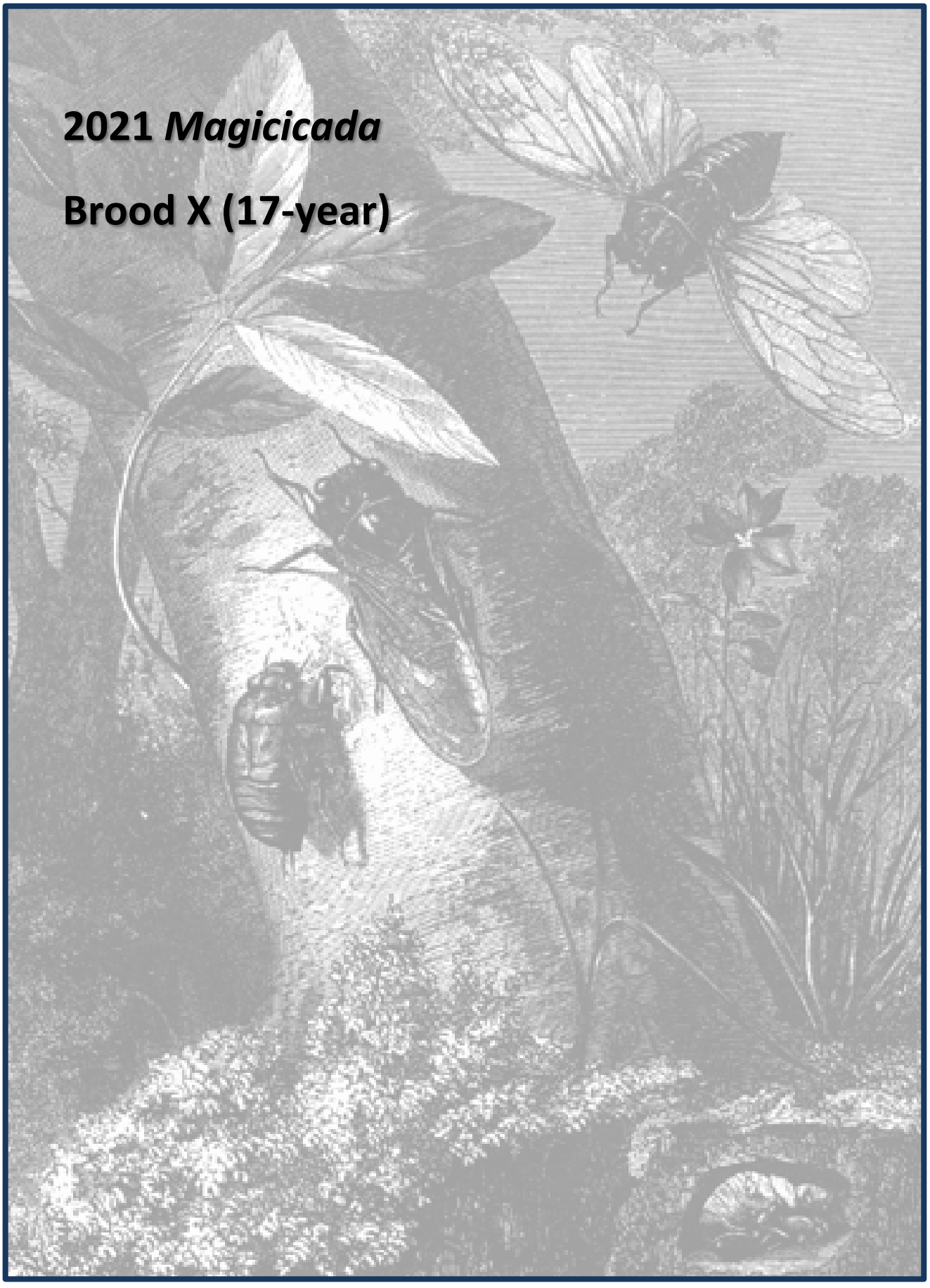
2021 *Magicicada*

Brood X (17-year)



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Introduction

Periodical cicadas (*Magicicada* spp.) are among the most unusual of insects, with long life cycles, infrequent, periodic mass emergences, striking appearance, and noisy behaviors. Periodical cicadas are divided into broods, or synchronized regional communities sharing a common emergence schedule, with life cycles of either 13 or 17 years. Because brood and species formation may be triggered by climate fluctuations, the biogeography of periodical cicada populations, broods, and species is thought to reflect postglacial climate instability (Alexander and Moore 1962; Lloyd and Dybas 1966a, b; Lloyd and White 1976; White and Lloyd 1979; Karban 1982; Williams et al. 1993; Williams and Simon 1995; Kritsky and Simon 1996; Marshall et al. 2003; Marshall et al. 2011). Complicating matters, broods typically contain more than one species, and the ranges and evolutionary histories of species within broods may not be congruent (Simon and Lloyd 1982; Cooley et al. 2011; Sota et al. 2013).

Brood X

17-year periodical cicada Brood X is emerging in 2021. Brood X was mapped during the 2004 emergence, but since this is one of the larger broods, some parts of the brood have yet to be mapped in detail. The brood is divided into three major parts.

A perennial issue with Brood X is that it occurs 4 years after Brood VI and 4 years before Brood XIV, and these three broods are adjacent to each other in parts of their ranges. From a biological perspective, 4-year stragglers from either of these broods are of interest because they can cause gene flow among these broods. From a practical perspective, 4-year stragglers from any of these broods complicate mapping efforts, because populations may be difficult to assign to a brood. Some straggling emergences are easily identified as such, since they involve only small numbers of cicadas. Others are less easily interpreted, and the difficulty

may be compounded by the problem of "shadow brooding" in which repeated instances of straggling resupply populations of stragglers that are on the verge of becoming self-sustaining. We expect to see emergences in 2021 that are difficult to assign to a single brood in Kentucky (where Broods X and XIV are in contact) and in Georgia (where Broods VI and X are in contact).

2021 will also see an emergence of Brood X in the Washington DC Metro area. This area saw substantial emergences of 4-year early stragglers in 2017, and because 2017 was a Brood VI emergence year, these stragglers were sometimes confused with Brood VI. Expect to see heavy Brood X emergences in the DC metro areas with stragglers in 2017.

An overriding philosophy of the mapping project is: A Misleading Map is Worse Than No Map At All. There will be substantial numbers of stragglers in 2021, and if they are mistaken for Brood X emergences, these mistaken records will create the impression that Brood X has grown suddenly and substantially larger, when no such thing is true. When we collect mapping records, we keep track of densities– in all likelihood, true Brood X emergences will be dense and widespread, while straggler emergences tend to be more patchy and scattered.

Key points about stragglers:

- Stragglers typically occur at low densities
- Stragglers are typically patchy
- Stragglers populations generally don't last for long!

Brood X Outstanding Questions:

- What is the northern limit of Brood X in Michigan, and what populations exist in northern Ohio?

- Are the three species groups (-decim, -cassini, and -decula) equally represented among stragglers?
- Brood X comes into contact with Brood XIX in south eastern Illinois. To what extent, if any, do these broods overlap, and are their boundaries stable?
- Brood X comes into contact with Brood XXIII in southern Indiana. To what extent, if any, do these broods overlap, and are their boundaries stable?

Planning a mapping route

Brood VI is a small (by geographic extent) periodical cicada brood. It is extremely difficult to map even small broods in their entirety, so you must carefully prioritize your mapping effort. It is not always easy to know where to start, but existing maps are reasonable predictors, and known collecting localities in the Cicada Central database or elsewhere are good starting points.

Note that –decim species choruses are strongest in the mornings, while –cassini species choruses are stronger in the afternoons. Weak –decim choruses can be difficult to hear from a moving car or if there is a lot of ambient noise (highways, construction, mowing, etc.). Take these factors into account—under poor conditions, you will need to think carefully about planning your route—and you'll also need to be careful about estimating population densities or collecting negative records. If the weather cooperates, you can map from dawn until dusk

Here are some suggestions for planning a mapping route. These suggestions are based on the methodology described in (Cooley et al. 2013).

1. Use the maps on www.cicadas.uconn.edu or a GPS navigator to find areas of emergence and to keep track of how long cicadas have been out in any given area.
2. **Begin and end each day with a positive record!** Each day, when you start mapping, you should go to an area where *Magicicada* are known to be present. Note the time, weather and temperature conditions, etc., and whether the cicadas are singing. You should return to known emergence locations (positive records) throughout each day (e.g., don't spend an entire day just obtaining negative records), and you should end each day by visiting an area of emergence.
3. If the cicadas are not singing (e.g., it is raining, cold, etc.), you can still obtain records, though the process will be slow. Since negative records taken under poor conditions can be questionable, under poor conditions you should concentrate on visually locating areas of dense emergence (searching for adults, shed skins, etc.). You can also use periods of poor conditions to drive long distances to other mapping areas. Use the web to obtain current weather predictions.
4. If the cicadas are singing, then attempt to crisscross or "stitch" the brood boundary by driving slowly back and forth across the boundary, collecting both positive and negative records at 1/10 mile intervals (the trip odometer in some cars can be helpful here, as it may display 10ths even if the regular odometer does not). **Negative records are just as important as positives!** You can typically hear a *M. cassini* chorus from a closed vehicle at highway speeds, and extremely dense *M. septendecula* choruses can also be heard at speed. However, *M. septendecim* choruses have a pitch that is closely imitated by the tread patterns on some car tires or by the alternators of some cars. For all but the strongest *M. septendecim* choruses, or when mapping in the afternoon, you may need to stop your vehicle and turn off the engine. You don't need to fully stop the car or turn off the engine for every record, but you will need to do so periodically just to be certain.
5. You should also consider stopping occasionally to take voucher photographs, recordings, and specimens. If you are collecting for genetic studies, plan to make at least a few large (ca. 100+ *M. septendecim* and other spp. if possible) collections stored frozen (dry ice or nitrogen) or in 95% ethanol for later genetic analysis. Clearly label all vouchers!

What to look for

Most literature makes note of the extreme densities typical of *Magicicada* (e.g., Dybas and Davis 1962). In reality there are shades of gray—periodical cicadas emerge as single individuals, light density choruses, and full choruses. These kinds of emergences are qualitatively different; single individuals seem to be stragglers, or off-cycle cicadas; low-density emergences may occur because of extinction or straggling, and high density emergences seem to have shaped much of cicada biology and behavior. Mixing these types of records is one reason that older emergence maps often suggest that the geographic extent of certain broods was once much larger than at present—stragglers or off-cycle emergences adjacent to an emergence tend to give an inflated impression of a brood's geographic extent (Marshall 2001).

Although it is possible that we will find stragglers from any brood adjacent to X this year, when 17-year periodical cicadas accidentally accelerate, or "straggle," they tend to do so in increments of 1 or 4 years, with 4-year advance emergences especially common among 17-year species. Thus, 4-year late emergences of Brood VI are possible in 2021, as are 4-year early emergences of Brood XIV. The straggling phenomenon may be a source of confusion about brood boundaries, since stragglers from one brood may be mistaken for low-density populations of another. **Thus, it is especially important to collect density information, especially where broods are in close proximity.** It is also important to collect any "stragglers" found for genetic analysis. Therefore, if at all possible, when mapping you should note whether cicada densities meet any of the following criteria (these correspond to criteria listed in the instructions for the "Map-O-Matic" device). Beware that the timing of the emergence may affect your perceptions—choruses develop after adults emerge in

large numbers, and choruses eventually die out, though individuals dwindle on.

The information below can help guide you in categorizing an emergence. As with any attempt to come up with simple categories, there will be situations that don't seem to fit well into this scheme. That's OK—take notes as you go, and if you find a situation that doesn't seem to fit, take especially detailed notes, photographs, recordings, etc..

1. **No cicadas present.** No physical evidence of cicadas, and no songs heard. Negative records based on lack of songs must be taken under appropriate conditions in quiet surroundings.
2. **Stragglers.** A single individual ("straggler cicada"), or a very small number of highly localized cicadas. You may find physical evidence of a straggler, such as a single adult, nymph, shed nymphal skin, fragment of an adult (often a wing). More likely, you will hear a single adult singing, or widely scattered adults singing. The individual songs will be clearly audible, and there will be no perceptible background chorus.
3. **Low-density populations.** This category is difficult to define—it's more than a handful of cicadas (category #2), and less than a full emergence (category #4). Low-density populations may consist of a few widely scattered individuals. You may find physical evidence of cicadas such as nymphs, skins, adults, or body parts. If you hear cicadas, you will be able to clearly distinguish individual calls, and there may be periods of silence between calls. As you back away from an area of calling, the calls will not blend together into a uniform chorus, though you may hear more or less continuous, weak sound. Note that in the absence of other evidence, holes in the ground—even seemingly large numbers of holes—or even turrets—are not reliable evidence for *Magicicada* (though if you find suspicious holes, you should note that you found them).
4. **Full emergence.** Large numbers of nymphs, cast skins, or adults. If you are not at the very beginning or end of the emergence, you should also hear choruses. Large numbers of holes—of a size that you could insert you pinky into—and perhaps even turrets might be visible on patches of open ground. In extreme cases (or on open lawns), there may be piles of dead or rotting cicadas under trees, and the smell might be noticeable. Under

appropriate weather conditions (warm, humid, sunny days) singing and flying cicadas will be clearly audible and visible. A full *M. tredecim* chorus will have a constant, tonal drone of about 1.1 kHz; a displaced *M neotredecim* chorus about 1.7 kHz, and an undisplaced *M. neotredecim* chorus about 1.3 or 1.4 kHz. You will be able to hear the individual songs of cicadas that are very close to you, but as you back away from the woods edge, the individual songs will blend together. A full *M. tredecassini* chorus may include synchronized calling and flying, which will be evident by intense waves of sound and periods of movement. A full *M. tredecula* chorus will have a metallic "beat" to it. Note that the relative densities of the species in a chorus will vary significantly, and over surprisingly short distances. An emergence is considered to be a full emergence if at least one species is dense.

Recording your data

Using the app "Cicada Safari." Project principals should avoid reporting records over the app. Principals' records are considered "verified" and are classified as such in our database. **Records submitted over the website are considered "unverified" and are classified as such**.

Using paper maps. If you are marking records using paper maps, please use DeLorme state atlases. Inside the front cover, please write in indelible ink your name and "2021 *Magicicada*." Either hand-deliver or mail the maps to John Cooley at the end of mapping. To note records on the pages, mark positive records in pencil as dark circles and negative records as open circles, using landmarks and your car odometer to accurately place the circles. It is also extremely helpful if you trace your route lightly in pencil, using arrows to indicate direction of travel and occasionally noting time, temperature, and weather conditions. You may also wish to note chorus densities and species present. Pencil is an excellent choice for record keeping because it is erasable yet it will not be damaged by water or alcohol. Advantages: Can be geocoded later, permanent hard copy may be archived. Disadvantages: Requires expertise and accuracy in map reading, and geocoding requires specialized software and may be tedious.

Using a handheld GPS unit. Make sure your GPS unit is set to use the WGS 84 map datum. If you are using a handheld GPS unit, you can either note the Lat/Lon of data points and copy them into a field notebook, or you can make "waypoints" that will be downloaded later. In either case, note in your field notebook (use pencil) things such as time, temperature, weather conditions, chorus densities, and species present. Advantages: Geocoding is rapid and instant, and some GPS devices can download waypoints directly into a computer. Disadvantages: Data must be downloaded or backed up frequently, which requires a laptop and special cables and software. If you are marking waypoints, unless you also make notes in a field book (which must later be transcribed), you will not collect data on density or species present. Beware that some GPS units purge their waypoints if you change the batteries. **You should submit all records on the standard datasheet reproduced in Appendix 2.**

Using the laptop datalogger ("Map-O-Matic"). If you are using the laptop datalogger, then each time you start along a new road or enter a new region, start the logger. Then, as you drive along, use the keypad to enter data according to the following schemes:

For Brood X:

	Scattered Individuals	Light Chorus	Full Chorus
M. septendecim	7	8	9
M. cassini	4	5	6
M. septendecula	1	2	3
None Present	0		
Remove Previous	"X" or "–"		
Quit	"q"		

The datalogger will automatically record the time, latitude, and longitude of each keystroke. However, you should occasionally make notes about temperature and weather conditions; to enter note-taking mode, press "+" and when you are done with your note, hit "return". To quit the program, type "." or "q". If you pass a chorus in which there are multiple species, make a separate record for each species in quick succession. They won't have the exact same coordinates, but they will be extremely close. When using this device, you should try to collect records on 1/10 mile intervals. Hand-deliver or ship the datalogger to John Cooley at the end of the project. **Note that some keypads require you to press the "NumLock" key in order to function properly**. Advantages: Allows rapid acquisition of locality, density, and species data. Disadvantages: Must be backed up frequently and requires some familiarity with UNIX operating systems.

Written descriptions of record localities. As you collect records, write in your field notebook a written description of the locality, noting date, time, weather, etc.. Try to record street addresses or intersections, and if a street has two identifiers (e.g., a name and a highway number), record both. You should submit all records on the standard datasheet. Advantages: Requires no special equipment. Disadvantages: Extremely difficult to geocode. Street signs may not match databases of street names used to geocode, so these sorts of records must often be geocoded by hand.

Standard Data Sheet

Data obtained will be incorporated into the periodical cicada database. This project will generate a lot of data, and in the past, data have been submitted in a variety of formats, which has greatly complicated and delayed their integration into the database. In order to streamline this process, **please follow a few simple rules** and use the standard data sheet to report data (electronic copies available at: https://cicadas.uconn.edu/datasheet/). The standard data sheet is an Excel-compatible spreadsheet with the following column headings, **in order:**

A. **Latitude**. Latitude North should be included in decimal (dd.dddd°) format **only,** WGS 84 map datum. Most GPS units can easily be set to display this format. Degrees, minutes, and seconds format (dd°mm'ss") or decimal minute format (dd°mm.mmm') are difficult for computers to parse.
B. **Longitude**. Longitude West should be included in decimal (dd.dddd°) format **only,** WGS 84 map datum. Most GPS units can easily be set to display this format. Degrees, minutes, and seconds format (dd°mm'ss") or decimal minute format (dd°mm.mmm') are difficult for computers to parse. **Note that Longitude West does *not* have a negative sign for any location in North America.**
C. **Date**. Dates should be recorded in dd/mm/yyyy format.
D. **Time.** Local time should be recorded using a 24-hour clock.
E. **Elevation.** Elevation should be given in meters (m).
F. **Temperature.** Temperature should be given in Fahrenheit (°F).
G. **Species.** Use full species epithets (skip the genus name, *Magicicada*) when reporting species identities. Do not use abbreviations (-decim, -decula, etc.), and use "unknown" when the species is not known or when you are recording a negative record.
H. **Density.** Use the four categories defined in **Appendix 1** to record density.
I. **State.** States should be given as 2-letter postal state abbreviations.
J. **Collector.** The last name or names of collectors should be recorded in this column.
K. **Locality Code.** Any locality codes assigned must use the format given in **Appendix 5** and are to be considered provisional until incorporated into the database.
L. **Locality.** A brief description of the locality.

M. **Notes.** Any notes about the collection site, the cicadas there, etc.,
N. **Other.** Once you have added columns A-M to your datasheet, you may add as many additional columns as you see fit. Remember to clearly label them.

Intentionally blank page for example standard Data Sheet

The GPS Datalogger

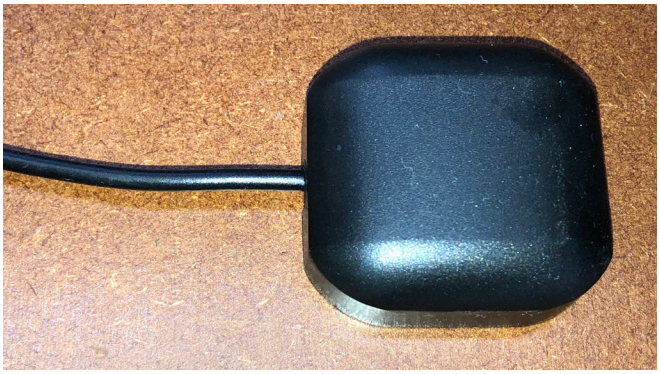
The “Map-O-Matic” datalogging GPS is a compact device constructed of off-the-shelf components.

Each kit consists of:

1. Raspberry pi computer with GPS.
2. Backup MicroSD card
3. GPS Antenna
4. Thermocouple probe
5. Keypad (Various models)
6. 12v Car charger/adapter

Do not obscure the fan on top or allow objects to fall into it! As with any electronic device, avoid exposure to moisture, direct sunlight, high temperatures, or shocks, and allow air to circulate around the vents. The device costs approximately $300, and if it is lost or damaged, you are responsible for replacing it.

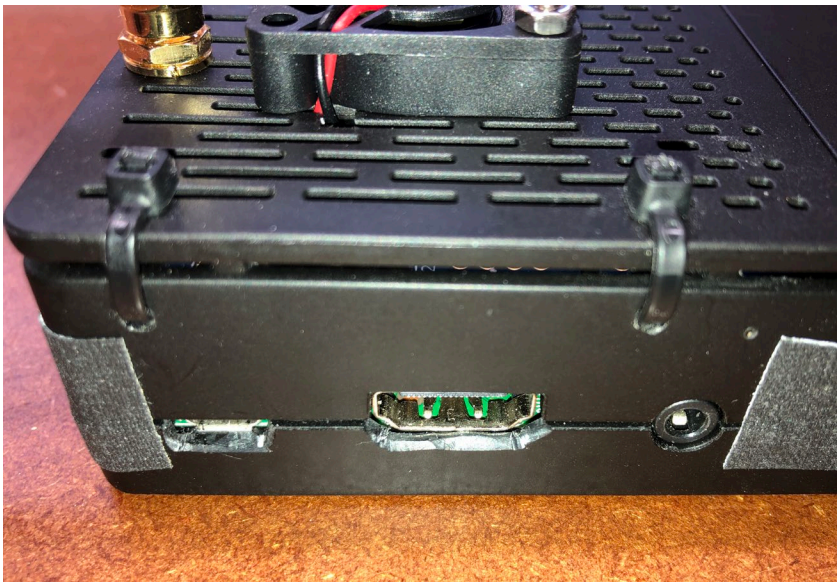
The mapper has a GPS antenna that is secured with a gold connector. The antenna may be removed by gently unscrewing the connector. The unit has an internal antenna and will function without the external antenna, but its sensitivity will be reduced.



The mapper has a thermocouple probe that plugs into an RJ-11 (telephone-style) jack on the top of the unit. Don't plug the probe into an actual phone jack, and don't plug anything other than the probe into the jack on top of the unit.

One end of the mapper has USB ports for connecting a keyboard, mouse, or thumb drive. Although the mapper has an ethernet jack, it also has WiFi and may be connected to any wireless network.

One side of the mapper has a MicroUSB power port. Any 5VDC USB power source may be used to power the mapper. This side of the mapper also as an HDMI port for video output to a monitor.



The Map-O-Matic device runs Raspian Jessie OS. This OS is extremely stripped down, though files are organized in a manner similar to Mac OS X or Windows 10. These units have limited memory and hard

drive space, and it is suggested that you periodically back your files up to a USB thumb drive and use another computer to email them to John Cooley.

Please do not replace, add, or modify any of the software on the computer. The software has been optimized for use in the datalogger. All units were tested before shipping.

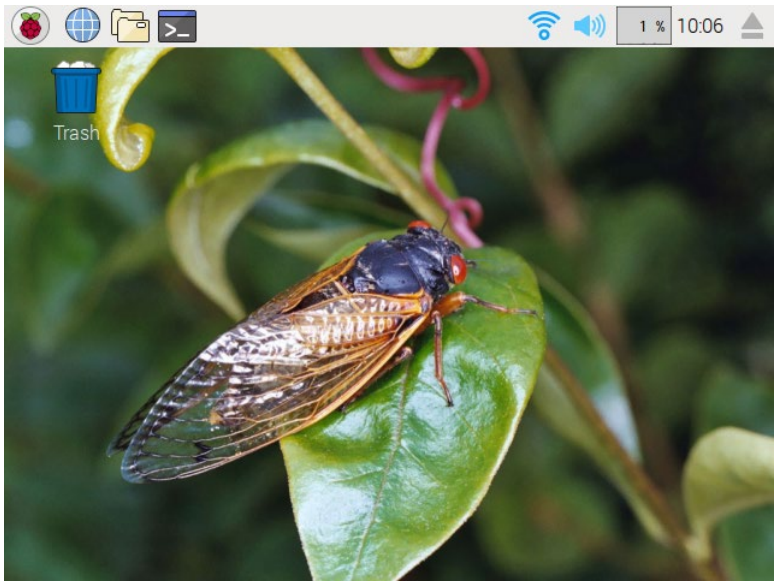
To use the Map-O-Matic device

1. Plug the car charger into the power socket of the computer and plug the other end into the cigarette lighter of your car. Be aware that in some cars, the lighter has no power unless the ignition is on, and that in most cars, if you start the car, power to the lighter may be interrupted. **The computer has no onboard battery, so it will crash if power is interrupted**.

2. Stick the GPS antenna to the outside of your car (it is magnetic). Run the cable inside the door, **and avoid slamming it in the door or pinching it in the window.** The antenna is moisture-resistant. You can also put it on the dashboard; however, if your car's windshield has a metallic coating, the antenna will not work.

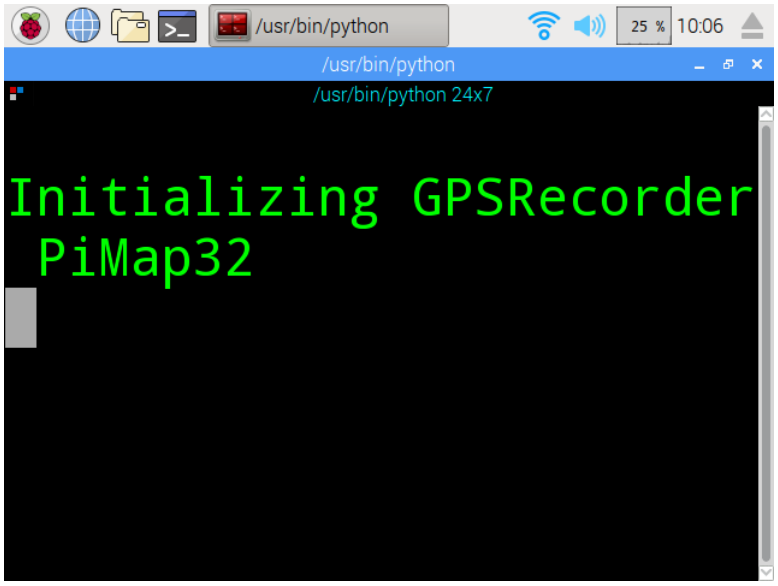
3. Connect all peripheral devices, such as monitors and keyboards, to the appropriate ports. Also connect the power cord.

4. Start the computer by pressing the power button or plugging in the power cord. When the computer has booted, you will see the following screen:

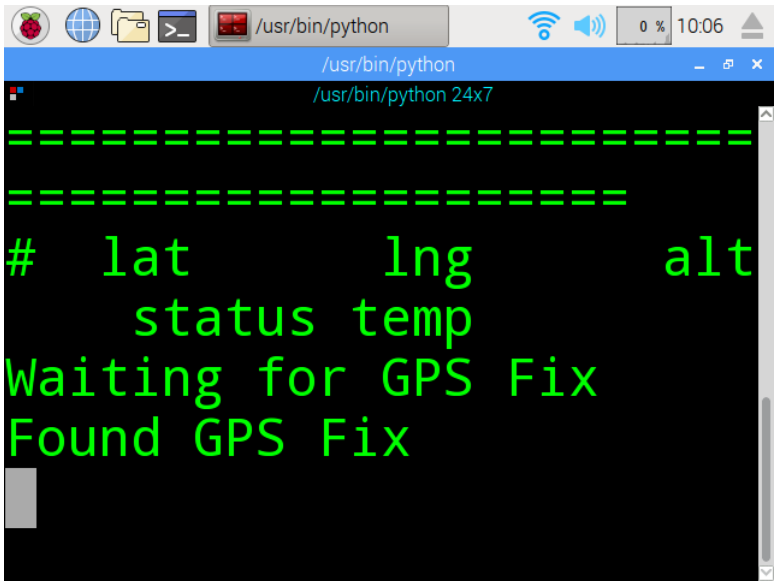


5. Once the computer has booted, in the "Favorites" menu along the left side of the screen (an image of a raspberry), choose the first item, "**mapper**." Each time you launch **mapper**, a new file will be created.

6. Once **mapper** has launched, you will see this screen:

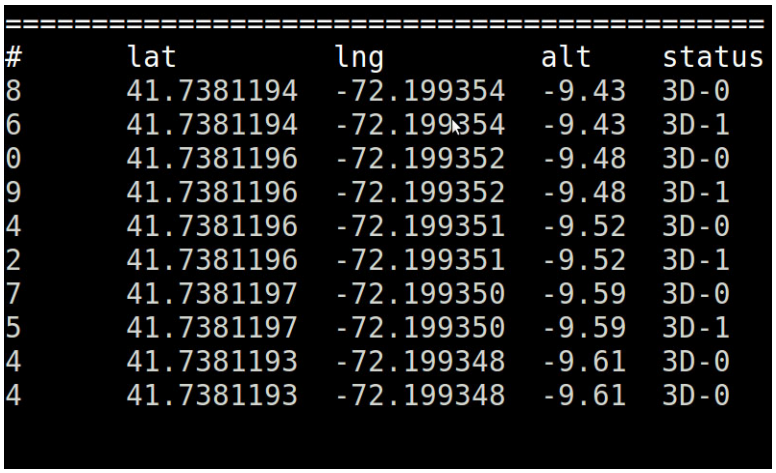


7. **Mapper** will not be ready for use until it has found a satellite fix. Once **mapper** is ready to use, you will see this screen, which indicates that the temperature probe is working and that the GPS unit has found satellites:



8. Once you're ready, move along your mapping route and press single keys according to the scheme noted under "Recording Your Data"**.**

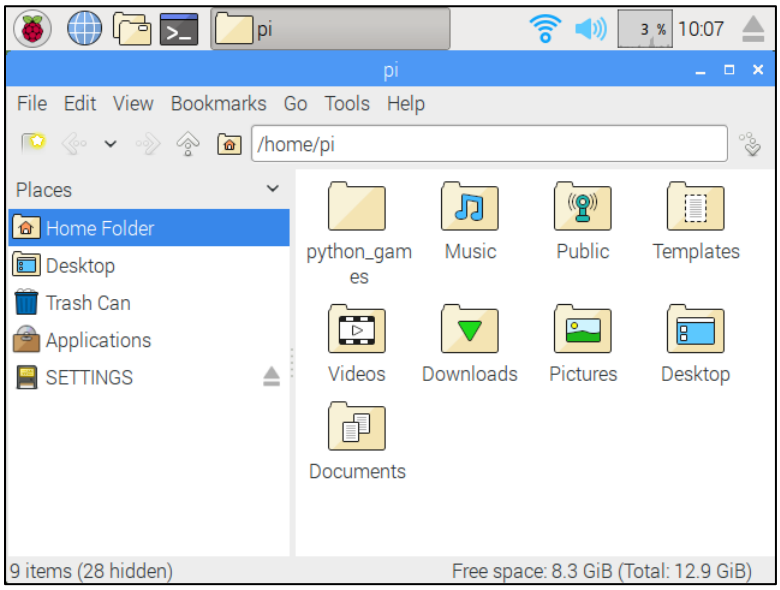
9. The computer will log the latitude, longitude, and the key you pressed. As you gather data, your screen should look like this, with your key in the left column, and GPS data in the other columns (the rightmost column indicates how strong the satellite "fix" is). Note that you do not actually need to read this screen; it's only there so that you can monitor that the unit is functioning. On some unites, the default font size is set extremely large to aid in monitoring the screen:



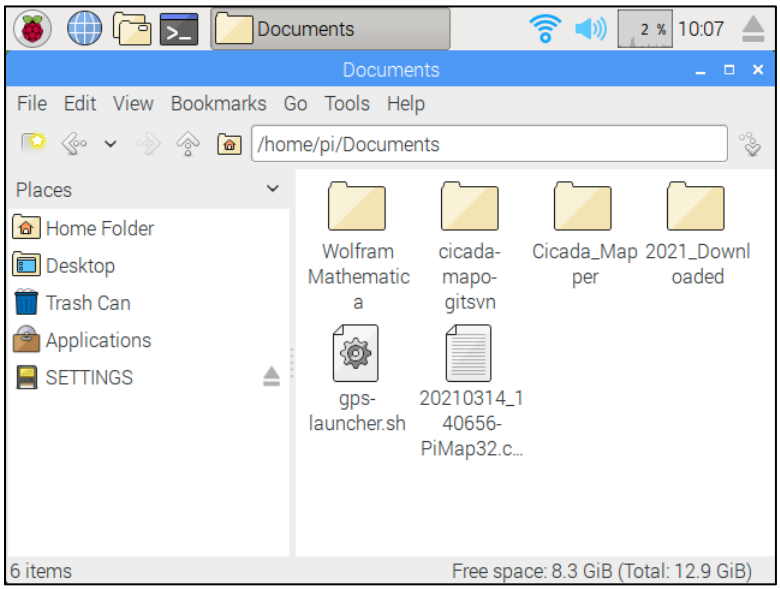
10. When you are done mapping run, press "q" to quit the program. **Mapper** will quit.

11. To start another mapping run, re-launch **Mapper.**

12. Data files will be saved in your documents folder, which you can access by clicking the “Folders” tab in the top menu bar (see image below).



13. Double-click on the icon for the documents folder to open it. You will see a number of icons in it (see image below). The data files are named according to the convention “yyyymmdd_tttttt.csv”.



14. Copy the files onto a USB drive, and then move them into the “2021 Downloaded” folder (your folder will have a slightly different

name). Periodically e-mail these files to cicada@uconn.edu. Doing so will effectively back up these files.

15. In the event that the computer malfunctions or the hard drive fills up, contact John Cooley.

Troubleshooting the GPS datalogger

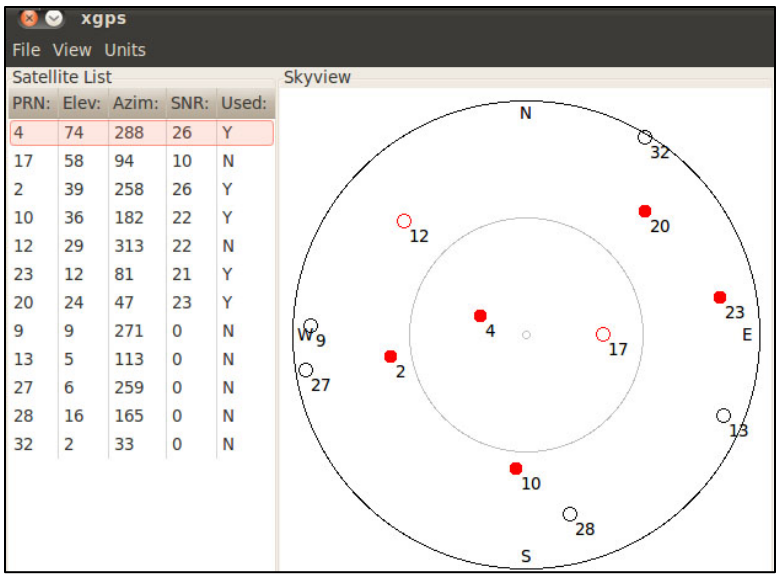
How to open a UNIX terminal window:

1) Start the computer and wait for it to finish booting.
2) Under the "internet" tab, choose "terminal"
3) Alternatively, from the home screen, type "CTRL-ALT-T"

How to test whether the GPS unit is finding satellites

1) Start the computer and wait for it to finish booting.
2) Place the GPS unit where it can "see" satellites (e.g., outdoors, away from trees)
3) In a UNIX terminal window, type the command **xgps**

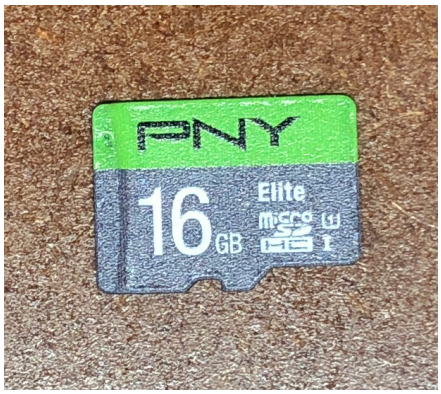
This command will bring up a window much like the screen on a standard GPS, as shown below:



Available satellites are listed in the table on the left, while the graphic on the right shows their predicted locations in the sky. **If no**

satellites appear in the table or in the graphic, then the computer is not communicating properly with the GPS unit. **If you can see satellites in xgps, then mapper should work correctly.** *Tip: Hold down the "alt" key to drag the XGPS window up so that you can see lat/lon.*

The Raspberry pi computer has no hard drive and the operating system and all files are loaded on a MicroSD memory card.



This card is located in a slot on the bottom of the computer.

This card is not readable by a conventional computer, so please **do not try**, as attempting to mount it on another computer could damage the file structure.

Each mapping unit is supplied with a backup MicroSD card. If your mapper ceases to function and the problem appears to be software-related, gently remove the card from your mapper and install the backup card. Your mapper should function normally.

GPS Navigator Devices

Database records as Points of Interest (POI)

Data points from the Cicada Central database have been provided as "points of interest" (POI) for loading onto Garmin automotive navigation devices. POI are point data analogous to GIS shapefiles. Garmin Nuvi automotive navigation devices (and some other brands) can display such data, under certain conditions. The advantage of displaying data points as POI is that the required files are very small and display quickly. The disadvantage of displaying data points as POI is that they are displayed only at 300ft resolution (standard screen models) or 200ft resolution (widescreen models). *Remember to turn off "proximity alerts" for these points of interest, or an alert will sound each time you approach a record!*

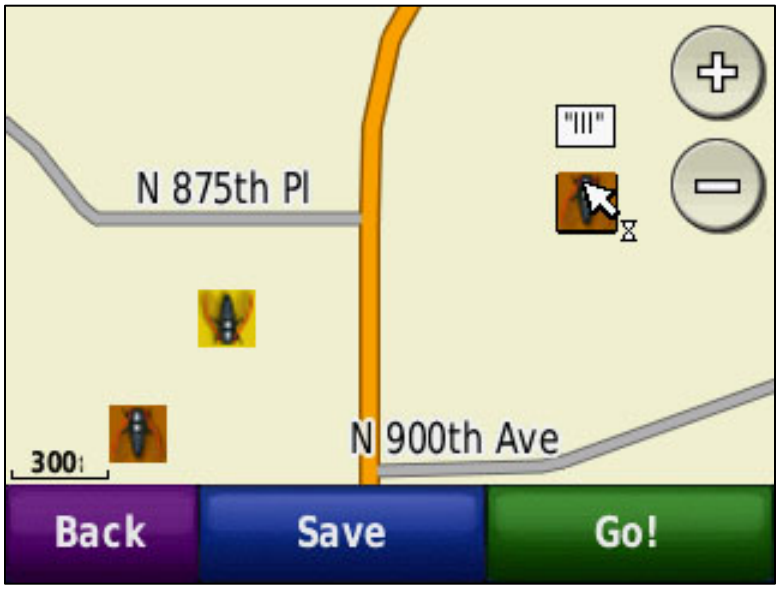


Figure 4.1. POI on a Nuvi 200 series navigator.

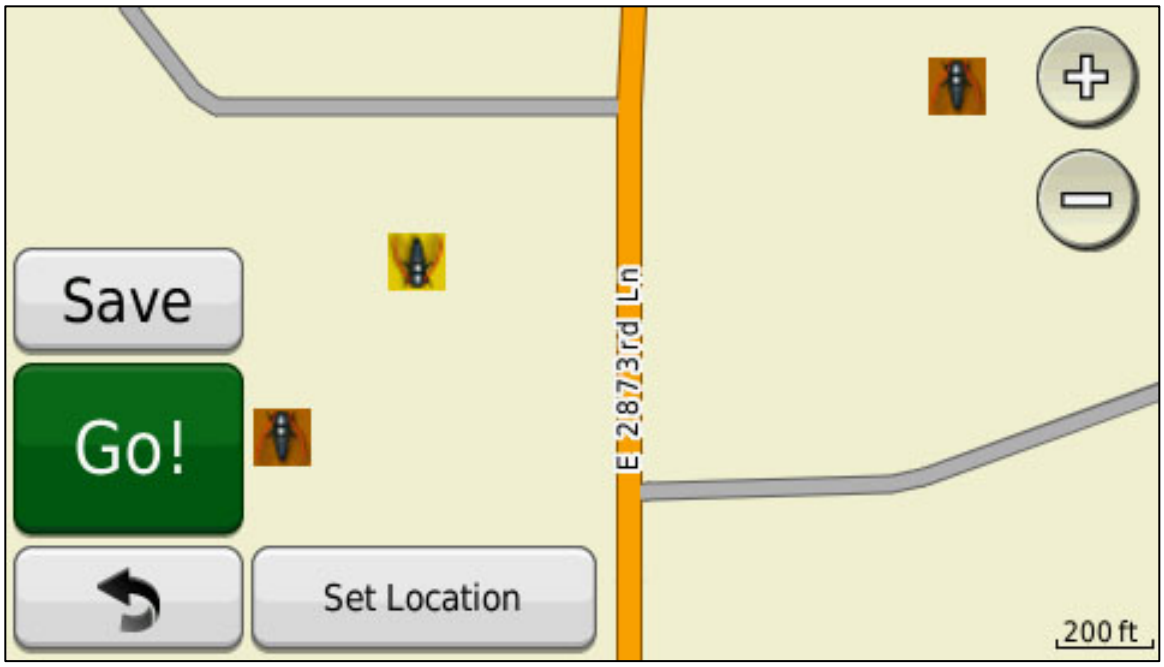


Figure 4.2. POI on a Nuvi 1300 widescreen GPS navigator.

The *Magicicada* POI dataset has been designed with distinctive icons. 17-year broods have a cicada icon with the head facing up, and 13-year broods have an icon with the head facing down. Adjacent broods also have different colored icons, and moving the cursor onto an icon causes the brood number to be displayed. As an example, Figures A6.1-A6.2 show an area near Siloam Springs State Park, IL, where Brood III (brown icons) and Brood XIX (yellow icons) are in close proximity.

To use this dataset, obtain the file "magi_poi_v4.zip" from **http://magicicada.org/about/poi.php**. This file will unzip to a folder named "POI_III". By downloading this dataset, you agree to several conditions:

- No warranty is made as to the accuracy or compatibility of these data
- Only experienced GPS users should attempt to program or modify GPS units, and by downloading this data set, you accept all responsibility for any damage to your GPS unit.
- You agree that these data are the property of Cicada Central and you agree not to distribute or republish these data without express written permission.
- These data are not to be used for scientific research purposes, as their accuracy has not been checked.

Loading points using POI Loader

1. Go to the Garmin Website and download POI loader (http://www8.garmin.com/products/poiloader/).
2. Connect your GPS unit to your computer using a USB cable.
3. Start POI loader.
4. At the "save options" screen, choose "Garmin Device" and click "Next". On the next screen, you will see your device; if it shows up properly, click "Next".
5. You now have the option to "Install new custom POI's…". Choose this option and click "Next".
6. You will now see a screen where you can navigate on your computer to find and select the "Magicicada_POI" folder. Do this, and choose "Feet and MPH" as the units. Also, choose the "Express" option for installation, and click "Next."
7. Your data points are loaded.

Advantages: Allows removal of points later. Disadvantages: Complex, and requires software and cables. May not be Macintosh compatible.

Loading points using a microSD card

1. Obtain a blank microSD card (small size will work).
2. Using your computer, place the file "Magicicada_POI" on the microSD card.
3. Insert the microSD card into the expansion slot of your Garmin device.
4. Start the Garmin Device.
5. When prompted to install the data on the device's memory, click "OK".
6. Your data points are loaded, and you may remove the microSD card.

Advantages: Fast and simple. Disadvantages: Without POI loader, you cannot remove the data points.

Locality Codes

The periodical cicada database makes use of site codes to tie specimens to locality data. These codes follow certain conventions that are designed to keep the database organized and to eliminate ambiguity. These codes contain four fields in the following format:

YY.SS.XXX.NN

These fields are defined as:

1) **YY** 2-digit year code. For this project, the year code will be 15.
2) **SS** 2-letter state code. This is the 2-letter US postal service state abbreviation.
3) **XXX** 3-character site code. This code consists of three alphanumeric (numbers or letters) characters. The three characters may be arbitrary, but they are typically chosen because they have some relationship to the site description. For example, specimens collected on "Rabbit Island" might be given the three-letter code "RAB".
4) **NN** 2-letter initials. This character is the first letter of the first name and the first letter of the last name of the person assigning the code.

Note that you are not required to put full locality labels into each specimen container, although it never hurts to do so. Instead, you can place a label in each container that consists of the site code ***as long as a standard data sheet providing full locality information for each site code is also filled out.***

Because of the possibility of accidental duplication of site codes, all site codes that are assigned in the field are to be considered provisional until all records are incorporated into the database.

Labeling specimens and specimen preservation

Specimens should be clearly labeled. The labels should contain the date, a description of the site, the names of the collectors, and the latitude and longitude, if available. Alternatively, specimen labels can consist of the locality code, ***as long as a standard data sheet providing full locality information for each locality code is also filled out.***

Specimen labels should be clearly written in pencil on both sides of a small slip of white paper. ***Do not use pen to write labels.***

Specimens for genetic analysis should be stored individually in small vials or in large Ball jars filled with 95% Ethanol. A paper label should be included inside the container, and the outside of the container should be labeled as well. Specimen containers should be kept cool and out of sunlight.

Practical Considerations

Things to have in each vehicle

1. First aid kit
2. Cell phone
3. Road maps
4. Field notebook, pencils, etc.
5. Extra batteries for GPS, camera, etc.
6. Water, food etc.
7. Maps of existing records
8. Jumper cables, functional spare tire, emergency kit
9. Camping gear (incl. cookware, clothesline, etc.)

Safety tips in the field

1. When you stop by the side of the road, ***pull all the way off the road***. If you cannot do so, it is not safe to stop.
2. Avoid stopping on busy roads.
3. Beware of roadside ditches, which may be hidden by weeds or grass.
4. Beware of roadside grass and weeds, which may hide sharp objects.
5. Keep valuables (computers, GPS units, etc.) out of sight. *This includes cases, battery chargers, and suction mounts for devices such as GPS units.*
6. Take frequent rest breaks.
7. Keep in touch with the group and let others know where you are.
8. Check all fluids in your car. This kind of work is hard on a car, and continual stop-and-go driving can cause your car to overheat.
9. Carry a piece of plywood roughly twice the size of the base of your jack, in case you need to change a tire on a soft surface.
10. It is a good idea to carry a set of jumper cables.
11. Try to stay away from busy roads, but also don't get bogged down on very poor quality dirt or gravel roads. If a road deteriorates to the point that you start to wonder seriously about it, it's time to turn back and try another route.

Places to get common items

1. Wal-Mart usually stocks computer flash drives, disk drives, De Lorme maps, white cooking gas, gas canisters, clothespins, batteries, etc. Sometimes Wal-Mart also has dry ice.

2. Barnes and Noble usually has a good selection of DeLorme maps.

Funding Sources

While in previous years, research expenses for mapping periodical cicadas were underwritten by NSF or by the National Geographic Society, there is no additional research funding for the 2021 emergence. Plan accordingly.

Important locations and contact information

1) Project homepage: www.cicadas.uconn.edu
2) Simon Lab, Department of Ecology and Evolutionary Biology, The University of Connecticut, 75 N. Eagleville Road, Storrs, CT 06269-3043. (860) 486-3947. The closest commercial airport is Hartford (BDL).

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