Dear Volunteers and Monarch Enthusiasts,

Congratulations and thank you for all of your hard work in 2004!

The Monarch Larva Monitoring Project has come a long way since its inception in 1996, when it was first used by researchers at the U of MN to study monarch larval distribution. This small-scale research tool has blossomed into a large citizen science project that has garnered the interest and involvement of nearly 1000 people from 40 states and Canada. Four years of support from the National Science Foundation have enabled the MLMP to become a model for citizen science programs.

Our success is due to the devotion of our small army of volunteers and trainers who diligently monitor their sites each week. Your efforts produce invaluable data that have been used to understand monarch population dynamics, migration patterns, and vulnerability to habitat degradation.

While monarch numbers have been low for the last few years, we encourage you to continue to monitor, even if you are seeing no or few monarchs. We need your data on monarch absence as well as presence!

We hope that you will continue to participate in the MLMP in 2005. If you don’t currently monitor, and are curious about our program, read on and join our team!

The MLMP Staff

KEEP MONITORING, even if you aren’t seeing monarchs!

We had reports from volunteers this summer that they hadn’t seen any monarchs, and were thus not monitoring. If this is true where you live, please keep going out, looking at as many milkweed plants as you can, and recording your data, even if your numbers are all zeros. As you’ll read in this newsletter, monarch numbers are low. To understand why, we need to know where monarchs are AND where they aren’t. The zeros are as important to our understanding of monarch population dynamics as the larger numbers. It isn’t as much fun to monitor when you don’t see monarchs, but we really appreciate your efforts during this period!

What is Monarch Larva Monitoring?

Do you ever wonder how a delicate butterfly could possibly migrate three thousand miles to Mexico without ever having been there before? Are you still amazed by metamorphosis and the transformation of a caterpillar into a beautiful butterfly? Did you ever raise a monarch in school or just stop and watch those orange and black wings flutter through a field of flowers? The migration, transformation, and beauty of monarch butterflies are just a few of the characteristics that have endeared this insect to nature enthusiasts throughout North America. The Monarch Larva Monitoring Project (MLMP) is an exciting way to contribute to basic knowledge about monarch population dynamics, and foster monarch and habitat conservation.

The MLMP involves volunteers from across the US and Canada in a long-term study of how and why monarch populations vary in time and space, especially during their breeding season. Specifically, we are asking:

* How do monarch population densities fluctuate throughout the breeding season?
* At what larval stages does the highest mortality occur?
* What plant qualities affect female host plant choice?
* What is the timing of monarch movement throughout their breeding range?
* How do monarch numbers vary with habitat size and disturbance?

To answer these questions, volunteers conduct weekly monarch and milkweed surveys, measuring per plant densities of monarch eggs and larvae. The results of these efforts will aid us in conserving monarchs and their threatened migratory phenomenon, and advance our understanding of butterfly ecology.

346 Sites Monitored from 1997-2004

In the past 8 years, MLMP volunteers have monitored 346 sites in the US and Canada. In 2004, 23 new sites were added to the MLMP. If there isn’t a spot where you live, consider adding one!
Unfortunately, the news about monarch numbers is not good this year. We hope that monarchs are able to rebound from their all-time low numbers, and encourage everyone to spread the news of the importance of preserving suitable habitat for monarch butterflies. The article below is excerpted from an analysis conducted by several monarch biologists (listed on page 3) in February 2005.

Reduced monarch numbers in Mexico

The 2004-05 winter butterfly population in Mexico is at a historical low. In December 2004 a team of workers from World Wildlife Fund-Mexico monitored all known overwintering sites of the monarch butterfly in the Transverse Neovolcanic Belt of Mexico. The total area occupied by the overwintering butterflies was 2.19 ha. This is the smallest value recorded in the past twelve overwintering seasons (see figure below).

The Summer 2004 Population was Low

We have used MLMP data from the upper Midwestern states of MN, WI, IA and MI for several years to provide a general picture of the population, since previous work conducted by researchers in Canada suggested that most monarchs that winter in Mexico come from the Midwest. There are several ways that we can use MLMP data to look at monarch numbers; one method is to look at the number of eggs per milkweed over the course of the summer. The graph at the top of the next column shows MLMP data from the upper Midwest in 1997 (a good year for monarchs) and 2004 (a bad year).

It appears that monarchs arrived in the upper Midwest slightly earlier in 2004 (the first peak is farther to the left in 2004). However, the second peak in 2004 is slightly to the right, suggesting that the monarchs took longer to develop in 2004 than they did in 1997. It is also clear that numbers were lower in 2004; the height of the second peak is approximately 0.05 eggs per milkweed plant observed, as opposed to about 0.22 eggs per milkweed in 1997. Since it is the monarchs from the second peak that migrate to Mexico, and thus carry on the population into the following year, we can use the height of this peak to compare monarch numbers from one year to another. The second graph does this over all years of the MLMP.

Monarch numbers are clearly variable, and we present some of the possible reasons for this variation below. However, the fact that three of the four lowest MLMP counts during this nine year period occurred in the last three summers is cause for concern. It also points out the key importance of continuing to monitor, even when no or few monarchs are being observed. It is important to document monarch numbers to understand what is happening to the population.

The fall 2004 fall migration was low

Extensive reports during the fall of 2004 by Journey North and Monarch Watch attested to a small fall migration through southern Canada and the eastern USA. In fall 2004, Monarch Watch volunteers tagged approximately 45,000 monarchs, the lowest number since 1996. Further evidence of a diminished 2004 fall migration comes from two Atlantic Coast monitoring programs in Cape May NJ and Chincoteague VA.
WHY IS THE POPULATION SO LOW?

Monarch populations fluctuate yearly from a combination of factors throughout North America. Some of these are beyond human control, but human factors are also of major importance. Here, we summarize our hypotheses on the main factors leading to such a small population.

Winter storm mortality during 2003-2004 was high

The size of the spring migration is determined both by the size of the migration the previous fall and the number of butterflies that survive the winter. It is highly likely that the mortality from January 2004 storms reduced the numbers of monarchs reaching the southern U.S. breeding areas in March - April of 2004. This, in turn may have resulted in a small wave of new first generation butterflies migrating to their northern breeding range.

The 2004 summer breeding season was cold and wet

The summer of 2004 in the mid-western breeding range was the coolest since 1992. Field and laboratory data indicate that the eastern N.A. monarchs may produce up to five generations in a year with favorable weather conditions, but fewer generations in cold years. Cold weather hinders population growth by limiting oviposition and by extending generation time, thus limiting the number of generations. The importance of summer weather is also illustrated in 1998 (see 3rd graph), when conditions were hot and dry, leading to short adult lifespans and poor quality milkweed.

Habitat deterioration in Mexico

The condition of the forests in which monarchs overwinter is rapidly deteriorating through illegal logging. Opening, or thinning, the forest by removing trees both within and adjacent to the overwintering sites exposes roosting butterflies to wind, wetting and radiational heat loss that increase the numbers that freeze to death. An intact forest serves as an umbrella and a blanket to overwintering butterflies; without this protection, mortality due to weather is expected to increase. The deleterious effects of forest thinning are exacerbated during winter storms.

Breeding and migrating habitat in the U.S. and Canada

A 2000 survey, using the methods of the MLMP, in Iowa, Wisconsin and Minnesota concluded that the majority of midwestern monarch butterflies are produced on milkweeds growing within agricultural fields. Much of this breeding habitat is being lost because of changes in U.S. agricultural practices. Adoption of soybeans that are genetically engineered to be resistant to herbicides has been widespread; these soybeans, many of which are known by the trade name Round-up Ready™, are currently used on well over 80% of Midwestern soybean fields. Herbicides are sprayed in early spring, killing virtually all other emerging plants, including common milkweed (Asclepias syriaca) and possibly potential nectar resources. The scale of this emerging problem is enormous, but as yet unquantified.

Decreased habitat quality is likely to be a problem during monarchs’ fall migration as well. As they migrate, adult monarch butterflies must obtain nectar from wildflowers to build up sufficient lipid reserves to survive the winter and remigrate back into the United States the following spring. While this problem has not been addressed quantitatively, herbicide use in herbicide tolerant agricultural fields may be hurting the native wildflower flora throughout the United States and Canada.

SUMMARY OF OUR CONCERNS

The striking decline in monarch numbers during the 2004-2005 overwintering season underscores the need to do all that is possible to minimize the negative impact of human activities on monarch populations. Monarchs have proven resilient to many environmental stresses, but the ongoing deterioration and loss of habitat in Mexico, the United States and Canada has the potential to drive the population below a level from which it can recover.

We are concerned that the cumulative and interactive effects of habitat degradation by humans and of random extreme climate events may, in the near future, bring the current large scale monarch migratory phenomenon to the point of collapse. We hope we are wrong in this assessment, but we feel that it would be irresponsible for us not to express our consensus. We are playing butterfly roulette, gambling that breeding success will allow the monarch population to recover from the combined effects of natural and anthropogenic mortality. Degradation of the overwintering habitat in Mexico and destruction of the summer breeding habitats need mitigation if the phenomenal migration biology of the monarch butterfly is to survive.

Dr. Lincoln P. Brower, Sweet Briar College; Dr. Alfonso Alonso, Smithsonian Institution; Dr. Linda S. Fink, Sweet Briar College; Dr. Barrie Frost, Queens University, Canada; Dr. Stephen B. Malcolm, Western Michigan University; Dr. Karen Oberhauser, University of Minnesota; Dr. Isabel Ramirez, UNAM, Mexico; Mr. Daniel Slayback, Science Systems & Applications Inc.; Dr. Orley R. Taylor, University of Kansas; Dr. Stuart B. Weiss, Creekside Center for Earth Observations; Dr. Myron P. Zalucki, University of Queensland, Australia. If you are interested in a full copy of this article, with citations, please contact Karen at oberh001@umn.edu.
Geographical Variation: How did 2004 Stack up?

While people are often most interested in how monarch numbers compare between years, MLMP data also illustrate regional variation. The “Results” section of our website (www.mlmp.org) shows data from every year of the project; these data can be displayed for an entire state or for each monitoring site. The three graphs below, from Texas, Minnesota and Massachusetts, show different patterns over the course of the summer, as well as different densities. Keep in mind that the x and y-axis scales vary between graphs, and that they are printed directly from the web. Color details aren’t as important as the overall patterns.

Texas volunteers found monarchs throughout the year, indicating that some monarchs do not migrate to Mexico, but rather stay in Texas, breeding year-round. Numbers were lower in the summer, with no monarchs observed during several weeks in June, July and August.

U of MN Ecology graduate student Reba Batalden is studying potential impacts of climate change on breeding monarch distribution, and is interested in patterns of egg-laying in Texas throughout the year. See more on this work in her article on page 15.

The first monarch eggs in Minnesota were observed during the week of May 30, and there were two clear peaks in abundance. The first peak includes the eggs laid by the generation of monarchs that emerge in the southern US (the offspring of winter migrants). These migrants laid eggs throughout June, and then there is a dip in numbers during a period after the migrants from the south die and before their offspring emerge. The second peak usually consists of two overlapping generations, but the cold weather in summer 2004 probably truncated the second of these generations (see article on previous pages).

MLMP monitors in Massachusetts did not record the arrival of monarchs until early July, a fairly consistent pattern. In addition, it appears that monarchs left the Northeast earlier than the Midwest, although there were a few larvae observed in September. We rarely see separate peaks in Northeastern monarch data, suggesting that there are fewer generations of monarchs produced in this region of the US. In addition, the densities of monarchs are lower in Massachusetts; the late season peaks in Minnesota and Massachusetts are approximately 0.15 and 0.045 monarchs/milkweed, respectively.
A Curious Find in Florida

While looking for monarchs in his milkweed patch in Clearwater Florida, Morris Eaddy came across a monarch larva that was just a little bit different. Morris “noticed a strange banding mark” on the 5th instar, and when he took a closer look, he saw “what appeared to be small antennae bumps.” The small protrusions that Morris saw were actually a third pair of tentacles (both photos courtesy of Morris Eaddy).

Florida is home to three different butterfly species in the genus Danaus. The monarch (Danaus plexippus), the queen (D. gilippus) and the soldier (D. eresimus) are all milkweed specialists whose adults are adorned with orange, black, and white scales. Queen and soldier larvae typically have three pairs of tentacles, two in the same position as monarchs, and another in the middle of the abdomen.

Bethany Farrey and Andrew K. Davis of Emory University have also recently written about the presence of extra tentacles on some Florida monarchs. On January 5th, they collected 11 larvae with extra tentacles from a garden in Miami Lakes. The larvae were reared in their lab, and all of the adults that resulted from the four larvae that survived appeared normal.

Read More About Monarchs With Extra Tentacles:

Male or Female?

The word morphology refers to the form and function of body parts. Organisms exhibit a variety of morphological characteristics, many of which distinguish the sexes. Described as sexually dimorphic traits, the physical and behavioral differences between males and females are often important reproductive signals used in assessing potential mates.

While determining the sex of a monarch caterpillar is impossible without performing a dissection, the adults are sexually dimorphic. Notice the pair of dots on the male’s hind wings, and the broad wing veins on the female.

Now examine the ventral view of a male and female abdomen in the photographs below. Note the presence of claspers on the end of the male’s abdomen. These claspers are used by male monarch butterflies during copulation. The male uses the claspers to attach to the vaginal groove (ostium bursa) of the female; once the male has grasped the female with the claspers, she cannot get away. This groove is located on the bottom of the female abdomen. It is visible when you grasp the butterfly by its wings, as shown in the pictures.

Monarch pupae are also sexually dimorphic, although the differences are hard to detect! Examine the two pupae pictured below.

In the pupae, the abdomen appears as a series of concentric rings that circle the top of the chrysalis. The female’s ostium bursa can be seen as a shallow groove extending into the second segment of the abdomen from the bottom of the cremaster. The male pupa lacks this extension.
Matching Game: What’s in YOUR Milkweed Patch?
(For more details, check out Milkweed, Monarchs and More by Rea, Oberhauser and Quinn)

1. ___
2. ___
3. ___

4. ___
5. ___

6. ___
7. ___
8. ___

9. ___
10. ___

11. ___
12. ___

Word List
A. Viceroy Butterfly  G. Whorled Milkweed
B. Male Monarch    H. Showy Milkweed
C. Queen Butterfly  I. Butterfly Weed
D. Viceroy Larva   J. Spider Milkweed
E. Queen Larva   K. Tropical Milkweed
F. Monarch Larva   L. Common Milkweed

Answers: 1D, 2L, 3K, 4H, 5A, 6B, 7I, 8F, 9J, 10C, 11G, 12E
The MLMP Goes to College

Dr. Beth Lavoie is a Mankato State University professor and one time graduate student of MLMP director Karen Oberhauser. During her graduate studies, Beth conducted research on the effects of leaf nitrogen content on monarch development and participated in MLMP projects, and has now brought the MLMP to her classes for pre-service teachers in southeastern Minnesota. Beth’s experiences with monarchs have provided the opportunity to develop a unique curriculum tool for educating pre-service teachers about the scientific process. Students in her independent study course attended a 1-day MLMP training session in May 2004. During this session, students learned about MLMP project objectives, basic monarch biology, milkweed and larval identification, and MLMP monitoring protocols. Following their training session, each student collected data throughout the summer and wrote a paper addressing a research question that they answered during the monitoring process.

Beth found that monitoring was a great tool for teaching about research. Students thought about science all summer as they conducted independent research. It also provided an opportunity for college students to study the database of the MLMP web-site, and use data collected by volunteers throughout the monarch breeding range.

Student papers varied broadly in their topic and scope. They represent an exciting range of topics, and also a range of the kinds of research made possible by the data collected by other MLMP volunteers.

The use of the MLMP protocol as a curriculum tool for teachers in training also benefits the MLMP. According to Beth, some of the students plan to monitor monarchs with their secondary science classes once they obtain teaching jobs. One student will monitor her own garden because this project has stimulated her curiosity about monarch butterflies and the factors that influence their abundance and distribution. Finally, while some of these future teachers may not choose to continue monitoring, they have learned valuable lessons about the methods of science and ways to conduct an authentic field study.

College or secondary school faculty interested in utilizing the MLMP database for student research should contact Karen at oberh001@umn.edu. The data that are used to create the weekly monarch density graphs can be obtained in excel format from the website, but other data are available by request. Data can easily be separated by state or region; for example, students could analyze the qualities of milkweed plants occupied by monarch eggs or larvae, the proportion of monarchs in each stage at different times and different locations, the proportions of monarchs that are parasitized by tachinid flies, and milkweed density in different habitat types. There is a wealth of data that could be mined by interested secondary and college students, and we are happy to facilitate this.

Some of Beth’s Students’ Projects:

**The effect of temperature on development time of monarch pupae.** This student found that the higher the temperature, the shorter the development time of monarch pupae.

**The effect of Asclepias syriaca height on Danaus plexippus egg density.** Using MLMP data throughout Minnesota, this student found that plants with eggs were significantly shorter than those without eggs.

**Monarch larvae on flowering and non-flowering milkweed plants.** Using MLMP data throughout Minnesota and Wisconsin, this student found that the proportion of plants with larvae is not significantly different for flowering and non-flowering plants.
Monitoring Materials

MLMP volunteers who attend a training session, or who have volunteered for one or more years can receive one deluxe monitoring kit free of charge. The materials are also available for the following prices to anyone who would like them. We provide one kit to each monitoring site; if you monitor one site with several people, you may want to purchase extra materials such as an apron to hold all of your monitoring supplies, or an extra clipboard to make data collection run more smoothly.

### MLMP Products

<table>
<thead>
<tr>
<th>Product Description</th>
<th>Price</th>
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<tbody>
<tr>
<td>Live Life Cycle Kit (20 eggs, 25 larvae, 2 pupae, 2 adults)</td>
<td>$50</td>
</tr>
<tr>
<td>Basic Monitoring Kit (apron, clipboard, pencil, hand lens, ruler, life cycle cards)</td>
<td>$25</td>
</tr>
<tr>
<td>Deluxe Monitoring Kit (add field guide and rain gauge to basic monitoring kit)</td>
<td>$35</td>
</tr>
<tr>
<td>MLMP Field Apron</td>
<td>$3</td>
</tr>
<tr>
<td>MLMP Clipboard with ID Guide</td>
<td>$4</td>
</tr>
<tr>
<td>Hand Lens with Magnifier</td>
<td>$3</td>
</tr>
<tr>
<td>Monarchs in the Classroom Curriculum (K-2, 3-6, and Middle School editions)</td>
<td>$17</td>
</tr>
<tr>
<td>Pocket Thermometer</td>
<td>$9</td>
</tr>
<tr>
<td>MLMP Pencil</td>
<td>$.50</td>
</tr>
<tr>
<td>Folding Metric Ruler (2 meters)</td>
<td>$7</td>
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<tr>
<td>Life Cycle Cards (set of 16)</td>
<td>$8</td>
</tr>
<tr>
<td>Rain Gauge</td>
<td>$6</td>
</tr>
<tr>
<td>Milkweed, Monarchs and More Field Guide</td>
<td>$9</td>
</tr>
<tr>
<td>Shipping costs extra; contact us or visit <a href="http://www.monarchlab.org">www.monarchlab.org</a> to order materials.</td>
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“Volunteers used their field guides often in the field and summer kids campers (6-8 years) became so interested in them that they fought over them!”

“Life Cycle Cards: Distinguishing one monarch instar from another can be tricky! Use the photographs with the description provided on the back of each card as a quick and easy monarch life stage identification tool.”

“Live Life Cycle Kit: This kit, which includes eggs, about 25 larvae of various sizes, pupa and adults, is very useful for teaching monarch biology and life stage identification. Those hosting a training session may receive a free life cycle kit during times of availability. Two weeks advance notice is required.”

“The curriculum guide has been great in adding age appropriate activities into our butterfly program.”

“The field guide is great...there is so much in the milkweed patch even when you are not finding monarchs.”

Live Life Cycle Kit: A clipboard, pencil, ruler and apron are part of our basic monitoring kit. These items make monitoring more efficient and fun!

Milkweed, Monarchs and More Field Guide: You will encounter many other invertebrates besides monarchs while monitoring. You can use this field guide to help identify all of the amazing creatures you come across.
Volunteer Spotlight: Sandy Cofran

"I'm basically a science dweeb looking for a needle in a haystack," Sandy Cofran told a reporter from the Boston Globe. On 26 August 2004 all of Massachusetts could read about the great work that Sandy is doing with monarchs. Sandy, who works at the Massachusetts Audubon Society Headquarters in Lincoln, agreed to share some of her thoughts on the project. Thanks to Sandy and all of the rest of our great monitoring team!

For the past seven years I have been the switchboard operator/receptionist at the headquarters of the Mass Audubon Society. In the past I have worked for small town newspapers—from being a writer/photographer to an editor—and spent eight wonderful years as a librarian. I enjoy working for Audubon because it gives me the opportunity to combine what I love (nature) with earning a living!

Having grown up in a very rural area, I have always appreciated nature and enjoy being outside more than anything! (I also spent a few years as a pet/animal sitter and that was THE BEST job I ever had; I got to be outside almost all day in all kinds of weather and in all types of habitats!)

I have been monitoring monarchs at the beautiful MASS Audubon headquarters in Lincoln—an old estate/farm with fields, old apple trees, etc—for two seasons. I started monitoring because I took a class through MASS Audubon about the MLMP, and it sounded like my kind of thing! I also monitor frog songs for the National Park service, and I am in my third year of doing that, too. Both of these projects get me out of doors and paying attention to nature, which I find both relaxing and extremely interesting.

Because of family commitments I have only been able to monitor for monarchs about an hour a week throughout the milkweed season here. This year I hope to monitor five days a week in July, August and September.

I haven't been able to drum up a monarch "buddy" to help me as yet, but I do enjoy being out alone...I can get distracted easily, so it's just as well that I keep all my attention to finding monarchs!

I think monitoring of all types is an important activity. Human beings are so radically altering the environment in so short a time span. I have real concerns for all of nature at this point. Plus, humans seem to believe that they are not a part of nature, that we will be able to overcome the damage we are doing and save ourselves! I wonder if we will??! I guess, if I can't save the world, I want to be a good witness to what is going on, and monitoring is a part of that. Plus, I want to appreciate everything we have left. The world is so FULL of wonderful creatures and events, and most of the time we are blind to them. I look for miracles everyday, and I always find them in nature!

I don't feel that I'm spending my “free” time monitoring. My time away from work and family commitments is my “expensive” time—the important time I get to spend on what truly nourishes my whole life—physical, spiritual, intellectual. That's my monitoring time!

Diane Ackerman, one of my favorite nature writers, wrote that she felt ‘love is paying attention.’ Whether I'm monitoring frog song, monarchs, or birds, I feel it's my chance to show love to a world that has always loved me and brought me great joy!

I would like to add that it feels great to be a part of an endeavor like MLMP. Even if I find only one egg or a couple of caterpillars...I know the information will be part of a much bigger "picture" and will perhaps help with research to preserve and protect these beautiful creatures.

Trapped in a Pupa for Six Weeks

Barbara Heck from Pittsburgh, PA collected a number of monarch caterpillars from her monitoring patch this year and raised them in captivity. While most of the larvae pupated and eclosed early enough to make a timely migration, one caterpillar did not pupate until September 23rd. Late to pupate and equally late to emerge, Barbara’s delayed larva remained in its pupa for six weeks. The timing of this late “bloomer” could be fatal, and illustrates the importance of weather to monarch development.

When the butterfly emerged on November 6th, the cool fall weather had already made Pennsylvania inhospitable to monarchs. Barbara decided to wait for a warming trend before releasing the butterfly. We'll never know if the butterfly made it to the overwintering sites in Mexico, but the fact that it left Pennsylvania when its fellow monarchs were arriving in Mexico doesn’t bode well!

"I learned so much about the monarch lifecycle and about the milkweed community. I had no idea so many critters lived on milkweed. I observed natural drama every week with ladybug larvae and aphids, stinkbug eggs, an on and on. Visitors and staff stopped by frequently to ask what I was doing and we all ended up learning a lot.”

Kristin Seinmetz
MLMP Volunteer
MLMP Volunteers Hard at Work.....

.... in the Field

What you’ve Shared:

- We are encouraging people in our community to grow milkweed. And we have initiated a community discussion about becoming a ‘butterfly neighborhood.’ We have thoroughly enjoyed being part of the MLMP this summer and look forward to continuing next year. The excitement of learning about monarchs is highly contagious!  Grit Youngquist, Minnesota

- We had a great time monitoring and look forward to continuing in 2005. We can now spot milkweed when traveling at 70mph and simultaneously shout “Monarch!” when we spot one. Our friends question our sanity.  Ron and Linda Straight, Michigan

- The most inspiring moment was during a MLMP training at the State Botanical Gardens of Georgia when the class went outside to the perennial garden to learn how to measure milkweed. A female monarch flew in and started laying eggs right before our eyes!  Susan Meyers, Georgia

- A great citizen science project that is fun to do and creates data that is helpful to researchers. Sure, butterfly biology, lifecycle, and ecology apply not only to monarchs but to all species. Other species just don’t have the spectacular migration.  Kip Kiphart, Texas

- Many students and their parents, who may never even consider monitoring, are now aware of monarchs and other butterflies and have altered pesticide practices in their yards.  Ann Richardson, Indiana
### Monarch Monitoring Challenges

Monitoring poses all sorts of challenges. We are often outside during the warmest periods of the day wading through thick fields of spine-covered weeds. Sometimes it’s cold, wet and windy, but we do it because we love to see evidence that butterflies have been visiting our fields. Sometimes monitoring can pose a different type of challenge. Distinguishing evidence of monarchs from imposters and look-a-likes can be difficult task. The quality of the data you collect depends on your ability to know what is and what is not a monarch, at all stages.

<table>
<thead>
<tr>
<th><strong>Eggs, or not?</strong></th>
<th><strong>Mimics Abound</strong> (see <a href="http://www.mlmp.org">www.mlmp.org</a> for color images)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finding eggs is one of the most challenging parts of the monitoring process. Their diminutive size makes them difficult to see. Sometimes we get so excited seeing eggs that we shout out the discovery to our monitoring partners. This zeal for egg discovery can occasionally lead us astray. Latex secreted by broken milkweed stems can resemble eggs, and may be included in the reporting of egg totals. Here are a few tips for avoiding this mistaken identity.</td>
<td></td>
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</tbody>
</table>
| - When you see an egg, slow down and take a second look.  
- If you’re over 40, bring along a hand lens!  
- Eggs are elliptical and end at a point.  
- Eggs have ridges; latex doesn’t! |
| There are many different types of orange, black and white butterflies but only one monarch. We often get reports from people who have observed painted ladies, red admirals, and a variety of fritillary species and thought that they were seeing monarchs. These species are only superficially similar to monarchs (see photos below). However, the viceroy butterfly (*Basilarchia archippus*) is a particularly good stunt double. Like the monarch, the viceroy has orange and black wings, with white spots that dot the wing’s outer edge and thorax. A casual glance at the viceroy may lead to misidentification. However, if you take a careful look, you’ll notice an additional black horizontal vein that cuts across the butterfly’s hindwing. Viceroys are also smaller than monarchs, on average, but size is not a definitive cue, since some viceroys are larger than some monarchs. Luckily, the larvae aren’t confusing; viceroy larvae eat willow leaves and resemble bird droppings! |

Next time you see an orange and black butterfly fluttering through a patch of wildflowers, take a good look before declaring its identity!  

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**Egg on top, latex on bottom.**

**Great Spangled Fritillary**

**Painted Lady**

**Monarch!**

**Red Admiral**

**Viceroy**

**Viceroy Larva**

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Just because there are lots of them doesn’t mean they aren’t eggs! Photo of actual monarch eggs by MLMP trainer Charles Cameron.
Train-the-Trainer Sessions: 2002-2004

For the past 3 years, a grant from the National Science Foundation has supported MLMP train-the-trainer workshops for naturalists throughout the US. We’ve given 13 of these workshops, and had the opportunity to meet dedicated conservationists, educators and monitors at each one. It has been an honor to meet everyone who attended these sessions, and while we can’t list all of their names here, we would like to take this opportunity to thank the individuals and institutions who have hosted these workshops, and share a few pictures. Together, we’ve braved rain, cold, heat, no monarchs, and a few mosquitoes, but it has truly been a pleasure to meet such a dedicated group of people. While we do not have as much funding to travel to distant workshops and cover all workshop costs in the future, we are happy to facilitate training sessions where there is a group of interested potential monitors, and welcome conversations about setting these up.

2002
Eastman Nature Center, Osseo, MN Lee Ann Landstrom
VT Institute of Natural Science, Woodstock, VT Charmain Kinton
NC Museum of Natural Sciences, Raleigh, NC Mike Dunn
Bamberger Ranch, Johnson City, TX Margaret Bamberger

2003
Blendon Woods Nature Center, Westerville, OH Sarah Dalton
Missouri Botanical Garden, St. Louis, MO Bob Coulter
Great Smoky Mountains Institute at Tremont, Townsend, TN Michelle Prysby
Gordon Bubolz Nature Preserve, Appleton, WI Joann Engel
Black Hill Visitor Center, Boyds, MD Denise Gibbs
Shaver's Creek Environmental Center, State College, PA Doug Wentzel

2004
Kalamazoo Nature Center, Kalamazoo, MI Bill Rose
Adirondack Park Visitor Interpretive Center, Paul Smiths, NY Milt Adams
Prairie Woods Environmental Learning Center, Spicer, MN Becca Conser

Trainer Spotlight: Judy Packard

A onetime fabric store manager and stay-at-home mom, Judy Packard is now an interpretive naturalist at the Chippewa Nature Center (CNC) in Midland, Michigan. She discovered the CNC many years ago while searching for a fun and educational place to take her son. Having worked as a guide at the nature center for the last 15 years, Judy has recently added the CNC to the list of MLMP sites.

In 2003 she raised and released some butterflies for the nature center and was immediately hooked on the monarch phenomenon. While she knew little about the MLMP, Judy decided to take a “Train-the-Trainer” workshop that was being held at the Kalamazoo Nature Center (see her training group in the picture on the left above). Following her training session, she established a 586 square meter monitoring site at her center and began to teach volunteers to collect data. According to Judy, a total of fifteen volunteers from all walks of life helped to monitor the site in 2004. While they had many days in which few or no evidence of monarchs were found, she and her volunteers maintained their commitment to monitor and record their valuable data.

When asked why she chose the MLMP as an activity for her center, Judy explained, “Our nature center believes in promoting research and developing programs for the general public that meet our mission to promote environmental awareness and foster stewardship. Both the MLMP and the Citizen Science program help to meet these goals.” According to Judy, monitoring is time well spent. It provides an opportunity for a diverse group of people to get together, explore the wonders of nature, and share each “others’ knowledge and the joy of finding larvae!”
Volunteer Honor Roll: The Iron Monitors

In athletics, the “iron-man” and “iron-woman” awards are bestowed upon those who never miss a game. This year we would like to recognize the “Iron-Monitors.” These are the tireless people who made it into the field week after week. Fighting off scorching sun, stifling humidity, and pesky mosquitoes, these monitors managed to collect data throughout the length of their monarch observation seasons. This is important; we need to know when monarchs aren’t in an area as well as when they are in an area, so extending the monitoring season at both ends makes the data even more valuable. Consider adding a few weeks, and see your name on this list in the future! The list notes the number of times the volunteers monitored in 2004, and the number of years they’ve been MLMP monitors.

The MLMP staff applauds your commitment to monitoring. We sincerely thank you for all of the valuable data you collect!!!

40 or More Monitoring Days
Kip Kiphart, Boerne TX (3 years)

30—39 Monitoring Days
Jane Borland, Arlington TX (4 years)

20 - 29 Monitoring Days
Deb Marcinski, Mayfield Village OH (2 years)
Cheryl Huffman, Avon IN (1 year)

16 - 19 Monitoring Days
Thomas Colins, Lake Jackson TX (2 years)
Val Cunningham, St. Paul MN (1 year)
Eric Johnson, Madison WI (3 years)
Jen Logan, Westerville OH (2 years)
Gayle Steffy, Frumore PA (3 years)
John & Marlene Weber, Asceley Twp. MN (4 years)
Lis Young-Isebrand, Minneapolis MN (3 years)

13-15 Monitoring Days
Denny Brooks, Midland MI (1 year)
Julia Cutshall, Huntingdon PA (3 years)
Sharon Duerkop, Appleton WI (4 years)
Ilse Gebhard, Kalamazoo MI (3 years)
Karen Goellner, Kirkwood MO (2 years)
Lois Hering, Chapel Hill NC (2 years)
Donna Kemp, Sparta WI (5 years)
Pat Landry, Stonington MI (8 years)
Paul Lipman, Shutesbury MA (1 year)
Cindy Peterson, Chanhassen MN (7 years)
Barbara Powers, Manchester VT (6 years)
Annette Strom, Duluth MN (3 years)
Heidi Wintersteen, Moreland Hills OH (2 years)
Listed below are the city locations of MLMP trainers: naturalists, teachers and others who have attended an official MLMP train-the-trainer workshop. While you can learn to monitor on your own using directions at www.mlmp.org, you may also contact a trainer to help you get started. A detailed list of the trainers at these locations, with contact information, is available on-line. Most trainers monitor their own sites, and would love to have you join them!

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Monarch Breeding Distribution under a Changed Climate

PhD candidate Reba Batalden is using MLMP data to study potential impacts of global climate change on monarch distributions. What she’s found suggests that monarch habitat could begin to shift northward over the next 50 years due to changes in temperature and precipitation. This study, conducted by Batalden, Karen Oberhauser and A. Townsend Peterson, identifies specific environmental conditions that monarchs require to survive. Extensive rain or prolonged cool and cloudy conditions can reduce egg laying and slow larval development, which leaves them more vulnerable to predation and can result in fewer generations. MLMP monitors saw the effects of this in summer 2004 (see article on pp 2-3). Prolonged hot or dry spells can reduce adult lifespan and fecundity, and continued exposure to extremely high temperatures causes larval mortality and developmental changes. Climate can also influence the abundance and quality of milkweed, which deteriorates in hot and dry conditions.

To assess where suitable summer habitat exists for monarchs, we used ecological niche modeling (a related article in the 2004 MLMP newsletter described a similar study of monarch winter habitat). To identify monarchs’ ecological niche, we used MLMP data showing monarch presence throughout the breeding season. When we compared these data to climate records, we could identify a set of environmental conditions conducive to monarch presence and reproduction; key parameters that seem important to monarchs are warm (but not too hot) and humid conditions. We then applied a climate change scenario to the model and identified where these environmental conditions would be under a changed climate.

We found few changes to the monarch’s early spring environment. By June (when monarch breeding begins in earnest), the areas of current and future distribution begin to separate as their range moves well into Canada. The map included here shows their predicted habitat in July 2055. The dark gray (in the south) represents current available habitat, light gray (north) is future habitat, and black (middle) is overlap between current and future habitat. If monarchs can disperse into newly suitable areas, they could occupy all of the black and light gray areas. If they can’t, only the black area will be available to them in the future. In either case, the dark gray areas are predicted to be unsuitable. The white squares show current MLMP sites that contained monarch eggs in July. The Twin Cities, and many other MLMP locations, could be unsuitable for monarchs in July 2055!

The availability of newly suitable habitat depends on whether monarchs and milkweed will be able to track climate changes to occupy their new habitat. If monarchs cannot expand their range, they could lose up to half of their current habitat area in some months.

This topic is the focus of Reba Batalden’s Ph.D. research. She will also conduct laboratory studies to determine the extent to which monarchs may be able to track environmental conditions and utilize new habitat as it becomes available.

www.mlmp.org Updates

We’re always looking for ways to make www.mlmp.org more useful and interesting. There are links to articles about monarchs and ecology, and also to media reports on the MLMP.

This year we’ve added an anecdotal reports section that allows volunteers or other monarch observers to report interested sightings that aren’t part of regular monitoring at a registred MLMP site. Andy Davis, at Emory University in Georgia reported a tachinid explosion! “We had some leftover larvae from the lab in November, that we decided to put outside our building in a milkweed garden... It's been unusually warm this fall, so they did fine, but grew slowly. In December, I collected all pupae and 5th instar larvae (48 in total) and brought them into the lab. They all eventually pupated, but then tachinid pupae started popping out of the monarch pupal cases left and right over the next week. We collected 28 tachinids total! I don't know what’s more interesting, that all these tachinids were around in December, that they emerged from the pupal cases (and not during the larval stage), or that there were so many!”

[Insert image of adult tachinid fly]
Community Connections Poster is a perfect teaching tool for MLMP volunteers and others interested in monarchs and their habitat.

Features
- Flowers: fast food for monarchs.
- Milkweed: the key to monarch success
- Predators: no defense is perfect
- Climate: not too hot, not too cold

This 2’ x 4’ poster is similar to one of the panels on our MLMP display, but is easier to transport and display. MLMP volunteers can have free copies of the poster to teach others about monarchs; we will send up to 4 copies of the unlaminated version for a $5 shipping fee for all 4 (there is a $7 shipping fee for up to 3 laminated copies).

FREE to MLMP volunteers and trainers
Contact Karen at oberh001@umn.edu