Conocephalus*** (smaller meadow katydids: local species include the long-tailed, short-winged, slender, woodland, black-sided, prairie, and straight-lanced meadow katydids).

- **Genus *Orchelimum*** (larger meadow katydids: local species include the gladiator, black-legged, long-spurred, delicate, dusky-faced, stripe-faced, nimble and common meadow katydids).

Subfamily Copiphorinae (coneheaded katydids: local species, all in genus *Neoconocephalus*, include the sword-bearing, Nebraska, round-tipped, robust, marsh, and slightly musical coneheads).

Subfamily Phaneropterinae (false katydids: local species are in three genera).

- **Genus *Amblycorypha*** (round-headed katydids: local species include the oblong-winged and rattler round-winged katydids).

- **Genus *Microcentrum*** (angle-wing katydids: our local species is the greater angle-wing).

- **Genus *Scudderia*** (*Scudder’s bush katydids: local species include the curve-tailed, fork-tailed, broad-winged, northern and Texas bush katydids*).

Subfamily Pseudophyllinae (true katydids: one local species, the common true katydid).

Subfamily Tettigoniinae (shieldback katydids: local species are in two genera).

- **Genus *Atlanticus*** (protean shieldback).

- **Genus *Roeseliana*** (Roesel’s katydid).
The long-tailed meadow katydid, like the black-sided meadow katydid, is a wetland species that can be abundant, but occurs in relatively few places and seldom with the black-sided. They are, however, capable of dispersal between wetlands, as some long-winged variants have been attracted to lights well away from suitable habitat.

**Season.** According to references, this species is active August to September. My limited observations of adults have ranged from August 16 to September 26.

**Similar Species.** Meadow katydids have relatively stout bodies and membranous wings that do not cover much of the abdomen when viewed from the side. They thus resemble grasshoppers more than do other katydids (though all the katydids are more closely related to crickets than to grasshoppers). The long-tailed meadow katydid is unusual in having two color variations: one is all brown, the other is a mix of brown and green colors. Both forms can occur together, for instance in the dolomite prairie at Waterfall Glen Forest Preserve in DuPage County. Both genders can occur in either color. The English name comes from the female’s extraordinarily long ovipositor, which is straight like those of the other members of its genus.

**Song.** In reference recordings the song is a continuous steady buzz with clearly distinguished though fairly rapid pulses (pulse rate about twice that of the black-sided meadow katydid’s song). The song of this species is too high pitched for older ears to hear without a frequency altering device (I once saw a male whose wings vibrated without my hearing anything, from perhaps a meter’s distance). A long-tailed meadow katydid song recording can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/228a.htm).
Short-winged Meadow Katydid (Conocephalus brevipennis)

This probably is the most abundant katydid of our region, forming dense aggregations of singing males in tall grass and sedge areas, at woods edges and along trails as well as in the open.

**Season.** According to the literature, males sing July to September. Here they seem to have a later season. So far, observed song dates have ranged August 1-October 19.

**Similar Species.** This is a relatively small species, and members of its Conocephalus genus in general are smaller than the Orchelimum meadow katydids. Also, female Conocephalus have straight ovipositors while those of Orchelimum females are curved. The short-winged meadow katydid is green with a brown back. Its most distinctive feature is the yellow-orange rear part of its abdomen. Nearly all have wings covering slightly more than half the abdomen, but rare long-winged individuals can be found. Nymphs are a brighter green; mature individuals often become somewhat browner. The femur pattern of twin brown stripes with a clean green area between them appears to be distinctive, in nymphs as well as adults. See the account for the prairie meadow katydid (C. saltans).

**Song.** Its song is a continuously repeated 2-second pattern, 2-3 evenly spaced ticks for 1 second alternating with a rattling buzz that also lasts 1 second (can be faster at warmer temperatures, slower when cold). The rhythm is so precise as to seem mechanical, metronome-like. Though children and young adults have no trouble hearing it, the song is high enough in pitch (well above 10 kHz) that I need the SongFinder device (reference recordings can be misleading in this regard; I can hear them, but not the song as it is produced in the field).

Short-winged meadow katydid song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/234a.htm) and at the Songs of Insects website (http://songsofinsects.com/katydid/short-winged-meadow-katydid).
Slender Meadow Katydid (Conocephalus fasciatus)

The slender meadow katydid’s preferred habitat appears to be areas of tall grass and forbs, especially damp spots, prairies, meadows, and wetland edges. It is locally common but not so universally distributed as the short-winged meadow katydid.

**Season.** So far, observed song dates have ranged July 10-October 1. The July 10 date was in the unusually early season of 2012. Otherwise, first song dates have been in August. These begin singing earlier than do short-winged meadow katydids.

**Similar Species.** Among the small meadow katydids of our area, this is the only one that always has long wings. In contrast with the rare long-winged individuals of other small meadow katydid species, slender meadow katydids have green abdomen tips, including male cerci and most of female ovipositors. Femurs of nymphs and adults are green with scattered black specks.

**Song.** The song is like that of the short-winged meadow katydid in being too high pitched for older unaided ears (10-20 kHz). The rattling buzz is longer (often 10 or more seconds), preceded by usually 3-4 (sometimes more) buzzing or tapping ticks. Singing is continuous except when the male is disturbed. The song’s timing clearly lacks the metronomic precision of the short-winged’s song. The wings do not visibly vibrate. Members of this species seem to prefer higher song perches than do short-winged, and on the stems of forbs rather than grasses or sedges. Slender meadow katydid song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/231a.htm) and at the Songs of Insects website (http://songsfinsects.com/katydidslender-meadow-katydid).
Woodland Meadow Katydid (Conocephalus nemoralis)

This is a species of open woodlands and woods edges. So far I have found them mainly in sand soil areas. McCafferty and Stein regard it as “somewhat uncommon in the northern part” of Indiana. Blatchley mentions that it has been observed ovipositing in decaying wood. My only Illinois location to date is the Gensburg Prairie.

Season. So far, the observed song dates in this study have ranged August 18-September 26. Some observers have found it singing well into the fall in other parts of its range.

Similar Species. Among the meadow katydids of our area, only this species and the long-tailed meadow katydid are all brown. The woodland meadow katydid occurs in dry areas in or adjacent to woods, while the long-tailed meadow katydid is a wetland species.

Song. The song’s pattern resembles that of the striped ground cricket, with occasional bursts of stuttering ticks added between the brief, rapid buzzes. It is softer and higher pitched than the ground cricket’s song, though, and older people may need the pitch-reducing SongFinder device to hear it. Singing is continuous except when the male is disturbed. Song perches are within 3 feet of the ground. So far I have heard them singing between 10 a.m. and 3 p.m. Woodland meadow katydid song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/233a.htm) and at the Songs of Insects website (http://songsofinsects.com/katydid/woodland-meadow-katydid).
Black-sided Meadow Katydid (Conocephalus nigropleurum)

I have found black-sided meadow katydids in marshes with tall grasses and sedges, but always among or adjacent to coarse-stemmed plants including cattails, willows or other woody plants. They seem to occur in relatively few places, but sometimes are locally common. I have found them with long-tailed meadow katydids at the east end of the dolomite prairie at Waterfall Glen Forest Preserve, and at Indiana Dunes State Park, but usually those two species do not seem to occur together despite similar habitat preferences. Some old references point to pine cone-like bud galls of willows as one oviposition site for this species, Blatchley (1920) mentions grasses as another, and Lisa Rainsong has observed oviposition in cattails in Ohio. She also has seen them feeding on cattail leaves and seeds.

**Season.** My observations to date are too limited to give a strong sense of its singing season. I have found adults as early as August 7 and as late as September 24.

**Similar Species.** No other local katydid has so much black on the abdomen. The head and the sides of the thorax are brown, eyes black. Otherwise there are two color variants dominated by green or brown, with varying amounts of yellow or tan in the legs.

**Song.** Sounds like a tiny snare drummer in recordings, has a rapid tapping quality when heard through the SongFinder. Its song goes on for minutes at a time, but is too high pitched for many people (including me) to hear unaided. In most areas where I have found it, any singing I might have heard through the SongFinder was drowned out by the songs of the abundant black-legged meadow katydids. Black-sided meadow katydid song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/229a.htm), and in Lisa Rainsong’s blog: (http://listeninginnature.blogspot.com/2013/10/hes-gorgeous-but-can-he-sing.html).
To date I have found this species only in the black oak savanna at Illinois Beach State Park and in the more elevated portion of the Gensburg Prairie. According to references, this species prefers grasses on dry poor soil, and may be limited to remnant prairie and savanna habitats on sandy soils in the region. Hebard said the prairie meadow katydid ranges throughout Illinois, but he found it only in sand areas along Lake Michigan and one near the Indiana border close to the Kankakee River (another likely sand area). Most if not all records from northern Indiana appear also to be from sandy areas. Blatchley describes it as relatively less active than other *Conocephalus*, spending much time on the ground rather than on plant stems.

**Season.** References give the season as August and September. My few observations to date all have been in that time frame. The few singing individuals observed were mid-day through the afternoon.

**Similar Species.** The three species of *Conocephalus* most likely to be confused in the region are *brevipennis*, *saltans*, and *stric-tus*. By far the most abundant, widely distributed and broadest in habitat range is *brevipennis*. It is distinguished by wings that are more than half the length of the abdomen, hind femurs that generally are green with a pair of narrow brown lengthwise lines, and a tip of the head that narrows anteriorly. Next in abundance is *stric-tus*, a dry soil species. It is larger than the others, the wings are about half the length of the abdomen, and the hind femur has a prominent diffuse-edged black lengthwise line. In *saltans* the wings are only a quarter the length of the abdomen, the femur pattern is like that of *brevipennis* but with a brown rather than green ground color, and the tip of the head expands both in profile and as viewed from above. All three species can have occasional long-winged individuals.

**Song.** The tiny wings do not produce a very loud song, faint even in comparison to other members of its genus. Through the SongFinder, to my ears the song is a rapid ticking sound which resolves to brief buzzes at close range. Prairie meadow katydid song recordings can be found at the Singing Insects of North America website (http://entomology.ifas.ufl.edu/walker/buzz/225a.htm)
Straight-lanced Meadow Katydid (Conocephalus strictus)

The straight-lanced meadow katydid prefers grasses growing on poor soil in dry areas. The only places I have found large numbers of them together are in sandy soil areas.

**Season.** According to the literature, the activity period for this species is August to October. They were singing by July 20 at Kankakee Sands in 2012, but many species were singing early that year. I found a male as late as 26 September in 2015.

**Similar Species.** This species typically is short-winged like most Conocephalus meadow katydids, but the male lacks the yellow abdomen tip of the short-winged meadow katydid and, as usual, the cerci are different. The cerci are brown, relatively long and straight, with elongated flattened tips and inward pointing teeth set well back toward the base. The female’s ovipositor usually exceeds the body length. Another feature that may prove helpful is a diffuse black stripe down the side of the femur. See also the prairie meadow katydid account.

**Song.** The song is a continuous buzzing, high-pitched at 10-20 kHz. That buzz changes speed, alternately slowing and speeding up about every 15-30 seconds (Alexander, Pace and Otte 1972). I need the SongFinder to hear it. Straight-lanced meadow katydid song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/238a.htm) and at the Songs of Insects website (http://songsofinsects.com/katydids/straight-lanced-meadow-katydid).

Photos: female top (uncommon long-winged variation), male above, cerci magnified right.
Dusky-faced Meadow Katydid (Orchelimum campestre)

Thomas and Alexander (1962) found the dusky-faced meadow katydid to be common, occurring in a wide range of marshes, and especially associated with grasses. I have found it only in marshes dominated by native plants, especially grasses and sedges, and these are becoming rare as invasive wetland plant species take over. The largest population in the region is at Midewin National Tallgrass Prairie in Will County. They may be more abundant south of the region, where invasive plants are not so dominant.

Season. Observed song dates have ranged August 8 to September 28, with an increase in singing from early afternoon into the night.

Similar Species. The appearance of this species is distinctive, its green legs very unlike those of the black-legged meadow katydid, and the head pigmented rather than pale. The head typically is amber-colored and marked with fine lines and dots of reddish brown, while that of the stripe-faced meadow katydid has a bright stripe down the center of the tan to white face. Some cam-pestre in populations close to Lake Michigan have green-tinged to bright green faces. This makes them similar to delicate meadow katydids (O. delicatum), but the females’ ovipositors are too short, and the males’ songs lack the doubled ticks of that species.

Song. The song is much quieter than that of the black-leg, and is variable. The buzz can be very long (from 4 seconds up to 3 minutes), commonly preceded by at least 6-8 ticks, but sometimes as many as 150 ticks without a buzz,, and sometimes there are buzzes without ticks. The ticks are fairly quick but irregularly spaced, and not doubled. Dusky-faced meadow katydid song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/266a.htm) and in Lisa Rainsong’s website (http://listeninginnature.blogspot.com/2015/10/has-anyone-seen-me.html)

Photos: above, whole insect, and head of a green-faced one. Above right, face view of a recently mated female, and dorsal and ventral views of a male’s cerci. Below right, lateral view of the female’s ovipositor.
Stripe-faced Meadow Katydid (Orchelimum concinnum)

The only place I have found this species to date in the region is Illinois Beach State Park. There it is abundant in swales and in wet grassy areas along the Dead River that are free of cattails and invasive wetland plants. Hebard gives swamps and bogs as habitat. Early descriptions placed it in dense grasses and sedges near ponds and streams, and around tamarack swamps and lakes. Thomas and Alexander found it to be very limited in its distribution, occurring in “a few northern relict marl bogs and other alkaline situations.”

**Season.** Newly matured individuals are singing and mating by mid-August. I have found them continuing into the first week of October. They begin singing around mid-day and continue into the night, peaking in the late afternoon into early evening.

**Similar Species.** This species has an interesting color development sequence. Nymphs and newly matured adults are mostly red-brown, both in body color and in the central facial stripe. The ground color of the face is pale tan, and the edges of the facial stripe are a little diffuse. As the season progresses, the body becomes entirely green to blue-green, the facial stripe darkens to black or very dark brown, and the face ground color lightens, in some cases to white.

**Song.** The song is high pitched; I needed the SongFinder to hear it from more than a few feet away. The songs at Illinois Beach State Park began with 3 or 4 ticks in some individuals, 6 or 7 in others, a little irregularly spaced, the last one leading quickly and directly into the buzz, which lasted a few seconds. The buzzes and tick sequences are longer, generally, in dusky-faced meadow katydids. Stripe-faced meadow katydid song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/253a.htm).
Gladiator Meadow Katydid (Orchelimum gladiator)

This is the common, early season large meadow katydid species widely distributed in our area. They begin in relatively wet places, though they may later move into drier meadows adjacent to low spots. Sometimes they can be found in pure stands of reed canary grass.

Season. Gladiator meadow katydids begin singing in June or early July (observed first song dates June 14-July 9 in different years). Usually they are done in July, but a few may extend into August (observed range of last song dates July 12 -September 3). A few singing in a marsh in McHenry County on 3 September 2015 were anomalous.

Similar Species. No other generally green large meadow katydid matures this early, or is this abundant. That said, there is little to separate this one structurally from the relatively uncommon, later season, drier habitat, common meadow katydid. Careful study of the precise contours of the very similar cerci, and of the shape of the edges of the sides of the pronotum (the saddle-like covering of the thorax) are needed to separate the two species (see the account for the common meadow katydid).

Song. The song is a somewhat rattling, often long whirring buzz (commonly 6-8 seconds), increasing in volume at the end and usually followed by 2-3 very soft ticks. The sound of the buzz can be confusingly similar to that of another early season katydid in a completely different group, the protean shieldback (both center around 15 kHz). The shieldback’s buzz is continuous or at least much longer than that of the gladiator, and lacks the gladiator’s distinctive ending. The lack of loud ticks, their lesser number, or their more regular spacing when present, along with the habitat difference, separates the song from that of the common meadow katydid. The ticks are more separate and deliberate relative to the black-legged meadow katydid, and seem attached to the end rather than the beginning of the buzz, but there is little overlap between the seasons of the two species. This one commonly sings into the night. Gladiator meadow katydid song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/263a.htm) and at the Songs of Insects website (http://songsofinsects.com/katydids/gladiator-meadow-katydid).

Photos: above, male; above right, female; below right, male cerci.
The black-legged meadow katydid starts out as a species of the water’s edge, but ultimately may disperse 50 or more meters (observed more than 200) from the water into dry meadows and thickets. It remains most abundant near water, however. Late in the season they sometimes sing from up in trees. This becomes by far the most abundant *Orchelimum* after late July. Females mate only once, preferring territorial dominant males, and lay eggs in plant stems (Feaver 1977). Feaver also found heavy mortality from horsehair worms in this species, killing 50% or more shortly after they molt into their adult instar.

**Season.** Males sing mid-July to late October or early November (first songs ranged July 18-August 15 in various years, last song dates October 9-November 5). They begin to sing 4-5 days after their final molt (Feaver 1977). Songs are produced early morning (by at least 8:20 a.m., later on cool days) until after dark.

**Similar Species.** The black-legged meadow katydid is the common, colorful *Orchelimum* of our area, green of the body having a slightly bluish tinge, with yellow on the femurs of the first two pairs of legs, black tibias, whitish heads and red eyes. None of our other species have this combination of characteristics.

**Song.** Meadow katydid songs all are based on a tick-and-buzz pattern, the ticks being separate single sounds and the buzzes being continuous rasps of the sound-producing structures of the wings rubbing together. Black-legged meadow katydids have just a few (commonly 3) quick, evenly spaced ticks between the buzzes, the ticks running into the buzzes, and there is a regular continuing rhythm of alternating ticks and buzzes. A tick-and-buzz set lasts 2-4 seconds: “tickety-buzz.” Though much of the song is very high pitched, most people have no trouble hearing it (there is sufficient energy in the 10-15 kHz range). See gladiator and common meadow katydid song descriptions for further distinctions. Black-legged meadow katydid song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/262a.htm) and at the Songs of Insects website (http://songsofinsects.com/katydid/black-legged-meadow-katydid).

Photos: male above, female below right, cerci (claspers at end of male’s abdomen) above right.
Long-spurred Meadow Katydid
(Orchelimum silvaticum)

This one is arboreal, often found at woods edges. Males may sing from trees, shrubs or herbaceous stems. The northern edge of this species’ range occurs in the region. (northernmost known Illinois locations are indicated by stars on the map) I have found them to be abundant in suitable habitat in the southern counties, but haven’t found them at all in the northern ones.

**Season.** I have found these singing as early as August 22 and as late as October 17, but this should not be taken to be the full extent of the song period. I have heard them as early as 10 a.m. and later than 10 p.m.

**Similar Species.** The long-spurred meadow katydid has the general body form of the large meadow katydids. It is a late season species that often prefers woody plants. Its activity period does not overlap significantly with that of the early season gladiator meadow katydid. Common meadow katydids are more typical of herbaceous vegetation in open habitats. Black-legged meadow katydids are much more colorful. The extraordinarily long, pointed inward cerci teeth (photo lower right) give the species its English name and are unmatched by our other *Orchelimum* species. Also, the eyes often are a brighter red than those of other species.

**Song.** The ticks are so fast that they are almost like a rattling slower buzz. They lead directly into the actual buzz, then there is a space of quiet between tick-and-buzz groups. Unlike other meadow katydids, the tonal quality of the ticks is identical to that of the buzz (or perhaps they are better described as very brief buzz segments rather than ticks). The frequency range is very broad, at 8-20 kHz, but a relatively small amount of the song’s energy is in the 8-15 kHz range, so that I need optimum conditions (calm, with few other sounds) to hear it unaided. Long-spurred meadow katydid song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/261a.htm) and at the Songs of Insects website (http://songsofinsects.com/katydid/long-spurred-meadow-katydid).
Nimble Meadow Katydid  
(Orchelimum volantum)

I first found this species in a pickerel weed patch (photo lower right), in water knee to mid-thigh in depth, in one of the Grand Mere lakes in Berrien County. In 2016 I found a population at Illinois Beach State Park in arrowheads (Sagittaria sp.). Hebard found them only where the water was at least waist deep. They are well named, quick to fly up to 20 feet when approached. One did something totally unexpected: he dove beneath the water and hid among the submerged stems. This unique behavior speaks of adaptation to life over deeper water than the habitats favored by other meadow katydids. This poses limits, however, especially considering that they apparently cannot live in heavier-stemmed emergents such as the yellow pond lily (Nuphar advena) or the lotus (Nelumbo lutea), which have come to dominate waters once known to host this meadow katydid.

Season. Blatchley gives their season as mainly August-September; Bland extends it to mid-October.

Similar Species. The head is colored like that of the black-legged meadow katydid, the hind femora green like those of dusky-faced meadow katydids, but with brown tibias, and it is the same size as those species, but the most distinctive feature is the yellow end of the abdomen, reminiscent of the much smaller short-winged meadow katydid. The pointed cerci are distinctively shaped, yellow with brown tips.

Song. The song reminds me of the woodland meadow katydid’s pattern, rapidly repeated brief striped-ground-cricket-like buzzes, except that the ticks between the buzzes are few, and I can hear the song clearly unaided (i.e., without needing the pitch-lowering SongFinder device). The buzzes have a slightly rattling quality and are produced at a rate of about 2 per second. Nimble meadow katydid song recordings can be found at the Singing Insects of North America website (http://entomology.ifas.ufl.edu/walker/buzz/248a.htm) and in my blog (https://natureinquiries.wordpress.com/2015/10/02/nimble-meadow-katydid/).
The name is misleading, as these are not nearly as abundant as the gladiator and black-legged meadow katydids (though Blatchley described them as the most common katydid in Indiana in 1920). Nearly every spot I have found them has been drier and more distant from water than the typical gladiator or black-leg site. They can occur in recently disturbed sites as well as established prairies, and seem to be most abundant over sand soils. Some places with relatively large populations are the Bong Recreation area in Kenosha County, Braidwood Dunes in Will County, and Gensburg Prairie in Cook County. Females lay eggs in plant stems, and may prefer dry plant stems (Feaver 1977).

Season. So far I have heard them as early as July 20 at Kankakee Sands (August 18 in DuPage County) and as late as September 27. They sing at least from mid-morning until late dusk.

Similar Species. As this is a large meadow katydid and generally green in color, it is similar to the gladiator and long-spurred meadow katydids. Cerci shape easily distinguishes it from the long-spurred, if there is uncertainty about the habitat. Song and season should be enough to separate common and gladiator meadow katydids, but there are slight differences in the contours of the cerci (see http://entnemdept.ufl.edu/walker/buzz/g248a.htm) and of the pronotum boundaries (see photos below).

Song. The song is distinct from that of the gladiator: the buzz often is shorter (up to 5 seconds), faster, and less rattling in quality (though not always), but more characteristic are the ticks. In fact the main need for distinction is between the common and black-legged meadow katydids, because these are active in the same part of the season. The common meadow katydid’s ticks extend over a longer time span than those of the black-leg, generally there are more ticks than in either the gladiator or the black-leg, but the most distinctive feature of their song is the irregular spacing of ticks. Usually there is a noticeable pause just before the buzz, but those at the Kankakee Sands site in Indiana produced an ending flurry of rapid ticks that blended with the buzz. Their song varies considerably with temperature, the buzz slowing to a rattle at lower temperatures. The irregular tick pattern is retained, though slowed. There is plenty of energy below 15 kHz, so most people can hear the song unaided. Common meadow katydid song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/258a.htm) and at the Songs of Insects website (http://songsofinsects.com/katydids/common-meadow-katydid).
Meadows and roadsides are home to this, our most common conehead. Numbers appeared to be quite low in the drought year of 2012, but quickly bounced back the following year. This is the conehead with the greatest dispersal ability among our species. Its southern range boundary has been mapped only to central Indiana and Illinois, and so it is one to watch for thinning in the southern part of the area as climate change continues. Females have been seen ovipositing on bluestem grasses, between the stem and the basal leaves. The young hatch in May in central Indiana (Blatchley 1920). The cone head may facilitate a nose-dive escape tactic, the insect holding still after dropping so as to blend with the grass stems (Faure and Hoy 2000).

**Similar Species.** The coneheads are distinguished from all other katydids by the protruding, cone-shaped extension of the top of the head past the eyes. The cone of this one is longer than that of the round-tipped conehead, with edges that are rounded out rather than pinched in as in the Nebraska conehead. The amount of black on the underside of the cone is intermediate between those other two species.

**Song.** The song consists of continuous rapid (4-6/second) ticks or short buzzes, at first starting at dusk and continuing into the night, but later in the season sometimes can be heard in afternoons (earliest noted 4:30 p.m.). The overall impression variously has been described as a distant steam locomotive and as a sewing machine. Though fairly high pitched at 12 kHz, the sound is loud enough to be recognized through the open window of a car driving past. Sword-bearing conehead song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/194a.htm) and at the Songs of Insects website (http://songsofinsects.com/katydid sword-bearing-conehead).

**Season.** Observed first song dates have ranged July 11-August 15. Last observed dates have ranged August 20-October 22.

Photos: above, male. Below right, female, (note the long straight ovipositor, its tip extending past the end of the wings, which gives the species its common name). Above right, face showing cone markings. All coneheads can be green or brown.
Slightly Musical Conehead (*Neoconocephalus exiliscanorus*)

References placed this species well outside our region, so it was surprising when, cruising the roads of the Indiana Dunes National Lakeshore at night in 2012, Gideon Ney and Nathan Harness of the University of Missouri recognized its songs and found one for me to photograph. Subsequently I have found them in several Indiana counties, with good densities in Fulton County around Lake Manitou. This is a wetland katydid in which the males sing from shrubs or tall, coarse herbaceous plants.

The slightly musical conehead was thought by its namer, Davis, to have a faint song, hence the name, but two decades later he described the volume as variable. He observed them devouring seed heads of *Spartina* grass. A female has been seen ovipositing in a grass blade, at dusk.

**Season.** Observations to date have ranged August 8-September 26. More observations are needed to determine their season. Like nearly all other coneheads, they are nocturnal singers.

**Similar Species.** The coneheads are distinguished from all other katydids by the protruding, cone-shaped extension of the top of the head past the eyes. This species has by far the largest cone of any of our coneheads, and it is entirely black beneath. The wetland habitat also rules out some others. As the photos show, both brown and green variants may occur. The enormous size range, typical of coneheads, results from females being much larger than males.

**Song.** The song is a continuous series of quick buzzes, around 3 per second. Perhaps the most remarkable aspect of this is that the males sing in unison, and are compelled to join the chorus. If one is disturbed, he quickly rejoins the production. The pitch is about the same as in the sword-bearing conehead, at 12 kHz, but the individual buzzes are louder and sharper than in that species. They are rougher, much briefer and more closely spaced than those of the Nebraska conehead. Slightly musical conehead song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/197a.htm) and at the Songs of Insects website (http://songsofinsects.com/katydidslightly-musical-conehead).
Nebraska Conehead (Neoconocephalus nebrascensis)

Season. The range of first song dates I have observed in the region is July 14-August 27. I have heard them as late as September 28. Nebraska coneheads often begin to sing right around sunset, when there is plenty of light, and continue into the night. On 15 August 2013 I found an unusual concentration of Nebraska coneheads singing at 3:45 in the afternoon, and singing in unison, at Houghton Lake in Marshall County.

Similar Species. None of our other non-wetland coneheads show this much black on the underside of the cone. Also, the side edges of the cone curve inward slightly. As in the other Neoconocephalus species, the overall color can be green or brown.

Song. Very loud, shrill, 1.5-second-long buzzes with 1-second pauses between, forming a distinctive continuous rhythm. The buzzes approach tones in their quality, but can hardly be called pleasing or musical, and are readily audible at 10 kHz. Nebraska conehead song recordings and photos can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/196a.htm) and at the Songs of Insects website (http://songsofinsects.com/katydid/nebraska-conehead).

The Nebraska conehead’s habitat is a vegetative mix, tall herbaceous and shrub understories of open woods, or scattered shrub areas in prairies or meadows not far from woods. It became clear in 2013, when I first spent time in every county in the region, that the Nebraska conehead decreases in abundance from south to north. They are very common in Fulton and Marshall Counties, I know of only one location in DuPage County where they exceed widely scattered individuals, and so far I have found none north of northern Cook County, though there is a historical record for McHenry County.

Photos: above, a green male in singing posture. Right, a brown male. The red star on the map marks the northernmost location found in this study.
Gideon Ney, Nathan Harness and I found abundant marsh coneheads at the Indiana Dunes National Lakeshore, and I later found them in the adjacent State Park. They were in herbaceous vegetation in wetlands. This species previously was documented only as far north as Tippecanoe County in central Indiana, and far southern Illinois, though it had been found farther north in Ohio (Erie County). It was first described from Vigo County, Indiana.

**Season.** Males were singing on August 8. I found them during the day on August 18 and September 8.

**Similar Species.** There are two wetland species with moderate length, pinched, unmarked cones in the region. The false robust conehead (see hypothetical species section) has a length of 49-68 mm, and its ovipositor is more than 1.2 times the length of the hind femur. The marsh conehead female’s length is 40-62 (smaller), and the ovipositor shorter than hind femur. Male marsh coneheads are 37-46 mm long, smaller than the female as is generally the case among the coneheads.

**Song.** The song is a fairly typical continuous conehead buzz, loud but not nearly so loud as the robust conehead. A definite crackle is audible in the song. Marsh conehead song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/186a.htm).
The round-tipped conehead can be found in roadsides and meadows, ranging from grassy areas to mixes of grasses, forbs and shrubs. It is locally distributed and seems to vary in numbers considerably from one year to the next. Published range maps suggest that our area is at the northern edge of this species’ range, but it is reasonably widespread and common in DuPage County. Oviposition is little known in coneheads. A round-tipped female was observed biting off the top of a grass stem and inserting her ovipositor into the revealed hollow end, according to SINA.

**Season.** First noted song dates have ranged August 4-September 2. Last song dates have ranged October 2-November 3. Males sing afternoons into the night (this is our only routinely day-singing conehead).

**Similar Species.** The cone is relatively short and round, compared to our other local conehead species. The robust conehead, which also may occur in our area, has a similarly proportioned cone, but lacks the black band near the tip though there may be a smaller, diffusely darkened area in some individuals.

**Song.** Long, loud buzzes, much longer than those of the Nebraska conehead though not as loud as those of the robust conehead. Sometimes there is a crackling quality that reminds some of an electrical short. Most people can hear the songs, which peak around 14 kHz.
Robust Conehead (Neoconocephalus robustus)

Hebard connected robust coneheads with sand areas, and while they are more abundant in such areas than elsewhere, I have found pockets of them or scattered individuals in clay soil areas (e.g., western DuPage County and eastern Kane). McCafferty and Stein associated them with "secondary field growth." I have found them in open woodlands, woods edges, weedy roadsides, prairies, and cornfields. Thus far, all sound recordings I have made in the region in an attempt to find false robust coneheads (N. bivocatus) either have been unambiguously this species or show an intermediate pattern. Gideon Ney has found such intermediates elsewhere in the bivocatus range, and is attempting to sort out the problem.

Season. Observed song dates in the region have ranged July 19-September 28.

Similar Species. The robust conehead has a cone similarly proportioned to that of the round-tipped conehead, but it lacks the black band near the tip though reportedly there may be a smaller, diffusely darkened area in some individuals. Walker, Whitesell and Alexander (1974), in distinguishing the robust conehead from its sibling species the false robust conehead, described it as preferring taller, more rank vegetation and flying when disturbed rather than dropping into the vegetation. The bivocatus song is not as loud, and has distinctive qualities in its pulses (see below) that give it more of a rattling sound. All our coneheads have both green and brown forms.

Song. The song is a very loud, moderately high-pitched continuous fast buzz, at 8 kHz readily audible at a distance from a moving car. At close range it is unpleasantly much louder than the song of any other conehead. Robust conehead songs show evenly spaced strong pulses, while false robust coneheads have pairs of pulses, one stronger in each pair, the spaces dividing the members of the pair being shorter than the spaces between pairs. Robust conehead song recordings and photos can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/195a.htm) and at the Songs of Insects website (http://songsofinsects.com/katydid/robust-conehead). I have posted a recording at http://natureinquiries.wordpress.com/2014/01/13/sound-ideas-an-odd-trio/
Oblong-winged Katydid (Amblycorypha oblongifolia)

The oblong-winged katydid lives in the forest understory, and shrubs and tall herbaceous plants in moist places. When they occur in open areas of tall herbaceous plants, there usually are woody plants nearby. Locally distributed and usually few, in some places in some years they can be heard singing in large numbers. I observed a female making single clicks in response to the songs of males around her, at Indiana Dunes National Lakeshore. According to Blatchley (1920), eggs are laid in the ground in moist soil, and take 2-3 years to hatch.

**Season.** The overall range of song dates over the years has been July 25-October 11. Early in the season they wait until after dark to sing, but later occasionally sing at mid-day.

**Similar Species.** The false katydids are larger than the meadow katydids, with less membranous, larger and more solid-colored wings. They lack the coneheads’ cones, and are less heavy-bodied than the common true katydid. Round heads are a prominent feature. This species and the rattler round-winged katydid have a rounder, less stretched out overall shape than do the bush katydids. They are smaller and lack the angularity of the greater angle-wing. The oblong-wing is most similar to the other common member of its genus, the rattler round-wing. They are larger, their wings are proportionately longer, and there are other technical features outlined at the Singing Insects of North America website at http://entnemdept.ufl.edu/walker/buzz/g001k.htm

**Song.** The oblong-winged katydid’s song sounds like “katydid,” with the first syllable relatively drawn out as though drawled (“deeyig-a-dig” is another possible rendering). Sometimes it sounds two-syllabled, “scratch-it” (Himmelman 2009) or “zeee-dik!” (Elliott and Hersberger 2007). The songs are several seconds apart, and are readily audible at 9 kHz. Oblong-winged katydid song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/007a.htm) and at the Songs of Insects website (http://songsofinsects.com/katydid/oblong-winged-katydid).

Photos: above, male. Right, female
The rattler round-wing is an insect of the undergrowth in open woodlands and forest edges. Song perches typically are closer to the ground than are those of oblong-winged katydids. Its range extends somewhat farther north than the literature indicates, as it occurs at Governor Dodge State Park in Wisconsin. Its song is not nearly as loud as that of the oblong-winged katydid, and it may prove to be more widespread and abundant as this survey continues. So far it seems to be spottily distributed, but common in the woodlands where it occurs. There also is considerable variation in numbers from year to year.

**Season.** First observed song dates have ranged July 7-28. Last observed dates have ranged August 23-October 4. This species sings at night, often beginning close to sunset.

**Similar Species.** See the account for the oblong-winged katydid (in sum, this one is smaller, and rounder of wing). As the photos illustrate, females have a color that is more blue-green than in males.

**Song.** The rattler round-wing’s continuous or long (2 seconds) slow rattling buzzes have distinguishable vibrations, hence the “rattler” name (vaguely reminiscent of a rattle-snake). The song’s moderately loud volume (pitch not too high at 12 kHz) can be largely buried when common true katydids are abundant in the same area. Sometimes the long rattle is preceded by a few shorter ones. Rattler round-wing song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/008a.htm) and at the Songs of Insects website (http://songsofinsects.com/katydid/rattler-round-winged-katydid).
Greater angle-wings are common on trees. Find them in forests, shade trees in residential neighborhoods, also in shrubbery and fencerows. Blatchley had no records north of Lafayette, Indiana, but said that it “probably occurs in small numbers in all parts of the state.” The eggs are glued in double rows on the sides of slender twigs roughened by biting (sometimes on the edge of a leaf or on another surface). They are grayish brown, oval, flat, 5.5x3mm. Each female lays at least 150-200. The eggs are deposited in September, usually at night, and hatch in May. Hatchlings have bodies 1/8 inch long, but with legs and antennae their overall length is an inch. Almost immediately they seek out leaves to eat (Blatchley 1920).

Season. First song dates have ranged July 22-August 17; last song dates have ranged October 2-November 3. Sings at night (noted as late as 3:45 a.m.), also sometimes in daytime especially later in its season (as early as 9:40 a.m.).

Similar Species. These katydids usually are out of sight in tree canopies, but occasionally one may fly low, landing on the ground or a low tree branch before climbing back to the heights. Its angular, relatively wide overall profile is distinctive. It is larger than either the oblong-winged or rattler round-winged katydid.

Song. The most typical song consists of distinct, fairly rapid separate ticks or clicks, in clusters, reminiscent of a rapidly ticking watch and lasting a few seconds. An alternate song, often beginning earlier in the season, consists of a loud “zik” or “tsip,” similar to the song of the fork-tailed bush katydid but louder, sharper edged, and usually produced from high in the canopy. Greater angle-wing song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/031a.htm) and at the Songs of Insects website (http://songsofinsects.com/katydids/greater-anglewing).
The curve-tailed bush katydid is found in shrubby meadows near woods edges, and open woodland understories. Though it may not occur in every such habitat, it is fairly well distributed. So far it seems to occur in small numbers where it is found. Females have been observed depositing eggs between the upper and lower surfaces of leaves (Riley 1874).

**Season.** The limited first song dates observed so far have ranged July 17-August 19, and last song dates August 22-October 10.

**Similar Species.** The bush katydids are very similar in overall appearance. Structurally distinguishing specimens requires close examination of external reproductive structures, drawings of which may be found at the Singing Insects of North America website at http://entnemdept.ufl.edu/walker/buzz/g060a.htm

In female curve-tailed, the ovipositor is green with a brown tip.

**Song.** The curve-tailed bush katydid’s song is a strange loud sound, like sand blocks being rubbed together deliberately 2-4 times (“zik-zik-zik”). Often these take the form of simple counting sequences (e.g., 2-3, 3-4, 2-3-4, 3-3-4). Each group in a sequence may take 1-3 seconds, the groups separated by 4-6 seconds, and sequences separated by more than 10 seconds. The volume increases from beginning to end in each group, and the songs are readily audible at 9 kHz. The number of syllables may be an indicator to females of a male’s quality. The sound quality is louder, sharper and raspier than the thinner sound of our other counting katydid, the broad-winged bush katydid. Curve-tailed bush katydid song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/061a.htm) and at the Songs of Insects website (http://songsofinsects.com/katydidscurve-tailed-bush-katydid).
The fork-tailed bush katydid can be found on tall grasses, flowers, trees, and bushes, especially on edges of meadows, marshes, etc. It perhaps mainly occurs in trees, both scattered and in forests. Egg-laying has been observed: a bit of the leaf edge is bitten off to provide admittance to the ovipositor, which creates a cavity between the surfaces before one or more eggs are injected (Blatchley 1920). They feed on plant material, including flowers.

**Season.** First song dates have ranged July 26-August 20. Last song dates have ranged September 10-October 11.

**Similar Species.** The fork-tailed bush katydid is smaller than most others in its genus. Reproductive structures are needed to distinguish this from other bush katydids (the forked structure visible in the male photos is the source of the species’ common name). The ovipositor is brown rather than the green of similar species. As shown in the photo, early-instar *Scudderia* nymphs are very colorful.

**Song.** Single “tsk” sounds, widely separated or sometimes at regular intervals of 2-3 seconds. These are similar to the secondary song of the greater angle-wing, but are lispy rather than sharp-edged in quality, are not nearly so loud (in part because they are higher pitched, 15 kHz vs. the greater angle-wing’s 9 kHz), and the song perch usually is relatively low. Fork-tailed bush katydid song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/063a.htm) and at the Songs of Insects website (http://songsofinsects.com/katydids/fork-tailed-bush-katydid).

Photos: above, female. Right column, clockwise from upper left: early instar nymph, female’s brown ovipositor, male reproductive structures lateral view and dorsal view.
I find broad-winged bush katydids in upland meadows, especially those with shrubs and forbs mixed into grasses. Their density seems to decrease from north to south in the region, though their range extends to the southern edge.

**Season.** First song date observations have ranged June 23-July 26. Last song dates have ranged August 2-September 28. Their season may go later in places where Texas bush katydids are few or absent, but this needs to be verified. Occasional counting songs (see below) may be produced during the afternoon, but those mainly occur after sunset. The day song is the main one broad-winged produce during daylight.

**Similar Species.** Wing proportion can be used to distinguish the broad-winged bush katydid (forewing length a maximum of around four times the width), but that ratio of length to width needs to be measured; it is not something that can be eyeballed.

**Song.** The broad-winged bush katydid, like the Texas bush katydid, has several songs. One seldom heard locally consists of single spaced clicks, slower than those of the greater angle-wing. The broad-wing also has fast-pulsed songs in daytime, each like a very quick, buzzing “katydid” and very similar to the corresponding song of the Texas bush katydid. The notes are more blended or blurred, less distinct than those of *texensis*, and with more (4-5) syllables. More distinctive is the nighttime song, which is the broad-winged bush katydid’s claim to fame. It has been described as the counting katydid, as it produces series of pulsed buzzes, adding 1-2 buzzes per group as it goes through a sequence of 5 or more such groups. It is distinguished from the counting sequences sometimes produced by curve-tailed bush katydids in the buzzes being less harsh, the sequences usually containing more than 3 groups, and the number of buzzes in groups increasing to more than 4 in the later groups. Broad-winged bush katydid song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/066a.htm) and at the Songs of Insects website (http://songsofinsects.com/katydid/broad-winged-bush-katydid).
Northern Bush Katydid (Scudderia septentrionalis)

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34-41mm

I had formed the impression that this species is rare, because I had heard only two individuals back in 2007. Then in 2016 I listened through the SongFinder pitch-lowering device and found them to be common. This was late enough in their season that I had time to find them in only a few more counties, but now I expect to find them in every county in the region. The species is arboreal, and also can be found in the undergrowth of open woodlands. Lisa Rainsong has found that northern bush katydids are attracted to light, and brought a male down to a bench with a pair of bright flashlights.

**Season.** This is the earliest bush katydid to sing. My observation dates have ranged July 13 to August 1. They probably are active later than that date, but by then the overlap between loud cicadas at dusk and loud common true katydids in the early evening drowns out their fainter songs. They begin to sing half an hour after sunset.

**Similar Species.** The song is distinctive. This species is smaller than other bush katydids, but distinguishing a specimen from other bush katydids would require study of external reproductive structures (see link under curve-tailed bush katydid).

**Song.** The northern bush katydid produces a distinctive, complex song in which series of at least six separate, quick ticks alternate with series of 5-9 discrete brief buzzes, a single round of ticks and buzzes extending over 5-10 seconds. Males also are known to produce low, spaced ticks which I have not observed.

Northern bush katydid song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/065a.htm) and at the Songs of Insects website (http://songsofinsects.com/katydids/northern-bush-katydid).
The Texas bush katydid is a species of meadows, prairies and old fields, and seems to prefer wetter sites. In DuPage County it is the most common bush katydid occurring in such habitats in some years, though it is not always to be found in them and generally does not occur in large numbers. Females lay eggs between the upper and lower surfaces of leaves (Blatchley 1920).

**Season.** First observed song dates have ranged July 14-August 6. Last song dates have ranged September 17-October 10. I did not hear this species at all in the drought year 2012, and only a few the following year.

**Similar Species.** The broad-winged bush katydid is the *Scudderia* species most likely to be found with the Texas bush katydid. Though the broad-winged has proportionately wider wings, in practice the distinction is not always easy to make in the field. In DuPage County the broad-winged seems to have an earlier-season activity period than does the Texas bush katydid. The easiest way to distinguish them is by their songs, especially their nighttime songs (see description below). The female is similar to the fork-tailed bush katydid, but her ovipositor is green rather than brown and she is larger. The male’s reproductive structures are shaped differently from those of other *Scudderia* species.

**Song.** The typical song produced after dark is called by some the slow-pulsed song. It lasts about 4 seconds, with some crescendo, like “dig-a-dig-a-dig…dig” (final note emphatic). During the day you are more likely to hear the fast-pulsed song, which is like a super-quick “katydid” (“dig-a-dig”), spaced as much as 3 or more minutes apart. The Texas bush katydid’s fast-pulsed song is distinguished from the similar day song of the broad-winged bush katydid in having 3 (occasionally 4) distinct syllables, not run together as those of *pistillata*. An exception that proved the rule was a *texensis* with a damaged wing that had a blurred song with 3 syllables (that individual is featured on the cover of this guide). There is a transitional time at dusk when both the slow-pulsed and fast-pulsed songs are produced. A final song, seldom heard locally in my experience, is a ticking, with faint individual ticks at 1-2 per second. Texas bush katydid song recordings and photos can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/062a.htm) and at the Songs of Insects website (http://songsofinsects.com/katydid/texas-bush-katydid).

Photos: above, male. Below right, female. Above right, close-up of male reproductive structures.
The common true katydid is abundant in our local forest tree canopies, especially in the southern part of the region (its distribution becomes more spotty in the Wisconsin and northernmost Illinois counties). Many katydids can fly, but this one is practically flightless. Sometimes they descend to the lower canopy, and rarely can be found on the ground, but their usual place high up in trees results in their being heard much more than seen. In the neighborhood around my home there are only 1-3 singing individuals in most years, and these show strong fidelity to their singing trees, sticking to the same tree through the entire season. The chosen trees are different from one year to the next. True katydids lay eggs in bark crevices or plant tissue, and overwinter in egg form. Blatchley reports that the eggs are dark slate color, flat and pointed at the ends, 6.5x2mm. Common true katydids eat tree leaves.

**Season.** Their singing season usually extends from July to October. Local first observed song dates have ranged July 7-31, and last dates September 25-November 5. Songs begin within the first half hour after sunset, though later in the season occasional songs can be heard during daylight hours. I have noted songs as late as 6:20 a.m., shortly before sunrise.

**Similar Species.** The heavy looking body, round profile and large size distinguish this species from all our others.

**Song.** The song is very loud, consisting of rasping pulses (usually two in our area, though members of some local populations produce sets of as many as four notes). Songs are separated from one another by spaces of one to a few seconds, with longer intervals and slower songs in cooler temperatures. One reason the songs seem so loud is their relatively low pitch for a katydid, with much energy in the 3-5 kHz range. Common true katydid song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/141a.htm) and at the Songs of Insects website (http://songsofinsects.com/katydids/common-true-katydid).
The protean shieldback is fairly common in open woods and brushy areas to grassy fields with dense tall herbaceous plants (but usually near woods). They were very abundant in 2007 in DuPage County, and were seen consuming dead periodical cicadas.

**Season.** Protean shieldbacks are predaceous katydids and have an earlier season than most other species because they don’t need to wait for plant growth. Their season is relatively brief. First song dates have ranged June 5-22, and last song observations have ranged June 18-July 7. In a given year their season may be only 2 weeks long. The males sing late afternoon until at least 11:30 at night.

**Similar Species.** The early season, heavy body shape, and brown or gray color are a distinctive combination. They are larger than Roesel’s katydids, and lack the yellow crescent on the side of the pronotum. The flightless males have short wings, females (as in these photos) can be wingless.

**Song.** The protean shieldback’s song is a variable 1-15-second or longer, high-pitched rattling buzz, with brief pauses between buzzes. It can be hard for older people to hear, centering around 15 kHz. The sound quality is like a stage whisper, a rapid “thithithith...” The only song that might be confused with it is that of the gladiator meadow katydid, whose buzz has a very similar sound, but usually is shorter, has more distinct beginnings and endings, and is more consistent in length with longer pauses between. Soft ticks, usually present between buzzes in the gladiator’s song, are absent from the shieldback’s. The shieldback is more likely to be in an upland area with woody plants, while the gladiator prefers grassier habitat in wetter areas. Protean shieldback song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/288a.htm) and at the Songs of Insects website (http://songsofinsects.com/katydid/protean-shieldback).
Roesel’s Katydid (Roeseliana roeselii)

Roesel’s katydid is a common species of open, grassy fields. It is native to Europe, and was introduced to the Montreal, Que- bec, area between 1945 and 1951. Its range has expanded south and west from there, and can be found throughout our area. They reportedly lay eggs in leaf sheaths, pits of stems, and dry plants, biting a hole in the stem to facilitate this (Kevan et al. 1962). There are 6 developmental instars (Gwynne 2001). They can have short, long or intermediate wing lengths.

Season. Roesel’s katydid is one of the predaceous katydids, species which act as predators and as scavengers of dead insects. This diet allows it to mature relatively early in the season. The range of first song dates across the years so far has been May 29-June 28, and last song observations have ranged July 2-August 2. They usually begin singing at mid-morning, but may begin as early as 7:15 a.m. on warm days, and continue to at least 6:30 p.m.

Similar Species. The brown color, especially the yellow-bordered black area on the side of the pronotum, separate Roe- sel’s katydid from all other local species.

Song. The sound quality of the Roesel’s katydid song is like a vocalized “zzzzz...” vibration. It is a fast buzz or drone, fairly loud (though I find that as I age I am less able to hear it, and on hot days the pitch rises enough that I require the SongFinder at mid-day; much of the frequency range is above 15 kHz). In cold individuals the buzz is slowed, has a rattling quality and sounds different from the usual song of a warm insect.

Roesel’s katydid song recordings can be found at the Singing Insects of North America website (http://entnemdept.ufl.edu/walker/buzz/301a.htm) and at the Songs of Insects website (http://songsofinsects.com/katydids/roesels-katydid).
Grasshoppers
Suborder Caelifera

Grasshoppers are distinguished from katydids by their shorter, heavier antennae. Most lay their eggs in the soil, and most overwinter in the egg form, though some (including the green-striped grasshopper) overwinter in the nymph or adult form.

Our local singing species, all in family Acrididae, fall into three subfamilies.

Subfamily Oedipodinae (band-winged grasshoppers: local species include the autumn yellow-winged, sulfur-winged, green-striped, Carolina, clouded, long-horn band-winged, Boll’s, mottled sand, Kiowa rangeland, and seaside grasshoppers, as well as a few others listed in the hypotheticals section). These produce sounds by crepitation, rattling their wings in flight, but according to Alexander, Pace and Otte (1972) they also can stridulate, and a few species in this subfamily only stridulate.

Subfamily Acridinae (silent slant-faced grasshoppers: our local species is the clipped-wing grasshopper). The family name, taken from Capinera, Scott, and Walker, is misleading, as the males produce loud crepitations in displays that appear identical to those of Oedipodinae. Physically they resemble Gomphocerinae, but lack the structure needed to stridulate.

Subfamily Gomphocerinae (stridulating slant-faced grasshoppers: local species include the sprinkled, marsh meadow, short-winged green, short-winged toothpick, spotted-wing, and handsome grasshopper, and almost certainly others; see the hypotheticals section). These produce sounds by stridulation, rubbing the legs against the folded wings.
Sulfur-winged Grasshopper (Arphia sulphurea)

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Our entire area is mapped well within this species’ range in general references. Blatchley (1920) described it as common throughout Indiana. Hebard (1934) listed Lake, Cook and Will County locations in Illinois with mainly June dates. Its habitat is dry upland pastures and meadows, along roadsides, and on rocky or gravelly wooded slopes. I encounter occasional individuals in DuPage County, where the soil is dominated by clay, and they probably occur in all such counties, but they are abundant and easily found only in sand soil areas in the region.

**Season.** This is an early species, wintering as a nymph and peaking in June, declining in July as the Autumn yellow-winged grasshopper becomes mature. My observations have ranged May 19-July 20.

**Similar Species.** Its basal wing area is always yellow, and it does not have the elevated, arched pronotal midridge of the larger Autumn yellow-winged grasshopper. Its season is earlier than those of other yellow-winged grasshoppers. Females are paler and more uniformly colored than males. Some males have pale edges to the forewings, which in the folded wings look like a blade of dry grass.

**Song.** Their crepitation displays are louder than those of the smaller green-striped grasshoppers, which are active in the same season, but are performed less frequently.

Photos. Top, dark male; center, spread hind wing; below, female. Right, male showing pale forewing edges.
Autumn Yellow-Winged Grasshopper (Arphia xanthoptera)

I first found this grasshopper in 2014 on September 19-20 in a large mowed lawn area at Bendix Woods County Park, St. Joseph County. All individuals there had orange rather than yellow hind wings, and I thought they were northwestern red-winged grasshoppers (A. pseudonietana). Study of a second population in the Midewin National Tallgrass Prairie in 2016, which has a roughly 50-50 mix of orange-winged and yellow-winged individuals, allowed me to correct the identification.

Our entire area is within the northern edge of the range. Hebard has many sites for it, mainly in the southern part of the state but also Chicago. Blatchley describes it as common throughout Indiana. Weedy borders, brushy fields and open woods outline a broad habitat range.

Similar Species. This is the largest of the Arphia species, at 31-38mm for males, 36-46 for females. It is distinguished from its congeners by the distinctly elevated arched ridge of the pronotum. The hind wings are yellow, orange or even pink in the base, bounded by a black band. Its body and wings are largely brown to blackish and fairly uniform in color. The tibias are dark, especially the distal ends.

Season. The season is given as July-November in the literature. My observations have ranged August 9-September 20.

Song. This member of the band-winged grasshopper subfamily has a loud crackling crepitation flight, showing its brightly colored wings in the process.
The green-striped grasshopper occurs in prairies, tall grassy meadows, and grassy open woodlands, and can be found in practically all areas with such habitat.

**Season.** This abundant species overwinters as a nymph, and is the first singing insect of our season. First display dates have ranged April 3-May 16, and latest displays have ranged June 26-July 26 in different years. To the south, as far north as Indianapolis, there are two annual generations with individuals occurring in September. Displays may begin as early in the day as 9:00 a.m. in warm weather, and continue at least until mid-afternoon, occasionally as late as 6 p.m.

**Similar Species.** You are most likely to notice first the displaying (flying) brown males. The hind wings do not have bright colors as in other members of its subfamily. Female green-striped grasshoppers are usually green and a little larger than the males. Sometimes they lay eggs in trails (as the one in the photo apparently is about to do). Grasshoppers have short, stout antennae compared to katydids.

**Song.** Sound is produced by the wings (crepitation) during display flights, a soft whispery or rattling buzz, sometimes with a faint crackling quality, without a sharp start or finish. Sometimes a male performs a series of these at intervals of 20-30 seconds, but more commonly the interval is greater. These displays, though audible, can be difficult to see, because the sound is made during only the last 1-2 seconds of the flight, and by the time the listener orients to the sound, the camouflaged male has gone still. The flights may be as short as 1-2 feet, low and level, but usually are longer. A recording of the Carolina grasshopper’s similar crepitation can be heard at the Songs of Insects website (http://www.songsofinsects.com/iframes/locusts/popup_carolinagh.html). The green-striped grasshopper’s crepitation is softer in volume and in quality of sound.
The Carolina grasshopper is common throughout the region in open grasslands, usually ones with some bare soil areas.

**Season.** Given the infrequent displays of this species, here I give the season as defined over the years by observations of mature adults (July 3-October 28).

**Similar Species.** This is the common large brown or gray grasshopper we encounter resting on the ground in summer into autumn. When flushed, its cream-edged black hind wings are distinctive, though a careless glance might confuse the flying grasshopper with a mourning cloak butterfly.

**Song.** Carolina grasshoppers do not display very frequently. Their display flights are partly visual, showing their cream-edged black wings, but also contain a crepitation element (a rattling sound produced by the wings). The displaying male flies up to an altitude of 2-3 feet, usually above a patch of bare soil or thin, very short vegetation, and hovers in place for up to 20 seconds. Carolina grasshopper sound recordings can be found at the Songs of Insects website (http://songsofinsects.com/grasshoppers/bolls-and-carolina-grasshoppers).
Clouded Grasshopper (Encoptolophus sordidus)

To date I have found this species at two sites, a restored prairie at Midewin National Tallgrass Prairie and an open area at Winamac Fish & Wildlife Area on sandy soil. I have heard crepitation displays in a couple other locations which may have been by this species. Our entire area is well within the range mapped in references. Hebard describes it as common in northern Illinois, listing locations in Lake, Cook and DuPage County. Blatchley indicates it is common throughout Indiana. It is grayish brown with solid dark bands across the forewings. Blatchley describes its habitat as dry upland meadows, pastures and roadsides. The median ridge of the pronotum is pronounced. Viewed from above, the pronotum is marked with a light X. The hind wings are nearly transparent, pale yellow with smoky outer edges. The hind femora are marked with dark bands, and the hind tibia are brown. Though the body length is shorter than the green-striped grasshopper, males 16-24mm, females 22-31mm, its stout form makes it appear bigger.

Season. I have observed this species in September. Hebard gives dates from mid-August through November, with most observations in September.

Similar Species. The wrinkled grasshopper, another late-season species that can occur in prairies, also is described as having an X mark on the pronotum. Its pronotum is described in being rougher in texture, it has smaller and more numerous dark spots on the forewings, and the upper edges of those wings often are marked by a pale line.

Song. The sound during display flights is described as similar to a bumblebee’s buzz. To my ear it often is softer, practically identical to that of the green-striped grasshopper, and like that species is produced as the male lands.
I first found this grasshopper at an open, sandy inland site at Memorial Forest in Marshall County. It was a minor component of the grasshopper community there. Later I found it to be the dominant grasshopper behind the foredune at West Beach in the Indiana Dunes National Lakeshore, likewise an open grassy area. The antennae are relatively long for a grasshopper. Usually gray or brown, the overall color pattern can be yellowish or blackish to match the habitat (compare the Memorial Forest grasshopper, above, to the Indiana Dunes one below). A narrow yellow strip runs from the back of the eye onto the pronotum. There are alternating light and dark spots on the leading edge of the forewing. The central black band on the hind wing is unusually wide. The basal region is usually orange, sometimes rose or yellow. The hind tibias are yellow with a black band. It is relatively small (males 20-32mm long, females 26-36mm).

**Season.** According to references, adults are active June-October. My observations to date are August 31-September 16.

**Similar Species.** The small size, coupled to the red hind wing base, are sufficient to rule out other species in the region.

**Song.** This species belongs to the band-winged grasshopper subfamily, whose members generally include crepitation in their displays.
Boll’s Grasshopper (Spharagemon bolli)

Boll’s grasshopper is mainly a sand soil species that may be found in dunes behind the Lake Michigan beach, as well as oak savannas and dry prairie-woodland boundaries. Places where they are common include the Indiana Dunes area and the savanna at Illinois Beach State Park.

Season. According to references, adults are active June-October in Wisconsin, peaking in July. My observations have ranged August 3-October 5.

Similar Species. The forewings are crossed by a few dark bands. There is much yellow in the black-bordered hindwings, which show when the grasshopper flies. It is similar in size to the Carolina grasshopper, perhaps a little smaller. The angle of the back dorsal edge of the pronotum is greater than 90 degrees. As the photos show, there can be considerable variation in color pattern (the above photo is from Illinois Beach State Park, Lake County, Illinois; the photo to the right is from Miller Woods, Lake County, Indiana).

Song. As in other members of their family, display flights are partly visual, showing their yellow hind wings, but also contain a crepitation element (a rattling sound produced by the wings).

On-line Photographs. Additional photos of Boll’s grasshopper may be found at the BugGuide website (http://bugguide.net/node/view/141123/bgimage).
Mottled Sand Grasshopper (Spharagemon collare)

Our entire area is just within the southern boundary of this species’ range. Hebard includes the sandy coastal area of Lake County, Illinois, among other locations. Blatchley (1920) indicates that it is common in sandy areas of northern Indiana, and mentions Fulton and Marshall Counties. It lives in sandy grass areas, including ones with sparse vegetation.

**Season.** Observations in the region have ranged June 28-October 5.

**Similar Species.** This grasshopper is yellowish brown to dark gray, with numerous dark speckles. There is a prominent median pronotal ridge. Forewing color is variable, sometimes with 3-4 irregular dark bands. The base of the hind wing is pale yellow, bounded by a black central band. The angle at the posterior edge of the pronotum is acute. Males 23-31mm, females 27-37mm.

**Song.** This grasshopper’s crepitation displays are relatively noisy.
This is mainly a western species, but it is mapped over all our area with the range limit at our region’s northern edge. So far I have found it only in open flat areas behind the foredunes at Illinois Beach State Park. According to the literature it lives in sandy or barren areas, feeding on grasses. It is medium-sized (males 20-25mm, females 23-30mm), grayish brown or greenish yellow, with large black spots or bands on the forewings. It has an elevated central pronotal ridge with two notches. The large head is elevated above the pronotum. There usually are dark stripes on the face beneath the eyes. The forewings are long. The variable hind wings often have pale yellow basal areas bounded by incomplete, mottled or pale black bands. The hind tibia are pale blue or blue gray.

**Season.** According to references, adults are active June-November. My observations range August 3-September 26.

**Similar Species.** The head of the similar, likewise small, longhorn band-winged grasshopper also is large and elevated above the pronotum, and it also is a species of open sandy areas. The hind wing bases in the Kiowa rangeland grasshopper are pale yellow or nearly colorless, and the hind tibia are blue or blue gray, in contrast to the other species’ bright red wing bases and yellow-and-black-banded hind tibia.

**Song.** This is a member of the band-winged grasshopper subfamily, whose members generally include crepitation in their displays.
Seaside Grasshopper (Trimerotropis maritima)

The seaside grasshopper is common on the Lake Michigan beaches, and in the grasses just above the beaches. In 2013 I found them in a barren area of cinders and spread wood chips in Cook County's Burnham Prairie area. They are very alert and difficult to approach. They fly strongly for short distances when flushed, usually with wings crackling sharply. When one lands near another, they signal one another by flashing their hind legs in a stridulating-like motion (photo, lower right).

**Season.** My few observations have ranged August 3-October 5. They reportedly may crepitate loudly after dark.

**Similar Species.** The size and habitat should separate this species from other yellow-winged grasshoppers. The tibias are yellow, the insides of the femurs banded yellow and black. General coloration matches the substrate: compare the Indiana dunes beach pattern, above, to that from Illinois Beach State Park, top right.

**Song.** As in other members of their family, display flights are partly visual, showing their yellow hind wings, but also contain a crepitation element (a rattling sound produced by the wings). Their crepitation can be loud and crackling.
Clipped-wing Grasshopper (Metaleptea brevicornis)

This marsh grasshopper is added to this guide in 2016. Though regarded as “silent” by some authorities, I have observed loud crepitation displays in two locations, and Alexander, Pace and Otte include it in their list of Michigan singing insects. Hebard had records only for central and southern Illinois. Blatchley described its range as “throughout Indiana.” According to current references its range contains the entire Chicago region. It is a strong flier, and can occur in large numbers where it is found in marshes and the edges of lakes, ponds and ditches. It feeds on grasses and sedges.

**Season.** August-September, according to references and my limited observations.

**Similar Species.** The habitat and array of physical features separate this grasshopper from all others in the region. The face is strongly slanted, the ends of the wings extend beyond the abdomen tip and have distinctive ends that appear to have been cut off at an angle. The hind wings are not strongly colored. The antennae are strikingly sword-shaped. Female colors can be dominated by green or brown. Males are much smaller than females, brown with green highlights as shown in the photo.

**Song.** Males crepitate loudly in displays that appear identical to those of subfamily Oedipodinae.
These live in dry wooded areas and brushy pastures. They are mapped throughout our area in references, but the only current records are a photograph by Mark Swanson from Lake County, Illinois, and my own observations at the Kankakee Sands preserve in Kankakee County. They lay their eggs in rotting wood.

Season. July–September, according to references.

Similar Species. They are fairly small (males 15-20mm, females 20-28mm), mainly brown but the sides of the male’s pronotum are shiny black. The black sides of the pronotum separate this species from all other grasshoppers in the region.

The face is slanted, the ends of the wings expanded and bluntly round, but do not reach the abdomen tip. The basal abdomen segments are black, at least in females. The hind tibia are orange or red.

Song. Both genders stridulate. Stridulation, in which the sound is produced by rubbing the legs against the folded wings, results in a sound that could be rendered “zuzz zuzz zuzz…” In my limited experience there is nothing to distinguish the sounds of the various stridulating grasshoppers.
Marsh Meadow Grasshopper (Chorthippus curtipennis)

The marsh meadow grasshopper is a species of grassy areas, usually mesic to wet, most often in grassy marshes and wet prairies.

Season. My observations have ranged June 24-October 5.

Similar Species. This is a small slant-faced grasshopper with orange or reddish legs, black femur-tibia joints in the hind legs, and yellow in the ventral abdomen. The rectangular sculptured areas above the antennae are another characteristic. The wings extend to the abdomen tip, more or less. Typical individuals have head and thorax mainly green, but there is much color variation in adults as well as nymphs. Females, especially, may have light brown, dark brown, and brighter, yellow-green color variants.

Song. There are two ways in which grasshoppers may produce sounds in display. Members of subfamily Oedipodinae rattle their wings, a sound production method called crepitation. The marsh meadow grasshopper uses the second method, called stridulation, in which the sound is produced by rubbing the legs against the folded wings. The resulting sound could be rendered “zuzzuzzuzz…” The song lasts up to several seconds. In this species the sound is not particularly loud and seems to be infrequently produced, though more often than many others of its subfamily.

On-line Recording and Photograph. The Songs of Insects website has a photo and recording for the marsh meadow grasshopper (http://songsofinsects.com/grasshoppers/marsh-meadow-grasshopper).

Photos: above, adult typical male. Above right, close-up of head. Below right, one of the many potential color variations.
The short-winged green grasshopper is described as common in grassy areas both wet and dry, though I have found it mainly in wetter habitats. Males usually are green on top and brown on the sides, but there is an all-brown variant. Females are green with some brown markings in my experience, but Blatchley said brown females are more common than green ones in Indiana, while most males are green. The wings are short, as the name suggests. Males 14-22mm long, females 23-30mm.

Season. My observations have ranged August 20-September 22. The literature indicates July-October

Similar Species. The typically bicolored males of this short-winged species are distinctive. Females are perhaps less so, but the short wings, dominant green color, and pattern of brown highlights should be enough to distinguish them.

Song. As in other members of subfamily Gomphocerinae, the short-winged green grasshopper stridulates, producing sound by rubbing the legs against the folded wings. The result could be rendered “zuzzuzzuzz…”
Spotted-wing Grasshopper (Orphulella pelidna)

This grasshopper is found in a broad range of habitats except deeply shaded ones, though in low densities where it occurs. The photographed individual is the only one I have found to date, at the Gensburg Prairie in Cook County. It feeds on grasses. Blatchley found it in dune swales in Lake County, Indiana, and in low meadows near Bass Lake in Starke County. Hebard regarded it as widespread and common throughout Illinois.

Season. According to references, adults are found July-October.

Similar Species. In appearance they are slender, variable and indistinctly marked. They may be brown or green, and have black and white accents. There are black triangles along the posterior portions of the lateral ridges on the dorsal pronotum. There is a series of small black rectangular marks down the forewings.

Forewings normally extend beyond the end of the abdomen. The hind tibias usually are brown, may be bluish. They are similar to the handsome grasshopper but smaller, with males 18-25mm and females 18-28mm, the forewings show speckling generally absent from the handsome grasshopper, and the lateral ridges bend toward one another strongly rather than slightly (photo, below). They also resemble their congener, the pasture grasshopper, differing most distinctively in having 2 cuts in each lateral pronotal ridge rather than just one.

Song. In addition to stridulating, it may produce brief crepitation sounds in flight.

Photos: above, adult female. Right, close-up of the distinctive shape and colors of the dorsal pronotum.
Short-winged Toothpick Grasshopper (Pseudopomala brachyptera)

Also known as the bunchgrass grasshopper, this species has a particular association with little bluestem grass and the dry habitats where it thrives. It is common in the prairie at the Nature Conservancy’s Kankakee Sands site in eastern Kankakee County. Blatchley had no Indiana records as of 1920. It is listed as threatened in Indiana today. Hebard described it as scarce and local in Illinois. It is more slender than most grasshoppers, with pointed wings much shorter than the abdomen. Its color often is uniform brown or grayish, sometimes with light stripes on the head, thorax and abdomen. The face slants down and back sharply rather than being rounded. The hind tibias are brown. There are prominent lateral ridges on the pronotum. Males 23-27mm, females 27-30mm. It is mapped throughout the area except for most of the Indiana portion.

**Season.** According to references, adults are found June-October. I first found it at the Illinois Kankakee Sands site on 28 June 2016.

**Similar Species.** The extreme slenderness, head slant, and blade-like antennae of this species are unlike any other in the region.

**Song.** At Kankakee Sands they stridulated frequently and quite audibly.
Handsome Grasshopper (Syrbula admirabilis)

This grasshopper is found among dry grasses, short to medium height, often on roadsides or on poor soils with scant vegetation. I have found it in the Kankakee Sands region in both Illinois and Indiana, and also at the Midewin National Tallgrass Prairie.

Season. According to references, adults are found June-October.

Similar Species. It is slender with a slanted face and long, slender hind legs. The hind tibia are brown or gray. The pronotal lateral ridges bend in slightly near the middle, and are marked with white stripes. Body color can be largely brown or green, often with much black in males. Females usually are green, males brown. The forewing pattern is distinctive, with leading edges green or grayish, trailing edges brown or black. The edge between those areas typically is a wavy line in females; they may have spots between them in males. There are stripes on the sides of the head. It is most similar to the spotted-wing grasshopper, but is larger (males 22-31mm, females 35-49mm).

Photos: above, adult female. Right, adult male.
Cicadas
Family Cicadidae

Cicadas are in a separate order from all our other singing insects. In the past that order was Homoptera, though most present-day taxonomies place them in order Hemiptera. Life history information is included in some of the species accounts.

Our local species fall into two subfamilies.

Subfamily Tibiceninae (concealed-tymbal cicadas: these include the green-winged, northern dusk-singing, dog day, swamp, Linne’s, lyric, and scissor grinder cicadas).

Subfamily Tibicininae (exposed-tymbal cicadas: our local species are Cassin’s and Linnaeus’ 17-year cicadas, and the prairie cicada).
On July 29 in 2013, while doing survey work in Indiana, I heard songs from members of this species in Newton and Jasper Counties, in oak woodlands on sand soils. I have added several more counties since, but they always have been in that same habitat.

Season. According to Alexander, Pace and Otte (1972) this species begins singing in late May or early June, and it may show a 4-year periodicity. My observations in the region have ranged from June 23 to August 20. I have heard them singing as late in the day as 4:00 p.m.

Similar Species. Cassin’s 17-year cicadas produce buzzes similar to cool-temperature *vitripennis* songs when connecting to fe-

males for mating (Court III signals; see the Michigan cicada website).

**Song.** A distinct, steady, rapid, continuous buzz, the individual pulses of which are readily discerned: sort of a mechanical twittering sound. The song somewhat resembles that of the sword-bearing conehead, but is much faster. It is unlike the songs of our other tree-dwelling singing insects and is produced in the daytime. Green-winged cicada song recordings and photos can be found at the Cicadas of Michigan website (http://insects.umz.lsa.umich.edu/fauna/Michigan_Cicadas/Michigan/Index.html#Diceroprocta_vitripennis), and in my blog post (http://natureinquiries.wordpress.com/2013/12/16/sound-ideas-green-winged-cicadas/).
The northern dusk-singing cicada appears to be limited to woodlands and forests in sandy soils in the Chicago region. References extend its range into Wisconsin.

**Season.** My song dates for this species range July 21-September 9. Though they may sing occasionally during the day, they mainly sing at dusk, as their common name suggests. This point was made most clear to me in Kankakee County. I had spent the entire day surveying the county without hearing a single *auletes*. Then, in Kankakee River State Park, beginning around 15 minutes before sunset, a number of them began to sing. They did not continue after dark. Most of my other records likewise have been around dusk.

**Similar Species.** This is our region’s largest *Neoibicen*, with a wing length greater than 45mm. It has a green or brown pronotal collar.

**Song.** The song is similar to the scissor-grinder cicada’s, being composed of slower pulses than the vibrato common to many *Neoibicen* cicadas. Those pulses often are a little faster than the scissor-grinder’s, at 2/second. The song typically lasts at least 15 seconds. The northern dusk-singing cicada’s song contrasts with the scissor-grinder’s in having sharper phrasing, and sustaining a single tone (around 3 kHz) rather than a pitch drop in each phrase. It has been describes as resembling a roller skater’s rhythm: “dirr-dirr-dirr...” Northern dusk-singing cicada song recordings and photos can be found at the Cicadas of Michigan website (http://insects.umz.lsa.umich.edu/fauna/Michigan_Cicadas/Michigan/Index.html#Tibicen_auletes) and at the Songs of Insects website (http://songsofinsects.com/cicadas/northern-dusk-singing-cicada).
Dog Day Cicada (Neotibicen canicularis)

The dog day cicada is one of our four most common, widely distributed cicadas of late summer. It prefers open woodlands or scattered trees, and does not really seem to be a forest species. Occasionally one can be observed singing in herbaceous areas far (50-150m) from the nearest tree. It distribution is northern, and it is the only Neotibicen to extend far into Canada. Its density diminishes southward in our region, and there are relatively few in Starke and Pulaski Counties. My most southern observations are in southern Fulton County and at Willow Slough in Newton County.

Season. Observed first song dates have ranged June 15-July 11, and last song dates August 30-October 12 (usually continues into the second half of September, though song frequency diminishes). There is an increase in numbers of singers in the second half of August. This species sings mainly afternoons to dusk, but sometimes sings in the morning (care is needed, because early morning songs of other cicada species can lack vibrato and be cut short).

Similar Species. This is the smallest of our late-season cicadas, its wing length usually less than 38mm. The color of the pronotal collar (a narrow strip just behind the head) is brown or green rather than black.

Song. The drone starts low and slow, rises in pitch and volume, becomes siren-like at just under 7 kHz, holds, then weakens to a halt. The tympanum vibrations are so rapid that it sounds more like a tone than like a buzz. The songs are relatively brief, 5-11 seconds. Dog day cicada song recordings and photos can be found at the Cicadas of Michigan website (http://insects.ummz.lsa.umich.edu/fauna/Michigan_Cicadas/Michigan/Index.html#Tibicen_canicularis) and at the Songs of Insects website (http://songsofinsects.com/cicadas/dog-day-cicada).
Linne’s Cicada (Neotibicen linnei)

This probably is our most abundant “annual” cicada of late summer, thanks in large part to its wide habitat range, from scattered trees through residential neighborhoods to forest centers.

**Season.** Observed first song dates have ranged June 14-July 11. Last song dates have ranged September 10-October 11, but singing is infrequent late in the season and only on the warmer days. It sings mainly in the afternoon from trees, but like canicularis sometimes starts early in the morning. Singing continues until dusk.

**Similar Species.** Of all the Neotibicen cicadas you may find dead on the ground, this one and the dog day cicada are the most likely. Linne’s is larger, with a wing length usually more than 38mm but less than 45mm. The pronotal collar is brown or green.

**Song.** The song is a drone with slow vibrato (8-10 pulses/second), rising from a non-vibrato introductory section, with timed lengths of vibrato sections ranging 6-15 seconds (median 9 seconds). The drone is easily heard, as it centers at 7 kHz. The vibrato can vary in speed and quality among individuals and/or conditions, more so than in other local cicadas. Linne’s cicada song recordings can be found at the Cicadas of Michigan website (http://insects.ummz.lsa.umich.edu/fauna/Michigan_Cicadas/Michigan/Index.html#Tibicen_linnei) and at the Songs of Insects website (http://songsofinsects.com/cicadas/linnes-cicada).
Lyric Cicada (Neotibicen lyricen)

The lyric cicada is found in forests, and is especially abundant in riparian and other low woodlands where it often is much more common than any other late-season cicada. Residential neighborhoods generally won’t have this species unless they are adjacent to a forest or wetland area. The lyric cicada shows a dramatic population cline through DuPage County, as I found in 2013. They were abundant in Kendall County on August 2, but I heard none in McHenry County on the next day. The northernmost observations as of 2015 in the region bring them within 2 miles of the southern McHenry-Lake County border (yellow stars on the map; red stars mark previous northernmost records).

Season. The range of first observed song dates is June 24-July 23. The lyric cicada finishes earlier than other Neotibicen cicadas; last song dates have ranged August 10-September 24. Typically the lyric cicada sings early in the morning, and concentrates its singing in the mornings, but can go into late afternoon or early evening, especially in August.

Similar Species. Of our four common Neotibicen cicadas, this is the one with a black pronotal collar. Usually there are fairly large chestnut-colored spots on either side of the dorsal thorax. Wing length is less than 45mm. The abdomen beneath has a broad, shiny black midline.

Song. The drone resembles Linne’s but is longer, with timed songs 18-62 seconds long (median 24 seconds). Also unlike linnei, the vibrating quality is held throughout, and is faster so as to be a rough buzz reminiscent of a power saw. It may sound like two pitches going simultaneously, while linnei’s song has two pitches in alternation. As in other common cicadas, the wide range of frequencies centers around 7 kHz. Lyric cicada song recordings can be found at the Cicadas of Michigan website (http://insects.ummz.lsa.umich.edu/fauna/Michigan_Cicadas/Michigan/Index.html#Tibicen_lyricen) and at the Songs of Insects website (http://songsofinsects.com/cicadas/lyric-cicada).
Scissor-grinder Cicada (*Neotibicen pruinosa*)

### Season

First observed song dates have ranged June 24-July 24 in different years. Last song dates have ranged September 16-October 24. This is mainly a late afternoon and early evening singer, but occasionally may be heard as early as late morning.

### Similar Species

The pronotal collar is brown or green, separating it from the lyric and swamp cicadas. It is larger than the dog day cicada, with a wing length larger than 38mm but less than 45mm. That leaves Linne's cicada. A comparison of wing shape and venation is needed to distinguish those two; consult the key in the Cicadas of Michigan website at http://insects.ummmz.lsa.umich.edu/fauna/Michigan_Cicadas/Michigan/key.html

### Song

The scissor-grinder’s drone consists of long, level pulses rather than vibrato wavering, 1-2 pulses/second, loud and centering at 5 kHz and so easily heard, and with a few seconds of non-pulsing fade at the end. Each pulse or phrase ends with a drop in pitch. It has been rendered “eee-oowee-oowee…” The song can last 20 seconds. Scissor-grinder cicada song recordings can be found at the Cicadas of Michigan website (http://insects.ummmz.lsa.umich.edu/fauna/Michigan_Cicadas/Michigan/Index.html#Tibicen_pruinosa) and at the Songs of Insects website (http://songsofinsects.com/cicadas/scissor-grinder-cicada).

The scissor-grinder is found in trees, from open woodlands to forests. It is not as abundant as our other woodland *Neotibicen* cicadas, but is widely distributed and must be included among our most common late season species along with the dog day, Linne’s and lyric cicadas.
Swamp Cicada (Neotibicen tibicen)

The range of the swamp cicada is mainly south and east of our area, but it appears to be expanding northward. Two of the northernmost Illinois locations to date are indicated by stars on the map. In the Chicago region, the greatest density apparently is in Berrien County which, like the Cleveland area where it also is abundant, is in the snow shadow of one of the Great Lakes. Commonly swamp cicadas sing in the morning from trees, bushes and tall herbaceous vegetation in or near wetlands. Sometimes a male changes perches by up to 40m between songs, possibly to compensate for low population densities. Note: the species name recently was changed from chloromera to tibicen.

Season. My limited observations so far have ranged from July 12 to September 25. I have heard them as early as 8:30 a.m. and as late as 5:10 p.m. Their singing peaks in the morning and diminishes significantly at mid-day, but continues intermittently through the afternoon.

Similar Species. Like the lyric cicada, the swamp cicada has a black pronotal collar and a wing length less than 45mm. In contrast with lyricen, the swamp cicada’s abdomen beneath has only an interrupted or at least little contrasting midline, the top of the head has much green, and the top of the thorax is mainly black without the significant chestnut spots. There are prominent white patches on either side of the dorsal anterior abdomen.

Song. The song is similar to that of Linne’s cicada but more percussive, the most extreme examples reminiscent of a rapidly struck tambourine (vibrato about 8 pulses/second). It rises in volume, holds, then fades, lasting 8-13 seconds (i.e., is significantly shorter than the lyric cicada’s song). Swamp cicada song recordings can be found at the Cicadas of Michigan website (http://insects.ummz.lsa.umich.edu/fauna/Michigan_Cicadas/Michigan/Index.html#Tibicen_tibicen) or the Songs of Insects website (http://songsofinsects.com/cicadas/swamp-cicada).
This is one of two species of periodical cicadas in our area (note: some records on the map are from the periodical cicada database, University of Connecticut). It is extremely abundant during emergences in northeastern Illinois, densities reaching 1.5 million per acre, with a preference for floodplain forest. Elms, ashes and other floodplain species are preferred, and the introduction of these trees into residential areas (as well as disturbance of woodlands generally) can confuse the habitat preference indications of the periodical cicadas. History of land use also influences where these insects occur (Strang 2013). Removal of forests for agriculture caused local extinctions, but trees planted in residential areas have provided expansion opportunities. The long time between generations is slowing that expansion, and these insects have not yet recovered all the ground they historically lost to agriculture.

Periodical cicadas are known for mass emergences at 17-year intervals (at this latitude), most recently in 2007, but there is an offshoot group that appears in certain northeastern Illinois locations four years early, and a few individuals come out a year or two before and after the main body. Scattered individuals emerged in 2011. In DuPage County, nearly all the singing periodical cicadas in these off years have belonged to this species. The next off-year emergence is expected in 2020, the next main emergence in 2024.

**Life Cycle.** As in our other cicadas, nymphs live on sap drawn from plant roots through needle-like mouthparts. Most mature nymphs emerge from the ground at night, though rainy days also can bring some out. They climb trees or other plants, the nymphal exoskeleton cracks open down the back, and the adult emerges. White at first, over a period of hours they adopt their mature colors. Males sing to attract females, which after mating lay clusters of eggs in the undersides of twigs through their saw-like ovipositors (photo, right).

The eggs hatch later in the summer, and the tiny first-instar nymphs drop to the ground and make their way into the soil.

In the 2007 emergence they were singing in small numbers by May 21. Singing peaked in June, and was diminishing by the last week of that month. By mid-July, the last few individuals were nearly finished. A few scattered late emerging individuals sang in late August to mid-September.

**Similar Species.** See Linnaeus’ 17-year cicada for physical appearance, and green-winged cicada for song.

**Song.** The song begins with several quick ticks, then has a single smooth buzzing tone that rises in pitch and then falls. The buzzing quality easily distinguishes it from the song of Linnaeus’ 17-year cicada. Most males congregate in large clusters high in trees. Their chorusing often takes the form of continuous synchronized rises and falls (waves) of song on a 6-second period. The volume of a chorus group’s aggregate singing is loud enough to be painful to someone standing beneath the tree. The singing diminishes by early evening, and quiets in the night. A recording is available on-line at the Cicadas of Michigan website (http://insects.umz.lsa.umich.edu/fauna/Michigan_Cicadas/Periodical/Index.html#Magicicadacassini)
This is one of two species of periodical cicadas in our area (note: some records on the map are from the periodical cicada database, University of Connecticut). It is extremely abundant during emergences in northeastern Illinois, though not as abundant as *M. cassini*. Densities have been measured at 133,000 per acre in northeast Illinois. In contrast with its congener, *septendecim* prefers upland forest. It also spreads into residential areas, but lags behind *cassini*. Both local periodical cicadas emerge at the same time, and references to them can be found in local newspapers as far back as 1888 (Strang 2013). This species is much less prone than *cassini* to emerge in years or at times other than peak emergences, except for the offshoot areas (described in the *cassini* account) where most of the insects appear to have shifted 4 years early.

They are consumed by many kinds of birds, mammals, amphibians, reptiles, spiders and predatory insects. Their large numbers overwhelm these predators, allowing them to produce prodigious numbers of eggs. Only one specialized consumer exploits them, the parasitic fungus *Massospora cicadina*, the spores of which apparently infect them when they tunnel to the surface.

**Life Cycle.** See the description for *cassini*. Nymphs tunnel to the surface 3–4 weeks in advance of emergence, and may monitor aboveground conditions to determine when to come out. Most emerge at night, though large numbers may leave the ground on rainy days. A percentage of them produce malformed wings or other structures, apparently most often when they do not quickly find a vertical surface from which to break out of their nymphal skins. In the 2007 emergence *septendecim* were coming out by May 21. As was the case for *cassini*, *septendecim* peaked in June. They were finished, or nearly so, by July 10.

**Similar Species.** Periodical cicadas are distinctive in their black and orange colors, orange wing veins and red eyes. *Magicicada septendecim* is larger than *cassini*. A thick orange line connects the eye with the base of the wing in *septendecim*, but that space is entirely black in *cassini*. They are smaller than the annual cicadas. Their flight also is slower.

**Song.** The song of *septendecim* is more a tone than a buzz, held at a high pitch and then slurring downward (masses produce a steady, high pitched tone). The song has been described as a sung “pharaoh.” The individual song is much lower in volume than that of the smaller *M. cassini*. Sings dawn through morning, diminishing in the afternoon but some individuals continue until dusk. Recordings can be heard on-line at the Cicadas of Michigan website (http://insects.ummz.lsa.umich.edu/fauna/Michigan_Cicadas/Periodical/Index.html#Magicicadaseptendecim) or at the Songs of Insects website (http://songs.ofinsects.com/cicadas/periodical-cicada)
Prairie Cicada (Okanagana balli)

This species occurs in prairies, and may be limited to remnant prairies. Research and monitoring has been conducted on this species by faculty and students at the University of Illinois, Chicago. They list several sites in Cook, Will and Kankakee Counties. Their own site, the Woodworth Prairie in northern Cook County, is remarkable for its small size (5 acres) and isolation from other prairies. The cicadas have maintained a population of a few hundred at that site. After first meeting the species there in early July 2013 I was inspired to seek it in other remnants, and found it at West Chicago Prairie and Belmont Prairie in DuPage County. It may be limited by poor dispersal ability. I will continue to check remnant and restored prairies to test this possibility. I observed one mating episode. A female flew to a plant near a singing male, then approached him. They exchanged a few wing-flicking displays, and then joined for 10 minutes (photo, right).

Season. Mid-June to mid-July, peaking in the last week of June in most years. The diurnal peak is 11:30 a.m.-2 p.m., with singing as early as 8:30 a.m. and as late as 4 p.m.

Similar species. This is smaller than our other cicadas, except for Cassin’s periodical cicada, and its early season and prairie to savanna habitat should rule out all others. It is black generously marked with grayish brown, and has brown wing veins.

Song. The song is a high-pitched continuous buzz, but the rapid pulses are discernible. Through the SongFinder (pitch lowering hearing aid) the song is much louder, and resembles that of a Neotibicen tibicen or N. lyricen. Sound analysis shows a peak frequency of 10.5 kHz, 50 pulses/second. Some, singing from compass plant (Silphium laciniatum) leaves, were louder and easier to hear. The SongFinder is helpful in finding them from a greater distance, say 50 feet, then moving in close enough to hear them naked-ear, and going from there. More information from the UIC study can be found at http://www.uic.edu/depts/bios/prairie/cicada_files/frame.htm. A recording of the song can be heard at http://www.insectsingrs.com/100th_meridian_cicadas/songs/Okanagana_balli_fragment_JRCooley.mp3. My own recording is posted in my blog at http://natureinquiries.wordpress.com/2013/12/02/sound-ideas-prairie-cicada/
Hypotheticals and Species with Undetermined Status

House cricket, *Acheta domestica*
No free-living feral populations of this Asian species currently are known in the region. Past records for Will, Cook and Lake Counties of Illinois are from 1934 and earlier.

Eastern striped cricket, *Miogryllus saussurei*
This member of the field cricket subfamily has never been found in the Chicago region, but its range includes counties not far west and south. It is smaller than *Gryllus* species at 10-17mm. It has a mottled color pattern reminiscent of the Japanese burrowing cricket, but is variable and can be almost completely black. It lives on the surface, its habitat described variously as dense herbaceous growth or dry wooded slopes under rocks and logs. Its song consists of brief buzzy chirps spaced more than a second apart, each rising in pitch and volume from beginning to end. Its season is reported as June and July.

Restless bush cricket, *Hapithus agitator*
A member of the same subfamily as the jumping bush cricket, this one has not been known to sing outside of Florida and Texas. Its known range ends a short distance south of the Chicago region. The song consists of brief buzzes, similar in pattern to that of the striped ground cricket but with a different sound quality. It is small, at 9-14mm, and its habitat range includes roadside weeds and undergrowth of wet forests.

Prairie tree cricket, *Oecanthus argentinus*
The prairie tree cricket ecologically is similar to Forbes’s tree cricket. It is described as having a like preference for coarse herbaceous vegetation, with occasional use of shrubs. The main range for this species is west and south of Illinois, and Laurel Symes failed to find them in the region during the surveys she conducted in her thesis work, but the species is retained on the hypothetical list because of old records which eventually may prove to be erroneous. It is pale, with relatively heavy spots on the basal antenna segments, and the pulse rate of its continuously trilling song is 51 at 25C, falling between the slower four-spotted tree cricket’s pulse rate of 40 and the faster rate of Forbes’s tree cricket at 65.

Delicate meadow katydid, *Orchelimum delicatum*
According to Thomas and Alexander (1962), early authors stated that this species occurred in low meadows near large lakes in the Indiana counties of Marshall and Starke. Thomas and Alexander themselves say it is “largely restricted to swales adjacent to sand dunes or sand beaches, where it is often associated with *…Calamagrostis canadensis* [a grass].” According to Thomas and Alexander (1962), some singing during the day, but most singing is done dusk into the night. The ground color of the head is green, but given the frequent occurrence of green-tinged *O. campestre*, this is not a diagnostic feature. Females with ovipositors well over half the length of the hind femur, and males whose songs feature doubled ticks, will be needed to establish this species.

False robust conehead, *Neoconocephalus bivocatus*
This is a sibling species of the robust conehead. McCafferty and Stein showed records for Porter and LaPorte Counties in Indiana, and possible members of this species were observed at Illinois Beach State Park in 2012. The differences can be subtle, the females having different ovipositor lengths and males’ songs with different pulse patterns and rates when recordings are analyzed (Deily and Schul 2004).

Slender conehead, *Neoconocephalus lyristes*
Hebard thought the slender conehead was at its northwest range extreme in the dunes area along Lake Michigan, “in swamps and on sand ridges.” Subsequently some have been found in Carroll County in northwest Illinois. All but 2 north-
Hypotheticals and Species with Undetermined Status (Continued)

west Indiana and northeast Illinois records of slender coneheads are dated 1935 or older. One of the remaining, from Beach in Lake County, Illinois, has no date. Regional records are limited to Cook and Lake Counties in Illinois, and Porter County in Indiana. Its song is described in the Singing Insects of North America website as “A high-pitched, smooth, continuous buzz produced in afternoon as well as evening.” Thomas (1933) adds the adjectives “loud, thin.” It is described by Alexander, Pace and Otte as a sibling species of *N. nebracensis*, different in its song and in being limited to marshes. Sometimes it is found in association with the marl/alkaline marsh species *Orchelimum concinnum*. Thomas says it begins to sing in full sunlight late in the afternoon, but that there are reports of morning singing as well. This would be unusual, as all our other coneheads except *retusus* are strictly nocturnal. He found it in glacial relict bogs with prairie character. August to September. Gideon Ney, who has found this species in other parts of its range, suspects that sedges in fens may be the best bet.

Common virtuoso katydid, *Amblycorypha longinicta*
There is a single 1935 record of this species in the Chicago region, in Kankakee County. Otherwise in Illinois and Indiana it is known only from the southern halves of those states. Its song is a very high-pitched, complex sequence of clicks, rattles and buzzes. The tibias and feet are brown, and there are a few brown spots on the wings. The size range is 29-37mm. It occurs in low herbaceous vegetation in open areas.

Lesser angle-wing, *Microcentrum retinerve*
This species is represented by several records in the southern two-thirds of Indiana, but so far has not been detected in the Chicago region. At 45-50 mm long, it is slightly smaller than the greater angle-wing but otherwise resembles it. Its habitat is similar, dwelling in tree canopies. The song is composed of clusters of 3-4 rattles, 2-3 such clusters comprising the song; a common pattern is a 4-rattle cluster closely followed by a 3-rattle cluster.

Treetop bush katydid, *Scudderia fasciata*
Alexander (1972) reported finding this species after dark in conifers at Warren Dunes State Park; this is the only record to date for the region. This bush katydid is very similar to the fork-tailed, differing in having a black stripe along the top or leading edge of the forewing. Its song is indistinguishable from that of the fork-tailed bush katydid.

Least shieldback, *Atlanticus monticola*
Though not yet known in the Chicago region, this smaller (19mm) relative of the protean shieldback is found just southwest of the region, and there is a disjunct region where it is found in the northern part of Michigan’s Lower Peninsula. They have backs that are gray-brown or rarely green in different individuals. Its extremely high-pitched rattling buzzes are produced about 2 per second. The habitat is described as weedy fields and brushy forest understory, like its larger congener. The season is July to autumn, with peak singing at dusk. Some authors split the species, and assign those closest to the Chicago region to *A. davisi* (Davis’ shieldback).

Pasture grasshopper, *Orphulella speciosa*
This species lives in areas with short-medium vegetation that includes grasses, including dry to wet habitats. August-October. We are well within its range. Blatchley knew them from only 2 Indiana locations in our area, at Bass Lake in Starke County and near Hammond in Lake. He mentions it as a hilltop and hillside species in Illinois. Hebard regarded it as common in Illinois and listed locations throughout the state. It can closely resemble its congener the spotted-wing grasshopper, distinguished by having one rather than 2 cuts in each lateral pronotal ridge. Males are a little smaller, at 14-21mm, females the same at 18-27mm. The face is not strongly slanted, color is variable brown or green or a combination of the two. Wings extend to the tip of the abdomen or beyond. A series of elongate spots is on the center of the forewings. There are black triangles on the dorsal pronotum as in *pelidna*.

White-whiskered grasshopper = Sand grasshopper, *Agenotettix deorum*
We are in the eastern extent of its range, but it is mapped throughout our area. It feeds on grasses and sedges, and lives in areas with little vegetation. July-October. It is relatively small (males 11-28mm, females 15-28mm), brown on top and yellow below. It is named for its white antennae. White stripes extend back from the head along the upper pronotum,
and bend toward one another near the middle. Forewings variable, usually about the length of the abdomen, and have central brown speckles. Hind femurs have a dark triangular spot on the center of the upper surface, and the junctions with the tibia are black. The hind tibia are orange or red. Blatchley did not know it from our area in Indiana. Hebard describes it as common and sand-loving in Illinois, and lists such locations throughout our area.

**Striped sedge grasshopper**, *Stethophyma lineatum* = *Mecostethus lineatus*
Our entire area is mapped within the southern extent of its range. Blatchley describes it as a species of low, boggy meadows, especially dense grassy areas around lakes or in swamps, and it was known from only 2-3 locations in Illinois (Hebard lists only Lake County locations in our part of Illinois). It is yellowish green with few contrasting markings, notably white markings on the forewings. The wings are long with widened tips. There is black at the junction of hind femur and tibia, and the tibia are yellow with black spines. Males 25-29mm, females 30-38mm. July-October.

**Clear-winged grasshopper**, *Camnula pellucida*
I have photographed this species at Whitefish Point in Michigan’s Upper Peninsula. Hebard gives locations in Lake and Cook Counties, Illinois, and Starke County, Indiana. Blatchley only mentions the last, at Bass Lake, in the second half of August. Its habitat is grassy meadows (they were in a sandy, grassy back dune area at Whitefish Point). The hind wings are entirely unmarked. The folded forewings have large spots, and the upper edges are marked with amber, converging to form a V. Males 20-25mm, females 25-31mm.

**Coral-winged grasshopper**, *Pardalophora apiculata* = *Hippiscus apiculatus*
Our entire area is mapped well within its range. Hebard indicates Lake and McHenry Counties in Illinois. Blatchley says it probably occurs throughout Indiana, but mainly is a species of the southern part of the state and of sand areas in the northwest. The habitat is meadows, upland pastures, roadsides, and especially sandy areas with much bare soil. It is relatively large, males 36-42mm, females 45-55mm. It is gray and brown with large, dark brown spots on the forewings. There is a golden V on the forewings as in the clear-winged grasshopper. The base of the hind wing is orange or rose colored, bounded by a black line. Haldeman’s grasshopper is similar, but has a larger number of smaller spots on the forewings. It winters as a nymph. Both species are described by Alexander, Pace and Otte (1972) as early spring grasshoppers that stridulate but do not crepitate.

**Northwestern red-winged grasshopper**, *Arphia pseudonietana*
This species is mapped in the entire Chicago region except perhaps for the southern portion of the Indiana area. Hebard had no Illinois locations, though he anticipated that it would appear in the northernmost counties with a local distribution. Blatchley listed no Indiana locations, either. He gives a location for Berrien County, but Bland has no records for that county. This is a grassland species that feeds on forbs as well as grasses. Relatively open, sand or gravel sites are given as habitat. Its body and forewing color are very dark, often blackish, and can be strongly mottled. The basal part of the hindwings is bright red-orange with a black margin, sometimes yellow or pink. The pronotum profile is flat, with a low median ridge. The size is close to the sulfur-winged grasshopper. The season given in the literature is July-November.

**Haldeman’s grasshopper**, *Pardalophora haldemani* = *Hippiscus haldemanii*
Our entire area is mapped just within the eastern extent of this grasshopper’s range. Hebard says it lives in sand areas,
Hypotheticals and Species with Undetermined Status (Continued)

and mentions Cook and McHenry, as well as Lake County, Indiana, which is the only location given by Blatchley for that state. That Indiana location was sparsely vegetated sandy areas a quarter mile back from Lake Michigan. This species is close to its congener, the coral-winged grasshopper (see the description for that species). Hebard mentions that some Illinois specimens have yellow inner areas of the hind wings, while all the others are various shades of pink. The Indiana observations were late June, and almost all Illinois observations were in June, but extending to the end of August. Alexander, Pace and Otte describe it as an early season species that stridulates but does not crepitate.

Wrinkled grasshopper, Hippiscus ocelote = H. rugosus
The map in Capinera et al. does not go beyond Hebard’s and Blatchley’s records. Hebard lists only Chicago as a location in our area, and suggests it would not be found north of Illinois. Blatchley indicates it had been found only in Fulton and Marshall Counties in northern Indiana, though it was more common farther south. He says its habitat is dry upland areas, especially open woodland pastures, meadows and roadsides. It keys closest to haldemani in Blatchley. Hebard separates it from Pardalophora, indicating that the cut in the central pronotal ridge is at the center in Hippiscus, closer to the head in Pardalophora (Blatchley also indicates this difference). The pronotum is rough and wrinkled, and has a pale dorsal X mark in males. The forewings have large dark spots and light bands, some of the latter producing the V when wings are closed. The bases of the hind wings vary from pale yellow to deep orange, but usually are pale pink or orange, bounded by a black band. Males are 28-40mm, females 39-53mm. Dates are late July to mid-October.

Bush cicada, Tibicen dorsatus
This large, colorful species occurs in pockets of relatively undisturbed tallgrass prairie in Illinois, though generally south of our region. It is active June-September. Its song resembles the lyric cicada’s, but slowed to the pulse rate of Linne’s. Males sing from the stems of prairie grasses and forbs rather than trees. To date the closest known location to the Chicago region is the Loda Cemetery Nature Preserve (Iroquois County, Illinois), only 13 miles south of the latitude of Newton County’s southern border.

Walker’s cicada, Tibicen pronotalis
This cicada is known here from historical records. It is mainly a riparian species, associated most often with willows and cottonwoods. It is one of the largest Tibicen cicadas, and photos show that it usually has the collar and area between collar and head a solid green or tan (when green, often with an orange cast), often with a central black oval adjacent to the head. The song is similar to the rhythm of the scissor grinder, perhaps a little faster and with a simple “zee-zee-zee” sound overlying a more continuous bass sound, and so readily distinguished. It often sings into the night, unlike other cicadas, with peak activity July-September.

Common grass cicada, Cicadetta calliope
This is a tiny (1-inch) tall grass prairie species, known from south central Illinois and apparently associated mainly with relatively undisturbed prairies, that is worth having on the hypothetical list for our area. They emerge in late June and are active into July. The color is light brown, sometimes with some black patterning. The song is very high pitched, and the SongFinder may be needed in the field if an older person is to hear it: a few brief buzzes precede a long buzz.

Say’s cicada, Okanagana rimosa
This is mainly a species of northern deciduous forests, but there are records for southeastern Wisconsin. It is generally black with bright orange markings on the underside of the abdomen, and orange spots on the pronotum and at the trailing edges of the upper abdominal segments. It has mainly a 4-year emergence cycle, but a few individuals can emerge each year. Its song is a prolonged, high-pitched buzz, similar to that of the lyric cicada but at a lower volume. Sometimes it gives shorter such songs in series. Alexander, Pace and Otte describe it as an early season species, grouping it seasonally with the periodical cicadas and the green-winged cicada. It sings morning into early afternoon.
Sources


Elliott, Lang, and Wil Hershberger. 2007. *The Songs of Insects.* Houghton-Mifflin. (out of print)


New York Cricket Crawl website: http://www.discoverlife.org/cricket/

Rannels, Steve, Wil Hershberger and Joseph Dillon. *Songs of Crickets and Katydids of the Mid-Atlantic States* (CD available through http://cricketsong.tripod.com/)


Singing Insects of North America (SINA) website : http://entnemdept.ufl.edu/walker/buzz/

http://songsofinsects.com/ website


University of Michigan cicada website:
http://insects.ummz.lsa.umich.edu/fauna/Michigan_Cicadas/Michigan/Index.html
