



Monarch Larva Monitoring Project 2011 Newsletter

A North American Citizen Science Program

150,000: the number of milkweed plants observed by MLMP volunteers in 2010! Needless to say, the magnitude of this project would not be possible without the hard work and generosity of our volunteers. Thank you!

We're excited about current work to combine MLMP data with findings from other monarch monitoring projects including MonarchHealth, Journey North, the North American Butterfly Association's Summer Butterfly Counts, and Butterfly Monitoring Networks. With these combined databases, we're working to answer questions such as how monarch movement across the landscape is affected by environmental factors, and how the timing and the location of the fall migration, including fall roosting sites, varies from year to year.

Here's to a wonderful 2011 monitoring season!

-The MLMP Team

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Citizen Science and the MLMP: Reflections from Karen Oberhauser

There is a lot happening in the world of citizen science and with the MLMP. It's definitely an exciting time to be engaged in what is becoming (or re-becoming) a fairly mainstream approach to scientific research.

Observing and Conserving

On April 7-8, I'll be at the American Museum of Natural History, attending a meeting called "Engaging and Learning for Conservation: Workshop on Public Participation in Scientific Research" (PPSR - a long way to say citizen science). At this meeting, citizen science project coordinators from throughout the country will reflect on how citizen science promotes conservation. I'll share the great conservation work done by MLMP volunteers—stewardship of the land you monitor, outreach and education activities, and environmental advocacy. Your direct interactions with your monitoring site and with monarchs provide a strong impetus to engage in actions that protect that site and the organisms it supports, and to share your expertise with children, students, the media, and others with whom you engage in your daily lives. You're conducting your own monitoring workshops, giving talks to community groups and schools, and helping others set up their own monitoring sites.

In addition to the actions that MLMP volunteers undertake, MLMP data have incredible conservation value. Many research questions could potentially be answered in many locations and at many times. Monitoring data, however, are specific to location and time; a missed monitoring opportunity can never be recovered. Because so many conservation programs depend on understanding how human activities affect other organisms, monitoring data can be used to assess the need for and success of conservation efforts. We work hard to manage and analyze your valuable data, and publish and share our findings. For example, our webmaster, Amy Witty, has recently changed the structure of the database to make it easier to query the data, and we are in the middle of a two-year project to coordinate analyses with other programs that monitor monarchs.



Photo by A. Eichorn.

The Milkweed Patch Web of Life

Almost 10 years ago, I talked with Ba Rea about putting together a small pamphlet about invertebrates that observers would be likely to see in their milkweed patches. We quickly decided that a pamphlet couldn't do justice to the diversity of organisms found in these habitat patches, and the result was "Milkweed, Monarchs and More," which is now in its second edition. In case you haven't explored the MonarchLab web store recently, it's also available in a larger edition (easier to read, but harder to fit in your jeans pocket, see page 11).

Reflections from Karen (Continued on page 15)

What the Data Say: Monarch Populations over Time

For the past year, a group of monarch biologists, GIS specialists, and experts in long-term data analyses have been meeting to synthesize millions of lines of data from a network of monarch monitoring programs (see www.monarchnet.org). Using data from these programs along with experimental findings from labs at the Universities of Minnesota and Georgia, we are working to understand what drives the large fluctuations that are apparent in all of these databases.

We can learn a lot just by looking at MLMP data, and this year I'd like to summarize some interesting regional patterns that we've observed, as well as providing our usual update on the long-term data from the upper Midwestern U.S.

15 and 18 Years of Data

U of MN MonarchLab members began collecting data at our site in Western WI in 1996, and many other MLMP volunteers joined the following year. So, counting the first year, we have 15 years of MLMP data. Because we were strongest in the Upper Midwest in the first several years, we analyze data from MN, WI, IA and MI separately. Figure 1 shows the peak egg density in July or August for each year (the line on the graph illustrates the average of all years). We use July or August egg density because these monarchs will migrate to Mexico as adults. As many of you noted, 2010 was a better year than the past few years, and better than average.

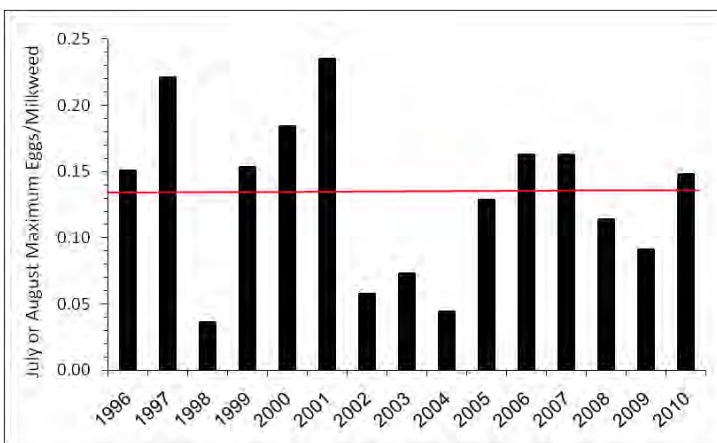


Figure 1. Peak egg density in July or August for each year. This density is calculated by summing all of the milkweed plants and eggs observed each week on all sites in the MN, WI, MI and IA, dividing the number of eggs by the number of plants, and selecting the week with the highest value. The horizontal line is the average over all years.

Personnel in Mexico, associated with the Monarch Butterfly Biosphere Reserve and WWF-Mexico, have been documenting the area occupied by overwintering monarchs each year since 1993. Figure 2 illustrates these data, also showing a line for the average across all years (the year on the graph is the start year for the overwintering season). There are interesting similarities and differences in the two graphs, but there is actually not a statistically significant correlation between summer breeding densities in the Upper Midwest and the size of the area monarchs occupy.

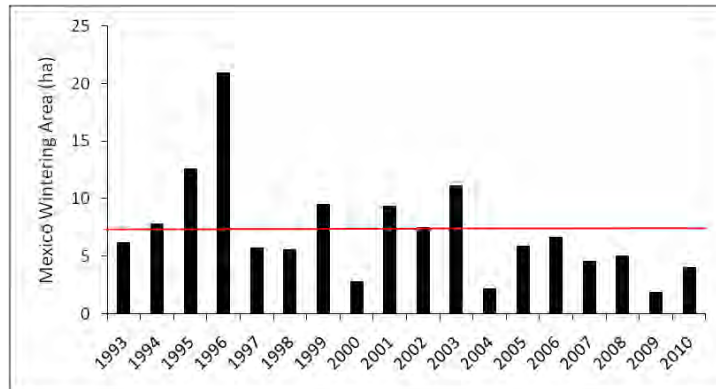


Figure 2. Forest area occupied by monarch colonies from winter 1993-1994 to 2010-2011. Data from Rendón-Salinas, E., C.A. Valera-Bermejo, M. Cruz-Piña y F. Martínez-Meza. 2011. Monitoreo de las Colonias de Hibernación de Mariposa Monarca: Superficie Forestal de Ocupación en Diciembre de 2010. Reporte inédito. 7 pp.

Four regions

Most biologists assume that the majority of monarchs that winter in Mexico originate in the Upper Midwestern U.S., but we know that fall breeding occurs in the southern U.S., and that monarchs from the Northeastern part of the breeding range also migrate to Mexico. So, we can also look at monarch production in other regions. We've done that, using data from 2005-2010, since we have better coverage outside the Upper Midwest during the second half of the project. We divided the eastern breeding range into four regions (see Figure 3).

There are many ways we can look at these data. For example, we can look at population numbers from one phase of the annual cycle of overwintering, migrating, breeding and migrating to the next (see Figure 3 for a visual). We have numbers for monarchs in Mexico, and then spring breeding densities in the South Central U.S (Arrow #1). Monarchs produced in the spring in the South Central region move north, and produce a spring generation in the North Central region (Arrow #2), then there is at least one more "summer" generation in the north (Arrow #3). Most monarchs leave the north central region at the end of summer and migrate to Mexico (Arrow #4), but some breed in the South Central region in the fall (Arrow #5). We think that at least some of butterflies produced in the fall fly to the wintering sites in Mexico (Arrow #6), although there is some winter breeding in the South Central region. We can look for correlations in succeeding generations to assess this model of monarch movement, and also to come up with speculations about intervening events that might prevent tight correlations in our estimates of population size.

The table summarizes correlations between the monarch populations represented at each end of the arrow. Correlation values can range between -1 and 1. You can think of them as representing the proportion of the variation in one value that can be explained by another value. The p-values in the next column tell us how sure we are that there really is a relationship – the value represents the chance that the

What the Data Say: Monarch Populations over Time (continued)

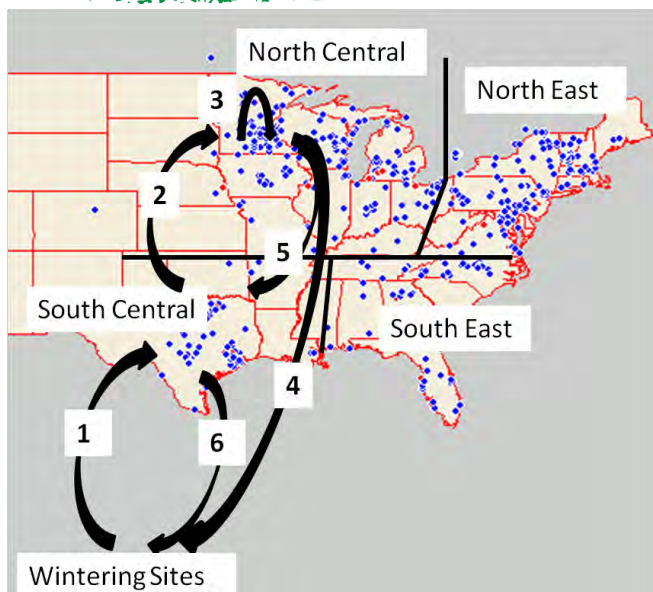


Figure 3. Monarch annual cycle in the Central U.S. and South Central Canada. Dots represent MLMP monitoring sites, and each arrow represents movement from one phase of the annual cycle to the next. See text for more explanation.

relationship we're seeing is just due to random chance, and not a real relationship. Thus, you can subtract the p-value from 1 to give you a sense of how sure you can be that there is an effect. Ecologists usually like to be at least 90% sure, so p-values under 0.1 are good. Because we only are using 6 years of data, we have a lower chance of actually seeing a relationship.

Table 1.

Arrow	Correlation	p-value
1	0.33	0.51
2	0.73	0.09
3	0.84	0.035
4	0.31	0.55
5	0.58	0.22
6	0.75	0.088

You can see first that all of the correlations are positive. That's encouraging! There are strong correlations represented by Arrows 2, 3, and 6. Thus, there tends to be a high density of spring monarchs in the North Central region after a year with high spring densities in the South Central region, and likewise for spring and summer in the Upper Midwest, and fall in the Texas and the following winter in Mexico. More detailed analyses and a longer time series will help us to understand these patterns better, but the correlations are exciting. Can you see any patterns in the Eastern data below (Figure 4)?

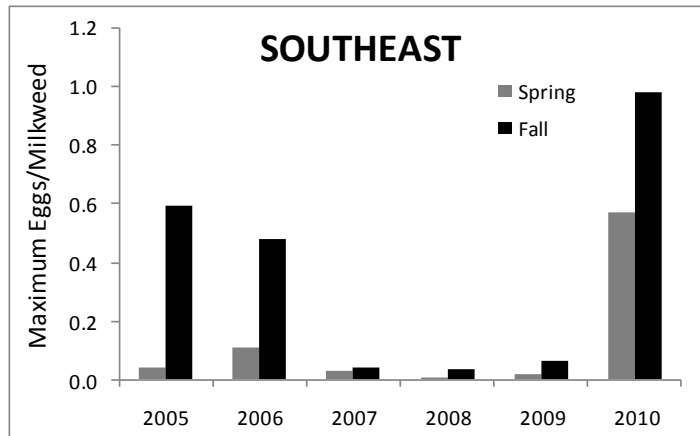
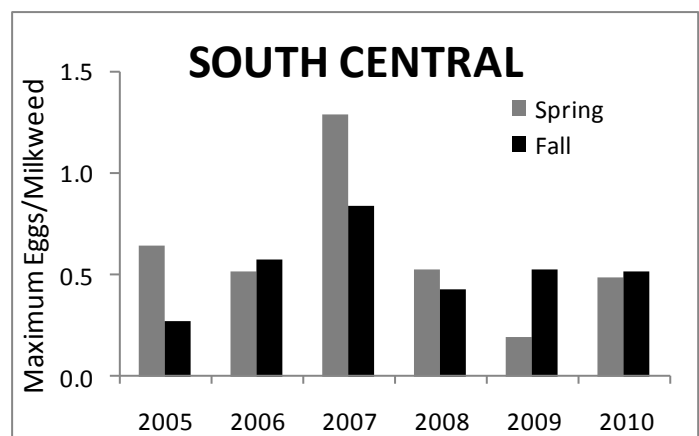
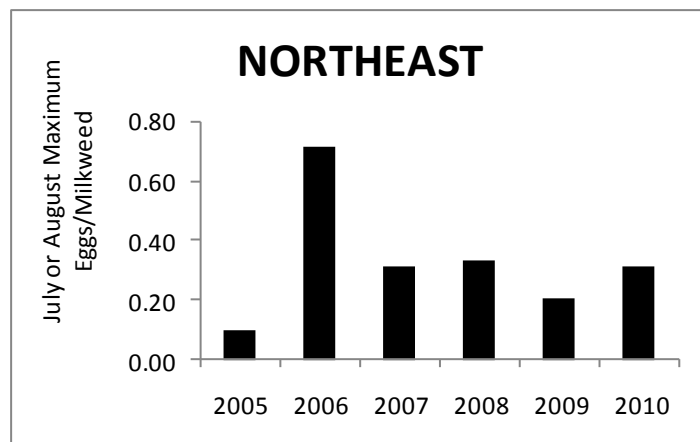
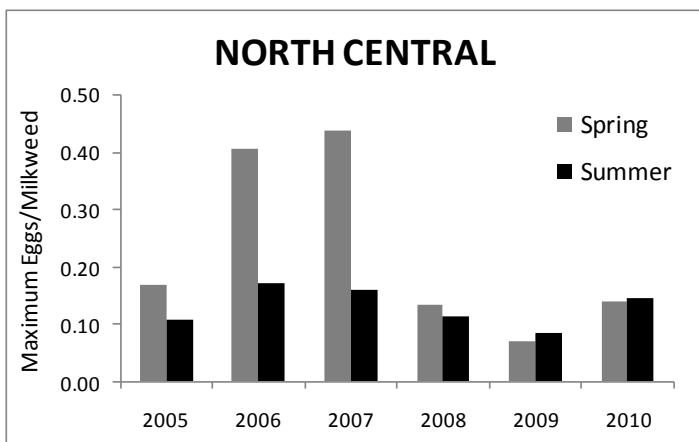
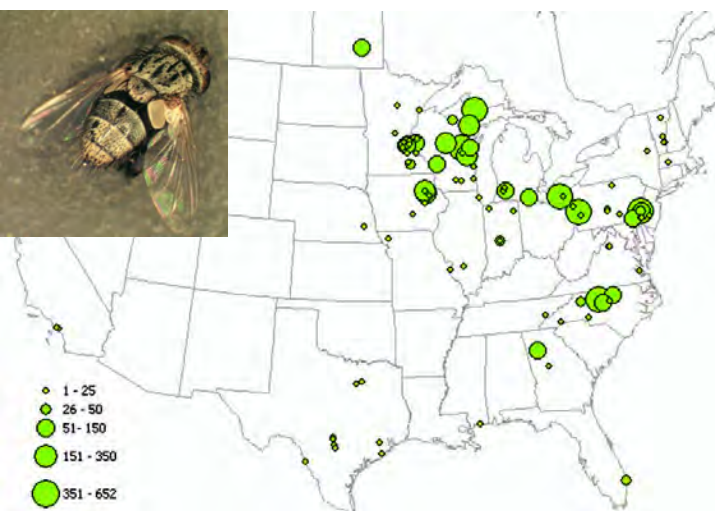


Figure 4. Peak egg densities in each region for each year. This density is calculated by summing all of the milkweed plants and eggs observed each week on all sites in the region, dividing the number of eggs by the number of plants, and selecting the week with the highest value. Dates for each season are: South Central spring = weeks of March 15-May 15, South Central fall = weeks of August 15-October 15, North Central spring = weeks of May 22-June 22, North Central summer = weeks of July 3-August 10, Southeast spring = weeks of May 8-June 15, South East fall = weeks of July 24-Sept 18, Northeast = weeks of July 3-August 10.

New Findings: Tachinid Flies and Monarch Density

Understanding relationships between predators and prey, or parasites and hosts, is an important area of ecological research. Ecologists expect that population dynamics of specialist natural enemies (organisms that only consume one species) should be tightly linked to their prey. On the other hand, population dynamics of generalist natural enemies (organisms that consume many species) are not expected to be tightly linked to any single prey, unless one prey is much more important than others. Likewise, the population dynamics of prey might be tightly linked to their most important predators, if their populations are controlled by these predators and not other components of their environment. We are using data on parasitism rates by tachinid flies to better understand the monarch/tachinid fly relationship, and host/parasitoid interactions in general.



Locations of collection sites for monarchs reared as part of the parasitoid study. If your site isn't on the map, consider adding it! Sizes of circles indicate the number of monarchs sampled.

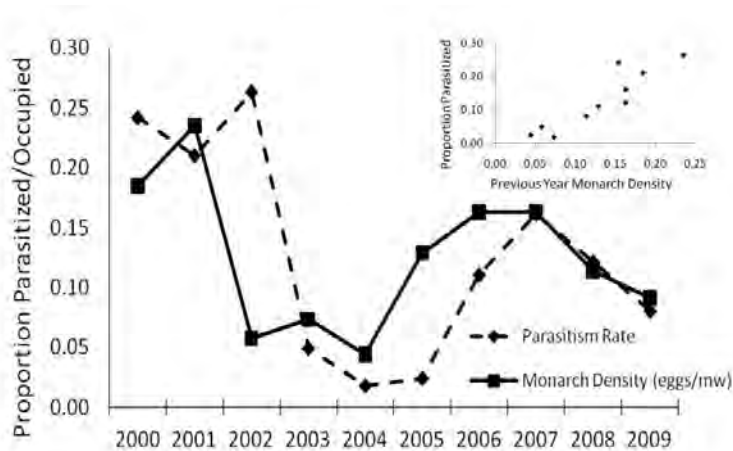
Wanted Dead or Alive: Monarch Parasitoids

If you are already rearing monarchs to test for parasitoids, please keep doing so! If you aren't, please consider doing so. Collect 4th and 5th instar monarchs from your MLMP site or any stage of monarchs from other sites, and record the stage at which you collected them and whether the monarchs produce parasitoids, adult monarchs, or die of some unknown cause. Enter your data under activity 3 at www.mlmp.org.

NEW THIS YEAR, send parasitoids to the University of Minnesota for identification. For more detail, see the new Activity 3 data sheet.

About 100 dedicated MLMP volunteers have collected over 8500 monarch larvae to measure parasitism rates by tachinid flies (see map). They rear the monarchs in their homes, recording the date and larval stadium at collection and the outcome of each rearing. We now have ten years of data on tachinid fly parasitism rates. Using MLMP data on monarch egg densities, we are working to relate parasitism rates to monarch densities. In a first step of this analysis, we used the July or August week with peak monarch density to represent annual population size (densities = # eggs observed in a week/# plants surveyed). MLMP data show a striking coupling between Upper Midwestern monarch population densities and tachinid parasitism rates (see graph).

Tachinid parasitism rates are tightly linked to monarch densities, with a one-year lag; i.e. a high density of monarchs in one summer leads to high parasitism rates in the next summer. There is no relationship between tachinid flies in one year and monarchs the next year. There is also no relationship between tachinid flies and monarchs in the same year (a good year for monarchs is not necessarily a good year for tachinids). This initial finding suggests that monarchs drive tachinid fly population dynamics, but tachinid flies do not drive monarch population dynamics. What is most interesting about this finding is the fact that the most common tachinid parasitoid of monarchs, *Lespesia archippivora*, has been reported to parasitize larvae of 25 Lepidoptera species in 14 families. MLMP findings suggest that perhaps the assumption that *L. archippivora* is a generalist is incorrect.



Upper Midwestern monarch densities (solid line) and tachinid parasitism rates (dashed line). Each dot on the inset graph represents the relationship between tachinid parasitism rates and monarch density the previous year. Note the strong relationship – a high monarch density year is always followed by a high tachinid parasitism year (and likewise with low monarch density years).

To study these issues further, we will do more detailed analyses of the relationships between monarch densities and tachinid parasitism rates in regions other than the Upper Midwest. We are also going to identify as many of the flies reared by MLMP volunteers as possible (see box).

More New Findings: Interactions Between Migration and Disease

Understanding the interaction between migration and infectious disease is fundamental to conservation efforts for many species. But the logistical challenges involved in collecting samples across the geographic scope of a species' range, from breeding to overwintering sites, can be enormous. A study recently published in the journal *Ecology** used data from the Monarch Larva Monitoring Project and Project MonarchHealth (University of Georgia) to address these challenges. The study is authored by Becky Bartel, Sonia Altizer (a co-founder of the MLMP), Karen Oberhauser, and Jaap DeRoode.

MonarchHealth (MH) volunteers capture wild monarchs, use non-destructive methods to sample scales from their abdomen, and send the samples to the University of Georgia to test for the presence of the parasite *Ophryocystis elektroscirrha* (Oe). In this study, Oe data were correlated with monarch densities measured by MLMP volunteers. The participation of MLMP and MH volunteers allowed data collection across geographic and time scales that would be impossible if the research were only conducted by professional scientists.

The main focus of the research was how migration affects disease dynamics. We tested two (non-exclusive) hypotheses: that 1) migration allows animals to periodically escape contaminated habitats ("migratory escape"), and 2) long distance migration weeds out infected animals ("migratory culling"). Data on Oe prevalence during the breeding season, fall migration, and at the wintering sites in Mexico; and monarch density during the breeding season allowed a detailed analysis of trends in parasite prevalence and its relationship to monarch density and stage of the migratory cycle.

Parasite prevalence increased over the course of the breeding season, and was positively correlated to monarch larval density. Both of these relationships supported the "migratory escape" hypothesis, since they suggest that Oe builds up during the breeding season, and that migration allows monarchs to leave "contaminated" areas.

As the fall migration progressed, Oe prevalence decreased, and the prevalence of infection among monarchs wintering in Mexico was lower than for summer breeding or fall migrating monarchs, probably because heavily infected monarchs didn't survive the fall journey. This supports the "migratory culling" hypothesis; the fact that their prevalence in the

migratory population decreases suggests that infected monarchs are less able to migrate successfully. Parasite prevalence was also lower among monarchs sampled at two



overwintering sites in Mexico as compared to monarchs sampled during the summer breeding period.



Many MLMP volunteers

also contribute data to MH, and a new version of the Activity 3 data sheet (Estimating Parasitism Rates) includes directions for how to combine this activity with Oe sampling. These exciting new research results illustrate the power of Citizen Science, and the benefits of data cross-pollination! For more information on Project MonarchHealth, visit www.monarchparasites.org.

Top: Scale samples are taken by lightly touching a transparent sticker against the monarch's abdomen. (Photo by Bruce Leventhal) **Above:** This scale sample is infected with Oe. The large black ovals are monarch scales, but the smaller clumps of black dots (circled) are spores. **Right:** As the fall migration to Mexico progressed, Oe prevalence decreased among sampled populations. (Photo by Reba Batalden)



* Bartel, RE, KS Oberhauser, JC De Roode, SM Altizer. 2011. Monarch migration, seasonal habitat use and parasite transmission in eastern North America. *Ecology* 92(2): 342-351.

Watch out for Milkweed Aphids

Monarchs share their homes with other insects that may eat them or compete with them for food. Aphids are one type of insect that can be abundant on milkweed, and they are important to learn about for many reasons. The bright yellow oleander aphid, *Aphis nerii*, has been introduced to the United States from Europe, which might affect some native milkweed aphids, or even monarchs. When aphids become very abundant, they can damage or even kill plants. This may mean that they compete with other insects, like monarchs, for food. Aphids may also attract predators, like ladybeetles or lacewings, that could also eat monarch eggs.

What to look for

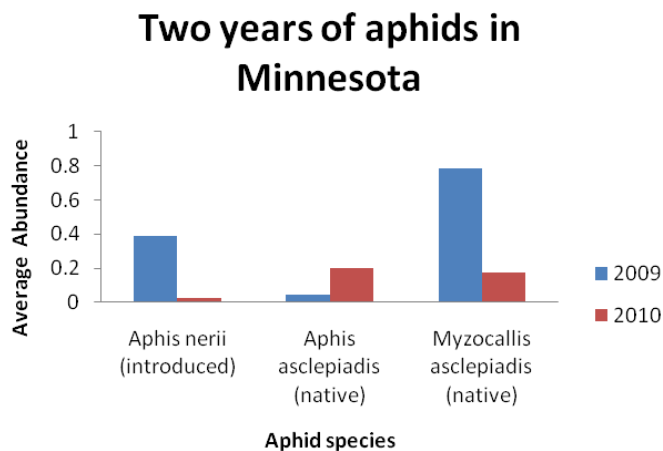
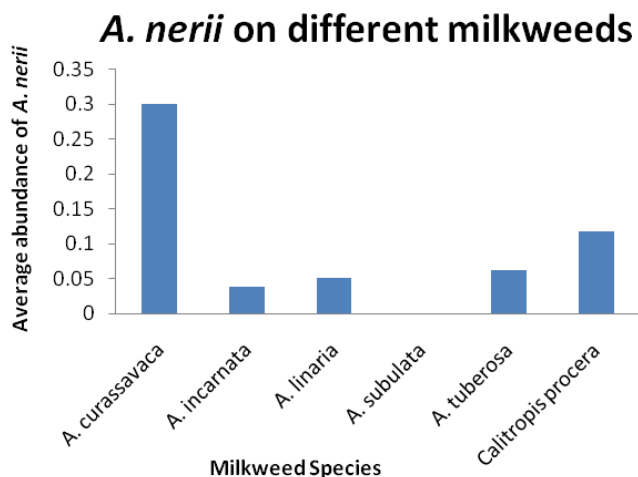
Aphids are small, soft-bodied insects that often live under leaves. They are herbivores with specialized straw-like mouthparts for sucking the sap out of plants. After eating, aphids secrete a sugary substance called honeydew onto the leaves, which can attract ants. When there are lots of aphids, the leaves can get sticky and sometimes a fungus will start to grow. Most aphids do not have wings, but some adults do.

What have we learned about aphids so far?

Lots! Thanks to dedicated volunteers who participated in pilot studies, we are starting to observe some interesting patterns. Gail Morrison monitored many milkweed species in Arizona, and she found that oleander aphids were most abundant on *Asclepias curassavica* but never showed up on *Asclepias subulata* (see graph). More observations like this will help us understand which milkweed species are most susceptible to aphids. Additionally, oleander aphids seem to be dominant at sites in California and Arizona, but native aphids are abundant on common milkweed in Minnesota. After two years of monitoring in Minnesota, with the help of Edward Xie, a high school student, we have discovered that the aphids at each of our sites changes over time. In 2009, aphids, including the introduced *A. nerii*, were much more abundant overall, but in 2010 we found few of the introduced species (see graph). More information will help us better understand aphids.

How can you help?

There are lots of ways to get involved at www.mlmp.org. The easiest way is to **look for aphids while you monitor!** Aphids can travel on the wind, so we are really interested in knowing whether or not you see aphids, particularly the introduced *A. nerii*, at your site each time you sample. You can record this information on the data sheets for Activity 1. We also learn a lot from **anecdotal observations**. Please share your observations, photos, or a brief season summary. These kinds of reports have already helped us to confirm that high densities of aphids



Top graph: Oleander aphid abundance on various milkweed species. Bottom graph: abundance of introduced and native aphid species in 2009 (left bars) and 2010 (right bars).

can kill well-established plants and that many other species of aphids are sometimes found on milkweeds. **Activity 5** involves weekly monitoring for aphids (it is complementary to Activity 1C for monarchs), and the **aphid identification cards** are included with the directions for this activity. If you have any questions or would like more information, please contact Emily Mohl (mohl@umn.edu).

Predators like ladybeetles consume aphids and may help to control their populations. Abundant aphids cover the flowering stalks of butterfly weed in the top right inset. The bottom inset shows a close-up of the introduced aphid, *Aphis nerii*.

Monarch Larva Monitoring Project: Beyond the Data

By Madaline Ebel, University of Minnesota Sophomore

“In the end we will conserve that which we love, we will love only that which we understand, and we will understand only that which we are taught.” -Baba Dioum

Through the mind of a seventh grade student, Baba Dioum's printed words across the back of a Monarchs in the Classroom t-shirt had a somewhat dismissible personal meaning. Teaching meant homework, understanding meant getting an A on a test, and conservation was an altogether uncharted term.

I first became involved with the Monarch Larva Monitoring Project the summer after sixth grade with an invitation to participate in two years of summer monitoring with a group of 12 of my peers, headed by my middle school science teacher, Cindy Petersen. Despite not knowing much about the monarch, I accepted the invitation under the pretenses of having a Type A personality and a rather petulant misconception regarding the college application process. What developed was life changing; I was hooked on science. After two summers at Spring Peeper Meadow (our group's weekly monitoring site) learning about the differences between common and swamp milkweed and the threats of tachinid flies, I was certain that I was destined to be a scientist. I attended the Insect Fair, and even though I can no longer recall the specifics of what my project entailed, the amazing feeling of achievement is vivid. Perhaps it was this feeling that continued to fuel my interest in the biological sciences – the pride in contributing to a program of continental impact and an evolving appreciation for the incomparable beauty of the monarch.

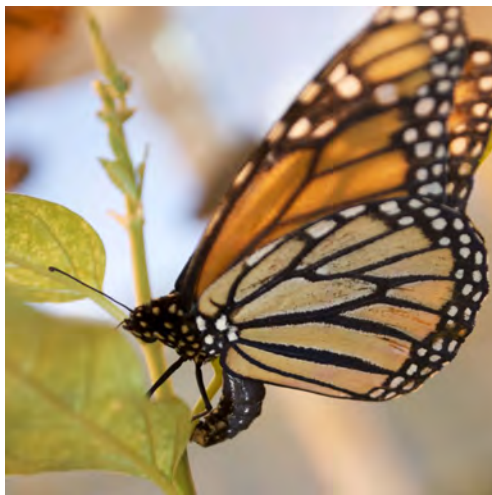


Photo by A. Eichorn.

The most beautiful and gratifying part of my experience came in the spring of my eighth grade year, when our monitoring group traveled to Morelia, Mexico to see the overwintering

sites, guided by Bill Calvert. Words are incapable of describing the humbling magnificence of the millions of monarchs clinging to every needle of every branch of the orange forest so hidden away in the mountains of rural Mexico. The remarkable beauty of these surreal sites will be forever clear in my mind, as will their influence. Currently pursuing a degree in Pre-Veterinary Animal Science at the University of Minnesota, the Monarch Larva Monitoring Project is responsible for sparking my interest in the sciences and I fully believe in its importance for securing the interests and enthusiasm of future biologists.

At twelve years old, I wasn't sure that spending a summer collecting field data on butterflies would have any positive effects on social standing, but the experience would change my life in ways that I only now begin to identify as a sophomore in college. I believe that the Monarch Larva Monitoring Project has infinite potential; it is the continental force behind monarch advocacy and conservation, and, of equal importance, it provides the opportunity to inspire young biologists of tomorrow.

Tips for a Successful Monitoring Season in 2011

Below are a few notes regarding the details of monitoring. Following these guidelines will allow us to use your data to its fullest potential. Thank you for all that you do!

1. Monitor as soon as you start seeing milkweed, and enter your data even if you don't see monarchs!
2. Be sure to measure milkweed density sometime in the middle of your monitoring season.
3. Update your site information every year, and note when you first see milkweed. Even if it's up several inches, you can still record the date.
4. In 2010, we added a new (optional) twist to monarch density data. You can now record the number of monarchs that you see on each "occupied plant," using data sheet 1C. You'll also record the plant species on which you find the monarchs.
5. Our analysis methods make it difficult to take into account monitoring frequencies greater than once per week. If you monitor more often, please only record your data on our website for one day per week (you can still do your own analyses for more frequent monitoring). If you miss weeks, only monitor once every two weeks, or need to monitor on a different day for a week, that's okay.
6. Send us your tachinid fly or wasp specimens if you rear any (see page 4).
7. Be sure to note the presence or absence of bright yellow aphids on your milkweed plants when you monitor.
8. We've made changes to our data sheets; let us know if you'd like us to send you hard copies.
9. Contact us if you have questions, comments, concerns, great pictures, poems, or just want to chat about monarchs.

Camera, Action, Picture!

Our volunteers are active! We receive numerous messages throughout the year with photos and stories they want to share. Unfortunately, we don't have room for everything volunteers submit, but here is a sample of what our volunteers have been up to.



Above: This close-up of a monarch egg about to hatch on milkweed was taken by Fred Ormand in North Carolina at Joyce Pearsall's site. You can even see the milkweed leaf's trichomes - the hair-like projections that act as a defense against herbivory.

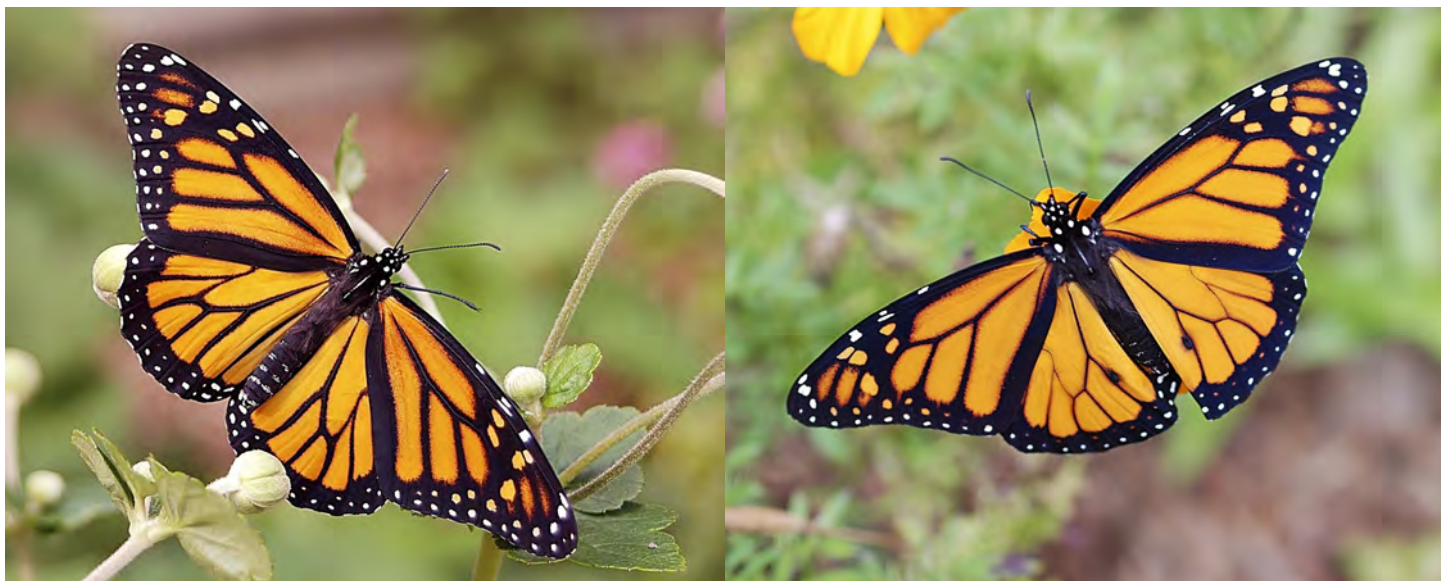


Left: Hadassah Zoharah took this picture of an acrobatic fifth instar on *Asclepias incarnata* (swamp milkweed) at Michael Blassey's monitoring site in Minnesota.

Right: Photographed and submitted by Jan Sharp of Wisconsin, this photo reminds us all of the diversity of life found on milkweed plants, including this tree frog.



Camera, Action, Picture!



Above: These two photographs of adult butterflies (female on the left, male on the right) were taken by Fred Ormand at Joyce Pearsall's site in North Carolina.



Here's another example of an organism you'll see while looking for monarchs - a hummingbird! These monarchs nectaring on liatris don't seem to mind the hummingbird's presence. Deb Nikita, of Wisconsin, photographed this scene while monitoring. She writes, "I was lucky enough to be in the right place and the right time with camera in hand!"



Denny Brooks took this photo while monitoring at his site in Michigan. He calls it "Checking the Paperwork." It never hurts to have someone else double check your data!

If you have an interesting photo you would like to share with us, post it in the photo gallery on our website - www.mlmp.org/gallery/submissions.aspx - and you might see it in our 2012 newsletter!

Driven to Discover: Citizen Science Research

Last year’s newsletter brought you an introduction to our newest endeavor, and we have exciting news to report on the project’s progress!

The Driven to Discover Project supports adult leaders (Teachers, Master Gardeners, Master Naturalists, parents, Girl Scout leaders, and others) as they lead citizen science research clubs of youth scientists. Research clubs choose to study either birds, through the Cornell Lab of Ornithology’s Bird Sleuth program, or monarchs, through the Monarch Larva Monitoring Project.

Our 11 ambitious adult leaders first attended a two-day adult leader training in April of 2010. Here, participants got an overview of the project, learned about the procedures of the citizen science programs, and had a crash course in leading youth in science inquiry.



The first snowfall of the season occurred during the Research Summit. It shortened the event, but we got to see beautiful views, like this one, at the Audubon Center.



A group of student scientists explains their research project during the interview portion of the Research Summit.

From here, research clubs hit the ground running, in search of birds and monarchs. The first part of the summer was devoted to collecting data for the citizen science projects as well as making casual observations about their monitoring areas. Through monitoring, students created their own research project addressing a question based on their observations. They spent the rest of the summer working on these projects with the Research Summit in their sights. Research teams prepared for the Summit by creating a poster display of their project, outlining their question, hypotheses, methods, and results to help them explain their work to fellow students and an adult interviewer.

Everyone arrived at the Audubon Center in Sandstone, MN on Friday November 12th for dinner and an introduction. The key component of the two-day event was the interview. Student scientists presented their work to a small group of peers along with an adult interviewer. There was a wide variety of projects, from birds to goldenrod to monarchs, and even algae!

“Parasitoid Pandemic” was one project about the monarch wasp parasitoid, *Pteromalus puparum*. The student scientist compared the rate of monarch parasitism in different locations. Of the 50 chrysalides she placed in the wild, only



Rob Blair (Left), Mike Rentz, Karen Oberhauser, and Tania Homayoun answer questions from students during the scientist panel. They all explained their paths to science and what motivates them in their fields.

Driven to Discover: Citizen Science Research (continued)

two were parasitized; one was near monarch frass, and the other was on goldenrod. She concluded these two were parasitized because of the scent of the frass and flowers.

Another student scientist studying birds in Duluth, MN, investigated the levels of *E. coli* in Lake Superior. Because birds can carry *E. coli* in their intestines, she hypothesized that higher bird numbers correlate to higher *E. coli* levels. She conducted bird counts in four areas along the beach or the harbor. Combining these data with Minnesota Pollution Control Agency data on *E. coli* levels in the lake, she concluded that there is a correlation between the number of birds and *E. coli* levels, because the locations with more birds also had higher *E. coli* levels.

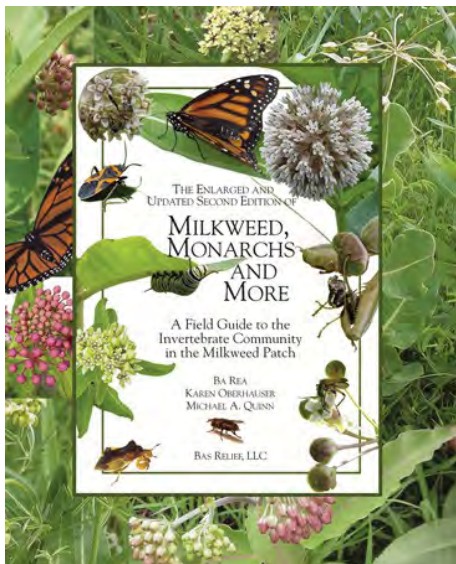
We're thrilled with the level of work these student scientists are conducting. Many students who presented work at the Research Summit have gone on to present their work at regional and state science fairs. We hope to continue to build momentum with this project in 2011!



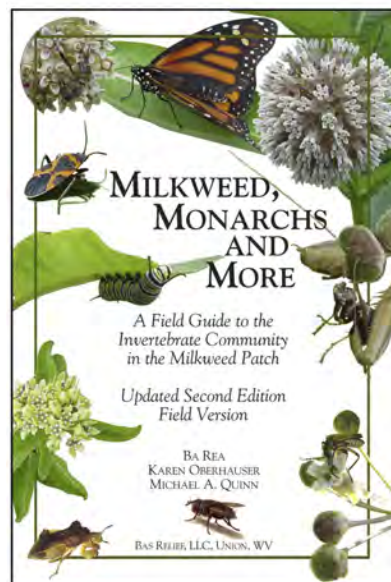
The scene on Saturday morning at the Audubon Center as the 60 student scientists are interviewed.

Updated Milkweed, Monarchs and More Books

Enlarged Version (8"x10")
Ideal for classroom use



Field Version (4"x7")
Perfect for outdoor excursions



Two new editions of Milkweed, Monarchs and More are available. Both classroom and field versions feature more milkweed and insect species as well as more glossary terms. If you're looking for a beautiful guide about milkweed and the invertebrates that depend on milkweed, including monarchs, then this is the guide for you! \$18 for 79-page enlarged version. \$9 for 100-page field version.

To order these books, or to view any of our other products, visit www.monarchlab.org/store

Volunteer Contribution: Got Milkweed?

Loree Bryer is an MLMP volunteer in California who also provides milkweed plants to Master Gardeners who then distribute them to schools, and potted plants to seniors who are unable to take care of a garden. “Putting a couple of milkweed plants in a container or in the ground placed outside a window is a simple gesture that keeps these individuals tied to nature but in a less strenuous way.”

By Loree Bryer

Monarch butterfly gardening is for the hopeful and the frugal in each of us. All it took for me was one milkweed plant and a single caterpillar and I was enamored. Today, I'm downright evangelical.

The purpose of this article is to share what I've learned about establishing a monarch butterfly habitat, concentrating on what didn't catch my eye in the rich information base that already exists. I started butterfly gardening just a year ago, putting a 3" tropical milkweed (*Asclepias curassavica*) pot on our driveway and bingo, within a week a caterpillar got me at hello. It's likely a miniscule egg was on that milkweed already and hatched after I received the plant from a friend. The hungry caterpillar munched all the leaves, reducing the plant to stick stems. Off I went on an urgent mission to buy a couple more plants. Soon, a few more monarchs fluttered around and there were caterpillars all over the two plants. Time to get serious. I had a delightful responsibility on my hands.

Milkweed

There are 100+ varieties in the milkweed family; an easy species to grow in SoCal is tropical milkweed, *Asclepias curassavica*. It grows quickly and from seed can easily host monarch eggs during the same season. It's forgiving and has lovely orange/yellow/red flowers. I germinated 100+ plants in our yard during one season – direct seeded, burlap cover to retain moisture - and got terrific results. Wash off plants purchased at nurseries as they may have been sprayed with a solution that kills caterpillars. I've learned the monarchs



Loree's backyard is a haven for monarchs, especially caterpillars. Even though 'weed' is in the name, the flowers of milkweed plants are quite beautiful, surprising people unfamiliar with milkweed.

gravitate toward smaller plants. All the adult monarch needs is a leaf big enough to support its weight (0.5 grams) for that egg-laying moment. There is no need for a flowering plant for the egg-caterpillar stage.

I've grown and repotted hundreds of *Asclepias*. I cut them back mid-January to 6" and they came back gloriously this year. It's important to cut them back to prevent the spread of diseases that can build up on the plants if they're used by monarchs over multiple generations. Water once a week once established. I'm trying to rear some *A. physocarpa* (goose plants with pods that will be golf ball size), *A. fascicularis*, and *A. eriocarpa* and failed at *A. tuberosa* and *A. californica*. It's best to have plants that are native to your area. Also, remember to be careful when handling milkweed - the milky sap is an irritant, so don't rub your eyes, and be sure to wash your hands after handling the plants, just to be safe.

I've learned it takes a bit of marketing sometimes to get somebody to start a habitat. “Milkweed” doesn't sound beautiful, but I've had so many friends come over and comment, “Oh, that's milkweed, I had no idea it was so attractive!” Then they beg for plants. If somebody is not really a gardener per se, but they are really interested in the idea of a habitat and are likely to see it though, I've gone to the extreme of digging up fully grown milkweed plants already in bloom, potted them in 5-gallon nursery pots, and it's love at first sight. There's just something about a plant in bloom that makes all the difference as a confidence builder, if nothing more.



Loree has created a beautiful butterfly garden in the front of her home. Besides monarchs, butterfly gardens attract important insects, including bees and other butterflies.

Got Milkweed? (Continued)

Once the monarchs become adult butterflies, you need nectar plants so they hang around. There's a good chance there's a lot of those in your neighborhood already, but you can always provide more with buddlejas, calendula, lantana, and even flowering milkweed. The list is endless. Again, native plants are ideal, so do a little digging to see what options are appropriate for your area.

Habitat

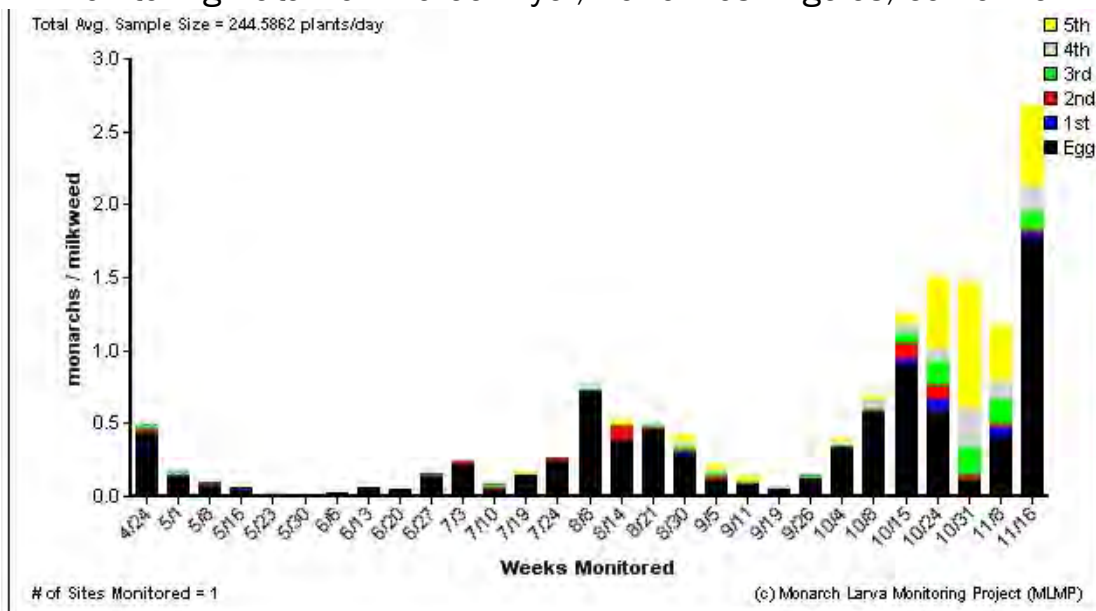
A monarch habitat is within reach of people of all ages. It's a great family project that's fun for everyone. A 5x or 10x magnifying glass and a hand mirror (to view eggs and caterpillars on the undersides of the leaves without disturbing them) are all you need to get started.

Realtors always say, "Location, location, location!" It's true for a habitat, too. I've decided to not plant milkweed directly beside a sidewalk; as they start hatching and wandering, the

risks of them getting squished by a bicycle or walker are pretty high. However, if your only choice is near a walking path, don't be deterred by this potential issue. Monarchs need our help. A sunny area near a fence is perfect. If you want to get compulsive like I did, in the fall go get sticks and poke them around in the yard – they will climb up and down them and pupate there. I put pots of calendula everywhere so I can relocate them if need be.

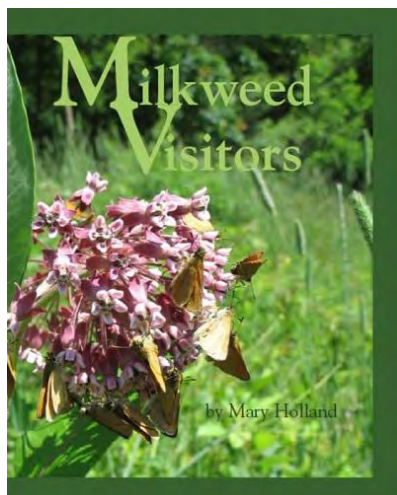
Monarchs don't know where your property line ends and the neighbor's begins. Help others in your neighborhood get started. You'll be amazed how captivating and fun it is to wonder if and when the monarchs will arrive. I have been blessed with resident monarchs, and I'm seeing the lovely fluttering, tattered wings of others who are on their way somewhere else.

Monitoring Data from Loree Bryer, 2010. Los Angeles, California



2010 marked Loree's first year of monitoring her backyard for monarchs. Her data are presented in this graph, and the density over time is quite interesting. The peak of 2.6 monarchs per milkweed (a high density!) occurred in the middle of November. Loree is seeing monarchs during their migration to the coast of California. In the spring the monarchs go east, away from Los Angeles, which is why she has few monarchs in the spring and early summer. Also of note is the 245 plants she monitors, on average, all in her backyard. Good luck monitoring in 2011, Loree!

Milkweed Visitors by Mary Holland



Milkweed Visitors by Mary Holland

Mary Holland has captured the critters that inhabit the milkweed community in large, clear, beautiful photographs, and clearly explains their roles in this fascinating, magical location. 32 pages. \$11.00

In addition to this book, we also have numerous other books and curricula about monarchs, including materials written in Spanish. To view our entire selection, visit www.monarchlab.org/store

Volunteer Spotlight: John and Marlene Weber

Two of the first volunteers for the MLMP, John and Marlene Weber, have been monitoring their site in Nevis, MN since 1998. The beginning of their 13 year journey with MLMP began when John heard about MLMP from a friend and contacted Karen Oberhauser for more info on this intriguing project. It seemed like a perfect marriage of his interests in butterflies and data analysis. John had been doing butterfly counts for the North American Butterfly Association (NABA) since he lived in Omaha, Nebraska. There he worked as Metropolitan Community College's Coordinator of Research and Analytical Studies. He attributes his attraction to MLMP to his experience and love of data and statistics. "John likes to keep track of EVERYTHING" says his wife, Marlene, about what caught his attention and kept him involved in the MLMP. Weber continued with his butterfly counts once he moved to Minnesota in 1993, taking part in the NABA's 4th of July butterfly counts at six different sites in North-central Minnesota. But, the butterfly counts only happened once a year. The idea of observing monarchs once a week, 15-20 times a year was intriguing.

John and Marlene contacted their friend Allen Olander about using part of his 400 acres of pristine prairie, meadows, and fields called Wolfsong as a monitoring site. The land is still very wild; indeed, it earned its name because the howl of a wolf has been heard there by Olander. One of the most challenging parts of getting started with MLMP for the Webers was choosing which part of this beautiful area to monitor first! The Webers realized they bit off a little more than they could chew after monitoring 6 different sites the first year. The following year, 1999, they picked three sites, one of which was a continued site from the previous year, appropriately called "Site 1." All three of these sites have been monitored by the Webers consecutively through 2010.

When asked what changes he has seen over his 13 years of monitoring, John highlighted two interesting patterns:

Global climate change

John believes it has gone into high gear from what he has seen. It doesn't have to just show up in the form of hurricanes and floods, John says, it also can be subtle changes. Over the 14 years of monitoring, he has seen monarchs showing up



Photo by S. Munafo

earlier and earlier in May, even before the milkweed plants are up and ready to receive eggs.

The more eggs/plant, the lower the survival rate

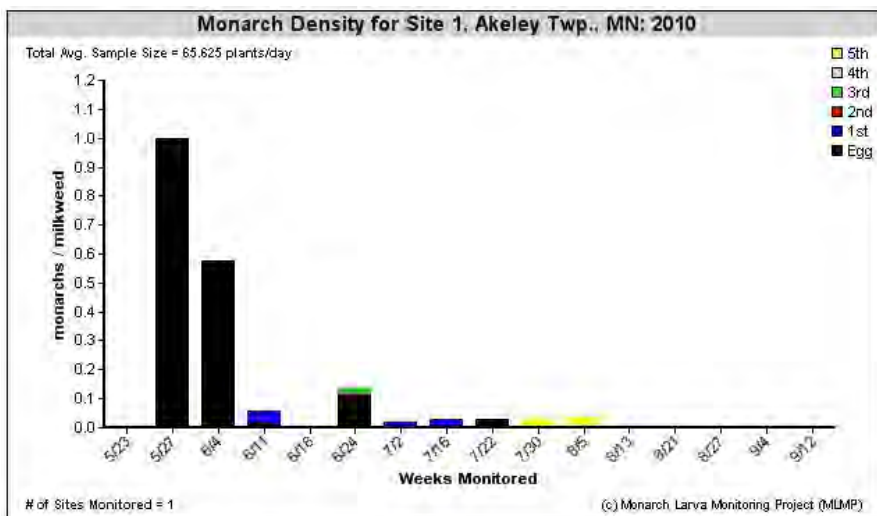
Last year must have been "the Guinness Book of World Record amount of eggs per plant!" exclaimed John. He observed up to 17 eggs on one plant. Then, the following week, that same plant had zero eggs and zero caterpillars. "There must have been some well fed predators!" John has observed over the years that the more eggs/plant, the lower the survival rate of eggs to adult monarch. John noted that in three of his monitoring years in which he observed an average of 2 eggs per plant, the survival rate was 10.3%. In years in which a higher egg density per plant was observed, there was a lower survival rate. He hypothesizes that a higher population per plant must attract more predators.

John and Marlene are motivated to continue monitoring by the awareness that their data collection efforts are part of a bigger picture of what is happening with butterfly research. "In our small way, we are contributing in our corner of the world to the bigger puzzle." In his 10 1/2 years doing analytical studies and research in Omaha, John learned that continuing long-term data is the most valuable. He sees the longitudinal value of the MLMP, and it is one of the things that keeps him coming back year after year. John sees MLMP as a long-term venture: "if it were only a couple years, we wouldn't be able to see the saga unfolding before us."

In addition to providing data on monarch eggs and larvae, John conducts butterfly counts, walking approximately the same route almost every day, noting every butterfly he sees, not just monarchs. He has sent pages and pages of data to us!

Thank you John and Marlene Weber for your very valuable long-term contribution to monarch research and conservation!

Left: The Webers' data from Site 1 in 2010. You can see the high density at the beginning of the season, with fewer monarchs (less than 0.1 monarchs per plant) in July and August.



Honoring our Volunteers

Our MLMP Honor Roll acknowledges volunteers who have made the commitment to monitor their milkweed patch year after year. Some of these individuals monitor on their own, while others represent efforts put in by many volunteer helpers. Thank you to every MLMP volunteer. Your hours of work are invaluable to our program and to monarch conservation!

14 Years

Pat Landry and CJ Meitner, Stonington MI
 Pete and Sanny Oberhauser, Pella WI
 Gayle Steffy, Lancaster PA

13 Years

John & Marlene Weber, Nevis MN

12 Years

Mary Bishop Kennedy, Fair Oaks Ranch TX
 Susan Payant, Marquette MI
 Cindy Petersen, Chanhassen MN
 Barbara Powers, Manchester VT

11 Years

Sharon Duerkop, Appleton WI
 Ray Sullivan, Wauwatosa WI

9 Years

Brian Bockhahn, Butner NC
 Jane Borland, Arlington TX
 Ilse Gebhard, Kalamazoo MI
 Eric Johnson, Madison WI
 Tim, Jan and Colin King, Long Prairie MN
 Kip Kiphart, Boerne TX
 Paul Lipman, Amherst MA
 Jessica Miller, New London WI
 Gillian Tuttle, Moravian Falls NC

8 Years

Marie Booth, Saint Paul MN
 Gail Gilliland, Duluth MN
 Karen Goellner, Kirkwood MO
 Donna Kemp, Sparta WI
 Deb Marcinski, Mayfield Village OH
 Laura Molenaar, New London MN
 Janet Mukai, Pella IA
 Annette Strom, Duluth MN

7 Years

Denny Brooks, Midland MI
 Judy Brupbacher, Canyon Lake TX
 Sondra Cabell, Hazelton IA
 Maureen Clark, Forestport NY
 Carol Cullar, Quemado Valley TX
 Sarah Dalton, Westerville OH
 Jill Faubert, Delray Beach FL
 Chris Goodwin, Dugald MB, CANADA
 Jessica Hegna, Saint Louis Park MN
 Cheryl and Angelica Huffman, Avon IN
 Don Luce, Minneapolis MN
 Anna Newton, WBT MN
 Kathy Phelps, Harrisburg IL
 Darlene Pinchot, Freedom PA
 Joseph Przypek, Danby VT
 Jan & Dexter Sharp, Clam Lake WI
 Kim Smart, Raleigh NC
 Kristin Steinmetz, Worcester MA
 Jennifer Unkles, Amherst MA

Mary Vanderford, Minnetrista MN
 Grit Youngquist, Saint Paul, MN

6 Years

Laura Bell, Crookston MN
 Carrie Benham, Jackson MI
 Walter Brown, Marlin TX
 Deb Dicks, Nekoosa WI
 Duane Flynn, Gastonia NC
 Audrey Fox-Patterson, Wellsboro PA
 Peg Goldman, Westport NY
 Stephanie Jacob, Upper Marlboro MD
 Vi La Belle, Saint Louis Park MN
 John Lawrence, Delmar NY
 Karl Pauli, Newport News VA
 Sherry Skipper-Spurgeon, Costa Mesa CA
 Ruth Vollrath, Green Bay WI
 Kerry Wilcox, St. Louis Park MN

5 Years

Sonia Altizer, Hull GA
 Dick Clayton, New London MN
 Julia Cutshall, Huntingdon PA
 Susan DeGross, Blissfield MI
 Susan Hebel, Green Bay WI
 Gail Manning, Fort Worth TX
 Carolyn Rock, Sturgeon Bay WI
 Ron and Linda Straight, Jackson MI
 Mary Stuesser, Shakopee MN
 Linda Tanner, Black MO
 Tim Vargo, Milwaukee WI



Reflections from Karen (Continued from page 1)

Flies, wasps and aphids

Just as we struggled fitting the milkweed patch into a pamphlet, we are being tugged to expand the focus of the MLMP. We've learned a lot about tachinid flies recently (see page 4); our collective ability to assess this parasitoid on a broad temporal and spatial scale may turn conventional

wisdom about the tachinid fly, *Lespesia archippivora*, on its head! This year, we're asking volunteers who collect monarchs and rear parasitoid flies or wasps to send us samples so that we can make detailed identifications. We're also studying the bright yellow aphid, *Aphis nerii*, and its relationship with milkweed and a parasitoid wasp, thanks to exciting research being done by U of MN PhD candidate Emily Mohl (see page 6). Several MLMP volunteers are collecting detailed data on the abundance of *Aphis nerii*, and most of you are noting its presence (and absence) in your milkweed patches as you

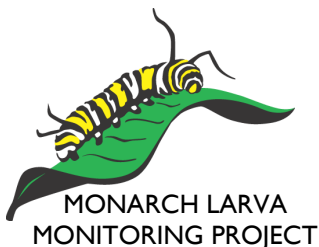


Photo by A. Salyi

monitor. If you'd like to get more involved in the aphid study, be sure to contact us.

Mainly Monarchs

As citizen science projects go, the MLMP can take a great deal of time. MonarchLab personnel monitor three sites, so we know that going out every week isn't always easy. However, the time that we put into observing our milkweed patches has incredible payoffs—it's exciting to turn over milkweed leaves, never knowing what treasures we'll see; relaxing to leave our desks and lab benches behind to get outside; and fun to socialize as we walk to our sites and poke around in the milkweed patch. We hope that you feel the same way. We don't want to overwhelm MLMP volunteers with a daunting array of different activities – collecting flies, counting aphids, measuring rainfall, assessing milkweed quality, and measuring milkweed density. Our focus remains monarchs, and we can't express strongly enough the importance of your contributions to our understanding of monarch density, if that's what you have the time to do. So, keep counting those eggs, larvae and milkweed plants every week (or less often, if you want), and update your site characteristics every year. We're mainly about monarchs, and everything else is just frosting on the cake!



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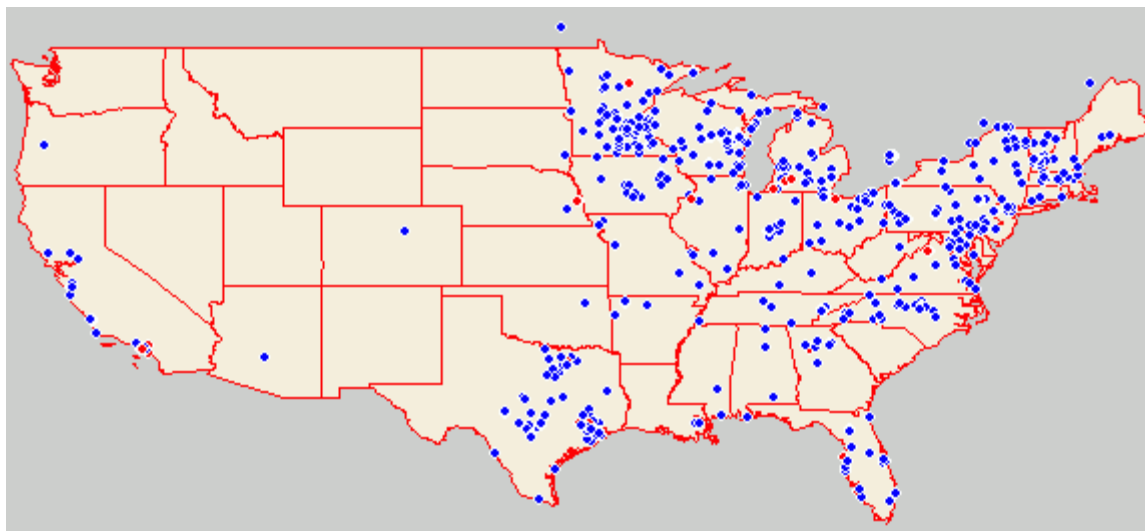
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WWW.MLMP.ORG

We Have Over 1000 Monitoring Sites!



In the past 14 years, MLMP volunteers have monitored 1097 sites in the US and Canada. To leave your mark on our map, join the MLMP!

Save paper!

Want to receive our newsletter by e-mail? Send an e-mail to bowe0182@umn.edu and we'll add your e-mail address to the list. The electronic version is in color!

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