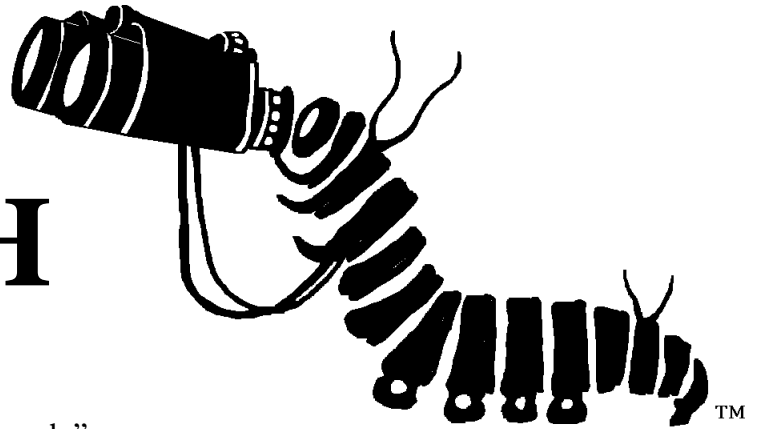


MONARCH WATCH

“Dedicated to conservation, education and research.”



May 1996 • Vol. 4 • No. 1

The **Monarch Watch** is a collaborative network of students, teachers, volunteers and researchers dedicated to the study of the biology of the Monarch Butterfly, *Danaus plexippus*.

The goals of the Monarch Watch are to further science **education**, particularly in primary and secondary schools, to promote the **conservation** of Monarch butterflies, and to involve thousands of students and adults in a cooperative **research** study of the Monarchs' fall migration. The project is directed by Dr. Orley R. "Chip" Taylor (Department of Entomology, University of Kansas) in collaboration with Brad Williamson (Olathe East high School), Dr. Bill Calvert (Texas Monarch Watch), and Dr. Karen Oberhauser (University of Minnesota).

1995 Season Summary

Another successful year! Tagging success varied greatly in different regions of the country this past season. Those of you in the northeast had a difficult time finding Monarchs to tag while the students at several schools in Kansas caught more butterflies than they could tag and saw more than they could count. Nevertheless, we had more tagged Monarchs recovered in Mexico (N=11) and throughout the United States than in previous years. Our recovery rate is improving. Last year we had one recovery in Mexico for every 1875 butterflies tagged and this year it was one per 1545. This may be luck or it may mean that we are all getting better at applying the tags properly. The number recovered relative to the number tagged may seem low but it is higher than recorded for the previous tagging program (1/5000) and it is generally higher than the recovery rate for bird banding studies. And, as you will see as you scan the summary, we are learning new things about Monarchs and making new connections that will further the education, conservation and research goals of our program.

Improvements We are working hard to increase the breadth and depth of the Monarch Watch. New projects have been added to our program and we are making progress with curriculum development. Slowly, we are adapting to all the new digital technologies and we've just added the first of many quick time videos to the web site. This past year we initiated and maintained a Monarch list serve and communicated extensively with many participants via e-mail. We recently added a toll free number (1-888-TAGGING) which logs your calls on a computer. This will make it easier for us to get back to you. Also, by fall, we will be able to conduct video conferencing with schools which have this capability.

Memberships This was a year of transition and growth for the Monarch Watch. As you know, to cover the operating costs of the Monarch Watch we had to move to a membership program this past year. Our membership costs are modest, a mere \$10, but it meant that we lost some participants from previous years but at the same time we also gained new members. The good news is that we will be able to continue the Monarch Watch and maintain the membership costs at \$10 again this year.

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This publication is funded by memberships and contributions to the Monarch Watch, and an NSF grant for curriculum development. Written and prepared by Orley R. Taylor, (Department of Entomology, University of Kansas, Lawrence, KS 66045) with the assistance of Jim Lovett and Kari Rogg.

THANKS!

Thanks to all members, taggers, participants and contributors to the Monarch Watch. We appreciate your cooperation and assistance in furthering the goals of this program.

Thanks to the regional coordinators. Without your assistance things would be even more hectic in the lab.

And, thanks to all the students at Kansas who so ably assist with the program, especially Danel Vickerman, Jim Lovett, Lauren Bone, and Kari Rogg.



LOST IN CYBERSPACE

We're back! At least we think so. On the 29th of February, the University Computer Center gave us a 7 hour warning that they were going to change the address that most of you have been using for the Monarch Watch web site. Ouch! This meant that if you tried to use the old address you received a message indicating we were busy or non-operational. This also meant that all internet indexes had us listed incorrectly. We requested the indexing services to change our address to <http://monarch.bio.ukans.edu> but the internet is growing so rapidly that it took some of them two months to make the correction. Sorry for the inconvenience, you should be able to find us now.

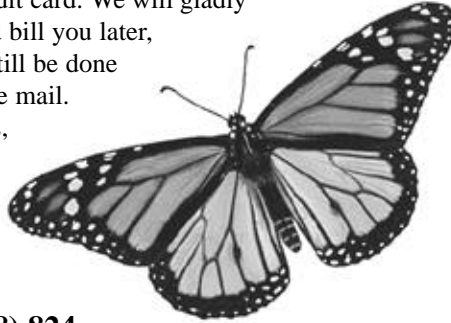
How to Reach the Monarch Watch

We're in the business of sharing knowledge, so it's important that you know how to contact us and access information. There are several ways to do this:

MAIL - Monarch Watch•c/o O.R. Taylor• Department of Entomology•Haworth Hall• University of Kansas•Lawrence KS 66045

Because we're a small organization and don't have a secure WWW marketplace path, we cannot take orders or send invoices online, or bill you by credit card. We will gladly take orders over the telephone and bill you later, but invoicing and payment must still be done the old-fashioned way: through the mail.

We send information, tags, t-shirts, pins and seeds through the mail, and usually send live animals overnight via Federal Express.



TELEPHONE - Toll-Free!

1 (888) TAGGING - [1 (888) 824 - 4464]

We now have a toll-free number and we've really gone high-tech. Your calls are answered by a computer which asks you to leave your name and number. The calls are digitally stored in the computer's memory; therefore, we can return calls more easily and efficiently since we don't have to play back taped messages. In the height of tagging season, we're inundated with phone calls, so this may not always be the fastest way to reach us though we try to answer all calls within 1-2 working days. When you leave a message, please be sure to give your name and full phone number (speaking clearly and slowly, of course!), as well as when you can be reached. You may also leave orders or requests for information. If you place an order for live materials, please include a shipping date in order to avoid delays.

FAX - (913) 864 5321

The fax machine is on 24 hours a day, but we only retrieve faxes 8-5 M-F, unless prior arrangements have been made.

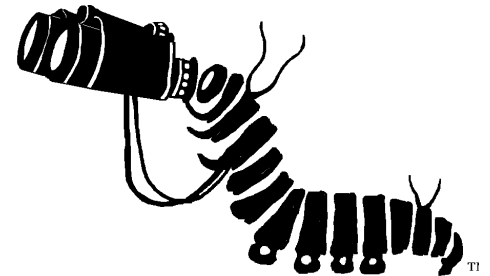
E-MAIL - monarch@falcon.cc.ukans.edu

The volume of e-mail we receive has increased exponentially, but it's still the most efficient way for you to send us orders and requests for information. Please be sure to include your snail-mail address (and an alternate summer snail-mail address if you're a teacher), and tell us just what you need. We try to answer all e-mail within one working day.

WORLD WIDE WEB (WWW) -

<http://monarch.bio.ukans.edu>

In the fall of 1994, we began an archive of monarch biology and information about the Monarch Watch on the World Wide Web. This continuously updated resource contains a wealth of information related to all aspects of monarch biology and the Monarch Watch. Our site already contains several photos and we plan to add audio and video clips in the very near future. Check with your Internet service provider to find out how to access the Web.



ELECTRONIC MAILING LIST -

listserv@ukanaix.cc.ukans.edu

"DPLEX-L" is the name of our electronic mailing list/discussion group on the Internet. The list is a free service and is a way to post e-mail messages to a group of other subscribers who share interest in monarchs and/or the Monarch Watch. To receive information about DPLEX-L, just send the message: "info DPLEX-L" to listserv@ukanaix.cc.ukans.edu You will receive an e-mail message that summarizes the goals of the list as well as the listserv commands you need to know in order to participate. To subscribe, send the message: "subscribe DPLEX-L [first name last name]" to the same address.

ELECTRONIC OUTREACH

On Monday, 13 November 1995, the Wall Street Journal in an article entitled the "World's a Lab" by William Bulkeley, the Monarch Watch and Journey North were cited as examples of computer aided outreach programs that allow students to connect with and contribute to studies conducted by scientists.

Monarch Populations: Fall 1995 - Spring 1996

FALL 1995: THE POOR, THE FAIR AND THE EXCELLENT

Monarch populations were extremely low in the northeastern states in the fall of 1995. Extreme drought prevailed from Ontario to Maine and through much of New York and Pennsylvania. There were many disappointed taggers throughout these states. Low numbers of Monarchs were also reported for areas to the south of this region such as Ohio, Indiana, Tennessee, and Kentucky. Along the east coast the numbers were also down, particularly at Cape May Point in New Jersey where Dick Walton has been conducting a migration survey for several years. Nevertheless, a modest number of Monarchs were successfully tagged from New Jersey through North Carolina.

The midsummer Monarch populations in the midwest seemed to be below normal and only at the end of August did it appear that populations were at the usual fall levels in the northern states. Nevertheless, the numbers of Monarchs seen moving south in Iowa and Nebraska were not remarkable and there was nothing to prepare taggers in Kansas for what happened in mid September. Monarchs arrived in large numbers on the 14th across central Kansas on a line extending from Olathe in the east to Sharon Springs in the west. Subsequent to their arrival, unseasonably cold weather delayed the migration for 4-7 days, depending on the location, and during this interval students at schools from Olathe to Hays tagged more than 6,000 Monarchs. The concentrations of Monarchs seen throughout central Kansas in this period appeared to be higher than in the previous three years of the Monarch Watch. Many observers reported seeing trees and hedgerows covered with thousands of Monarchs. In the previous season (1994), the migration stalled in Iowa for about a week and then stalled briefly again in southern Kansas before moving into Oklahoma.

A unique aspect of the migration this year was the ability to receive email messages from observers to the north. These reports allowed us to predict the arrival of the "front" or mass of the migration with some accuracy and to warn taggers to the south of the imminent arrival of the Monarchs.

WINTER 1995-1996

The numbers of monarchs reported throughout the range east of the Rockies were much lower than in the previous three seasons of the MW. High concentrations of monarchs were reported for Kansas, two locations in Oklahoma and several sites in Texas but these were the exceptions. Given the trend in most of the reports and the low tagging success throughout the northeast, our expectation was that the numbers of monarchs reaching the roosts in Mexico would be lower than normal in the winter of 1995-96. This does not appear to have been the case but it is difficult to be sure of the total numbers of monarchs roosting in Mexico. In some years, all the roosts

sites are visited by monarch experts and these researchers give a rough estimate of the overall population. These estimates usually range from 60-100 million. Only two of the roosting areas were visited this year, Sierra Chinqua and El Rosario. The numbers of monarchs at Chinqua appeared to be normal but several monarch specialists reported greater numbers of monarchs at El Rosario than usual.

Assessment of the conditions at the roosts and the general state of the overwintering population were complicated and more than a little confused by the differing assessments of the effect of the snow storm which dumped 13-27 inches of snow throughout the Transvolcanic mountains from 29-31 Dec. Fortunately, the early estimates of 30% mortality due to the storm were excessively high. Post storm assessments by several groups working independently placed the mortality rate at 5-7%.

SPRING 1996: OFF TO A SLOW START?

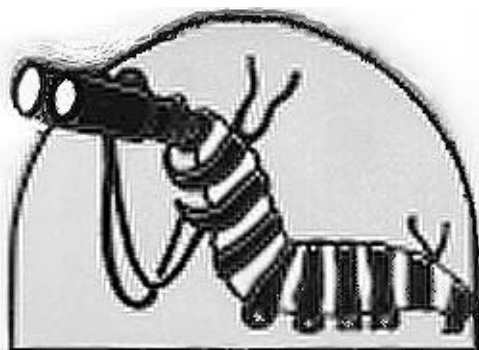
Although the numbers of Monarchs at the roost sites in Mexico were normal or above normal at the end of the season (early March) in spite of the snowstorm in December, unfavorable spring conditions appear to have hampered their recolonization of the breeding range. Monarchs began to leave the roosts in late February and early March but as they moved into northern Mexico and Texas, they encountered extreme drought conditions. The limited number of nectar producing flowers and the drought delayed emergence of the milkweeds seemed to reduce egg laying by Monarchs in Texas. In Fact, Bill Calvert reports that the number of adults seen, as well as the numbers of eggs and larvae found subsequently on the plants was extremely low. Reports of Monarchs to MW and Journey North from the midwest have been few a scattered. In Kansas, the first Monarchs are usually reported 6-10 April in the south central portion of the state. This year there were no reports for April and only Monarch reported so far was one seen by Chip Taylor on 16 May in Lawrence.

Drought conditions from northern Mexico combined with an unusual jet stream and spring moisture pattern may have had the effect of causing Monarchs to move in an easterly and northeasterly direction rather than northward through the dry regions of Texas, Oklahoma and Kansas. At this time (20 May), there are more reports of Monarchs from the eastern states, and even Ontario, than there are for most of the midwest. This is the third year in a row that the Monarchs appear to have moved up through the eastern states faster than they have the central midwest. Is this an artifact of the number and distribution of observers or is this pattern a consequence of weather factors that have the effect of limiting movement in the midwest while favoring flight to the northeast? Does anybody have an enterprising student who would be interested in relating patterns of spring Monarch sightings to weather conditions?

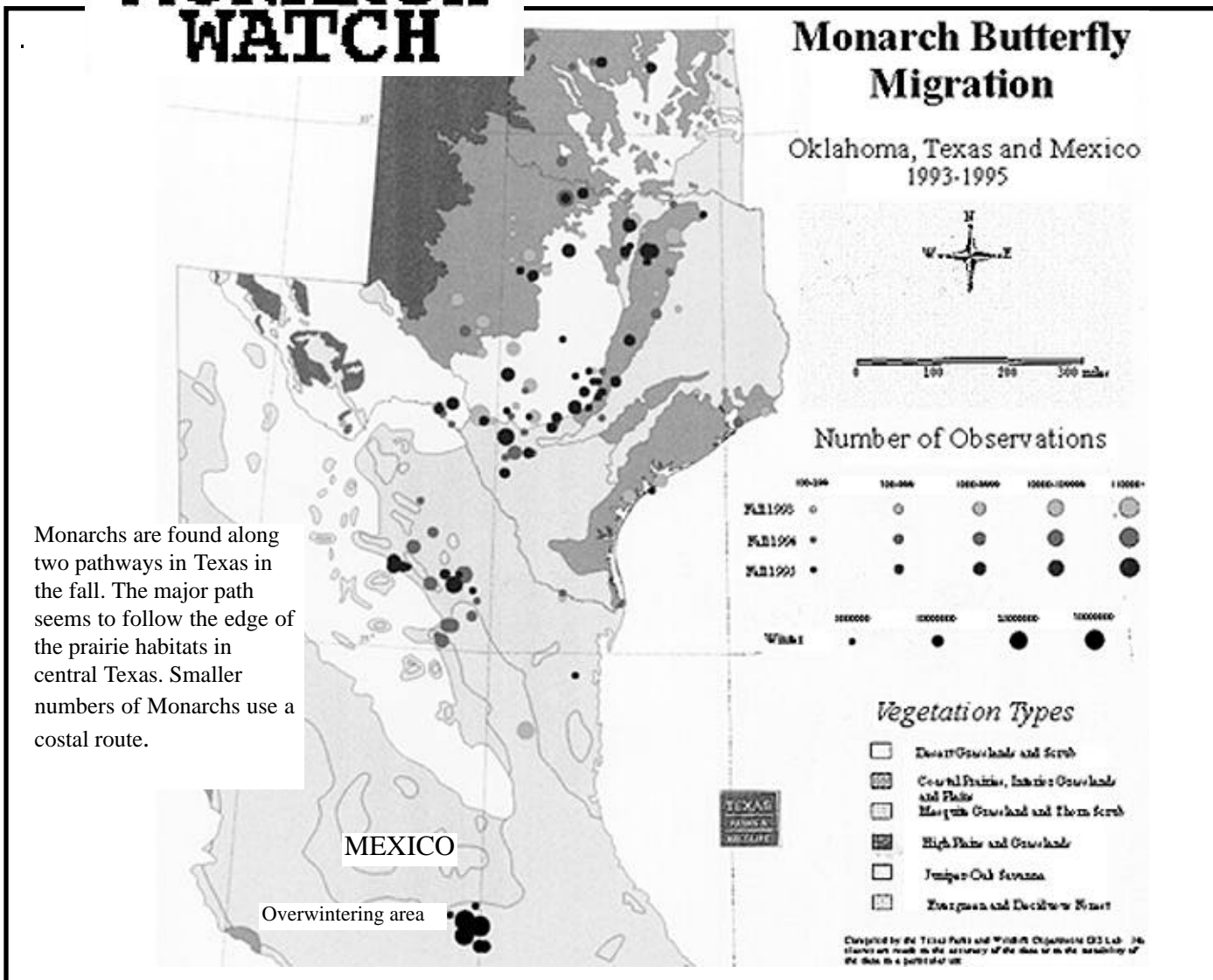
CURRICULUM AVAILABLE

Karen Oberhauser (University of Minnesota) has developed sets of curricular materials based on the monarch butterfly for K-2, 3-6 AND 6-8. These materials were developed with the aid of teachers who participated in workshops led by Karen and sponsored by The University of Minnesota Departments of Continuing Education and Ecology, Evolution and Behavior; The Medtronic Star Foundation; and The National Science Foundation. The curriculum includes basic information on monarch biology and incorporates activities and exercises appropriate for each grade level. Some of the materials are available on our web site, but many have not been incorporated yet, or just work better in a hard copy format. These materials have been tested in the classroom. Curriculum booklets (approximately 80 pages) are available for \$7.50 each (INCLUDES SHIPPING) from: Dr. Karen Oberhauser, Dept of Ecology, Evolution and Behavior, University of Minnesota, 1987 Upper Buford Circle, St. Paul, MN, 55108. NO PURCHASE ORDERS PLEASE!

GULLIVER PIN (see order form)



MONARCH WATCH



Monarchs are found along two pathways in Texas in the fall. The major path seems to follow the edge of the prairie habitats in central Texas. Smaller numbers of Monarchs use a coastal route.

Recoveries!

Summary of recoveries of tagged monarchs in 1995. Eleven tagged monarchs were recovered at the roosts in Mexico this past winter, 5 in El Rosario and 6 in Chinqua. The recovered butterflies were tagged in Arkansas (1), Iowa (1), Kansas (6), Maryland (1), Minnesota (1), New York (1). There were many other excellent recoveries within the United States this year and all of the recoveries within the US for 1992-95 are summarized on a map on page 10. The origins of all the Monarchs collected in Mexico are shown on page 16. There were three "unusual events" among the recoveries; T. Leiker and J. Leiker, both students with Donna Cooper at Hays High School (KS), both had Monarchs recovered in Mexico. Mark Gretch, of Keene, N. Y., only tagged 16 butterflies but had two nifty recoveries, one in Mexico which traveled at least 2580 miles and another which was found 215 miles to the southeast in Westbrooke, Connecticut. Most of the tag information is obtained from butterflies that are found dead, so it was very exciting to receive a report from Karen Oberhauser of the discovery of a tagged female, in nearly perfect condition, that was collected while mating at a roost on Sierra Chinqua (see photo on page 13).

Please return your data sheets! Our objective is to obtain accurate recovery data and to use these data to establish the migratory routes taken by Monarchs. The ratio of recoveries to the numbers tagged helps us establish the effectiveness of our program. To obtain information on the numbers of monarchs that were tagged, we need to have the data sheets returned to us. It is very time consuming and costly to trace down recoveries when the data sheets have not been returned. **Please help.**

Tag No.	Tagger	Mon. Sex	Where Tagged	Date Tagged	Date Recovered	Where Recovered	Observer	Interval	Est. Distance
AU 646	Mark Gretch P.O. Box 392 Elizabethown, NY12932	F	Keene, NY	19 Sep	Feb 1996	El Rosario colony, Mexico	Susumu Yamaguchi	5 m	2580 m
BW 003	John Fales 2809 Ridge Road Huntingtown, MD 20639	F	Huntingtown, MD	14 Sep	Dec 1995	El Rosario colony, Mexico	Jane Ruffin	3 m	2285 m
AN 008	Dodge Nature Center 1795 Charlton Street W. St. Paul, MN 55118	F	West St Paul, MN	4 Sep	1 Mar	El Rosario colony, Mexico	David Marriot	6 m	1990 m
AG 802	Karla VerMeer 4210 300th Street Sheldon, IA51201	?	Sheldon, IA	?	Mar 1996	Chinqua, Mexico	Eduardo Rendon and Enieda Montesinos	6 m	1820 m
CU 878	Shane Michaelis/Lu Shirley 801 Lincoln Wamego, KS 66547	M	Wamego, KS	23 Sep	Mar 1996	Chinqua, Mexico	Eduardo Rendon and Enieda Montesinos	6 m	1555 m
BP 359	J. Leiker/Donna Cooper Hays High School 2300 East 13 Hays, KS 67601	F	Hays, KS	18 Sep	24 Feb	Sierra Chinqua, Mexico	Karen Oberhauser	5 m	1510 m
BP 652	T. Leiker/Donna Cooper Hays High School 2300 East 13 Hays, KS 67601	F	Hays, KS	18 Sep	Mar 1996	Chinqua, Mexico	Eduardo Rendon and Enieda Montesinos	6 m	1510 m
BO 299	Harry Gregory 103 W 30th Ave Hutchinson, KS 67502	M	Hutchinson, KS	1 Oct	15 Jan	Herrada or Las Palomas, Mexico	Joel Rodriguez Zuniga	3 m	1500 m
CM 355	Rick Thompson 219 Atchley St Berryville AR 72616	F	Berryville, AR	25 Sep	30 Dec	El Rosario colony, Mexico	Hugo Reyes Santos	3 m	1445 m
CJ 954	Ron Turner Andover Middle School 1747 N. Andover Road Andover, KS 67002	F	Andover, KS	24 Sep	Mar 1996	Chinqua, Mexico	Eduardo Rendon and Enieda Montesinos	6 m	1445 m
AS 887	Jim Mason 1145 Jackson Wichita, KS 67203	F	Wichita, KS	23 Sep	Mar 1996	Chinqua, Mexico	Eduardo Rendon and Enieda Montesinos	6 m	1440 m
AM 907	Dawn Anderson/Earl Weininger Hillsboro High School 500 E Grand Hillsboro KS 67063	F	Hillsboro, KS	27 Sep	19 Oct	Carrizo Springs, TX	Bill Calvert	22 d	694 m

More recoveries!

Tag No.	Tagger	Mon. Sex	Where Tagged	Date Tagged	Date Recovered	Where Recovered	Observer	Interval	Est. Distance
BH 331	Julia Clemens 2258 Lamberton Rd. Cleveland Heights, OH 44118	?	Cleveland Heights, OH	?	3 Oct	Rock Island, IL	Darrin Good	?	465 m
AS 610	Troy Hicks/Earl Wienenger Hillsboro High School 500 E Grand Hillsboro KS 67063	F	Hillsboro, KS	20 Sep	4 Oct	Waurika, OK	Marie Tow	14 d	290 m
AU 652	Mark Gretch P.O. Box 392 Elizabethown, NY12932	F	Keene, NY	29 Sep	12 Oct	Westbrook e, CT	Thomas Maynard	13 d	215 m
CG 235	Ali Taghavi/Ken Highfill Lawrence High School 1901 Louisiana Lawrence KS 66046	?	Lawrence, KS	18 Sep	29 Sep	Arkansas City, KS	Justin Curran	11 d	162 m
AO 022	Jane Tyler Avery Middle School Somers, CT 06071	F	Sunapee, NH ?	?	22 Sep	Wappinger Falls, NY:	Bill Smith	?	152 m
CM 577	Arlene Klein Carson Valley School 1419 Bethlehem Pike Flowertown PA 19031	M	Flourtown, PA	12 Oct	27 Oct	Roxborough, PA	Brian McCabe	15 d	115 m
BO 125	Jane McDonald Oil Hill School 2700 W. 6th El Dorado, KS	M	Benton, KS	22 Sep	23 Sep	El Dorado, KS	Mary Jo and Jim Wichers	1 d	78 m
CK 683	John Wachholz Salina Central High School 650 E. Crawford Street Salina, KS 67401	M	Salina, KS	20 Sep	25 Sep	Lyons, KS	Judith Best	5 d	46 m
CB 809	Michael Veit P.O. Box 992, Lawrence Acad. Groton, MA01450	M	Groton, MA	13 Oct	22 Oct	Worcester, MA	Robert Killoran	9 d	27 m
BW 716	Debbie Lux 835 Powell Rd. Tabernacle, NJ 08088	M	Tabernacle, NJ	23 Sep	24 Sep	Lower South Hampton Township, PA	Sharon Nelson	1 d	26 m
AQ 178	Ann Burns Jackson Co. Conservation Bd. 201 W. Platt Maquoketa, IA52060	M	Maquoketa, IA	9 Sep	16 Sep	Bellevue State Park Bellevue, IA	Genevieve Dement	7 d	17 m
AS 039	Ryan Cane/Terry Callender Wamego High School 801 Lincoln Wamego, KS 66547	F	Wamego, KS	3 Sep	18 Sep	Manhattan KS	Jason Jones	15 d	15 m
204 AD	David Stucky/Al Neufeld Moundridge High School Moundridge, KS 67107	F	Moundridge, KS	17 Sep	27 Sep	Canton, KS	Lynn and Diane Nightingale	10 d	14 m
AF 384	Karen Newell	M	Minnetonka, MN	?	19 Oct	Minneapolis, MN	Mark Holman	?	11 m
CP694	Barbara Naylor 417 E. Tripp Sunnyvale, TX 75182	?	Sunnyvale, TX	?	7 May 1996	Garland, TX	Terry Whitt, Jr.	?	8 m
CB 662	Ellen Vannucci Poricy Park Nature Center	?	Middletown, NJ	?	before 14 Oct	Keansburg NJ	Michael Zazzarino	?	3 m
BO 329	Walter Knapp - Quincy Elem.	F	Topeka, KS	23 Sep	26 Sep	Topeka,KS	Jay Gibbens	3 d	2 m

Still more recoveries!

Tag No.	Tagger	Mon. Sex	Where Tagged	Date Tagged	Date Recovered	Where Recovered	Observer	Interval	Est. Distance
BE 018	Jane Ruffin 1013 Great Springs Rd. Rosemont, PA 19010	M	Cape May Pt, NJ	28 Sep	2 Oct	Cape May Pt, NJ	Dorothea Hall	4 d	0 m
AX 734	Jane Ruffin	M	Cape May Pt.	24 Sep	1 Oct	Cape May	Eileen Bremner	7 d	0 m
BE 146	Jane Ruffin	M	Cape May Pt.	30 Sep	1 Oct	Cape May	Eric Raun	1 d	0 m
AR 216	Karen DeVictor Pinckney Elementary School	F	Lawrence, KS	26 Sep	?	Lawrence, KS	Mrs. Grusch	?	0 m
BA402	Denise Gibbs Gaithersburg, MD 20882	F	Point Lookout, MD	28 Sep	1 Oct	Ridge, MD	Tom Harten	3 d	0 m
BR 711	Emily Shirey Lewisburg Elementary	F	Lewisburg, WV	13 Sep	6 Sep?	Lewisburg WV	Todd Ballentine	?	0 m
AB 902	Joe Southerton Mifflinburg Middle School	?	Mifflinburg, PA	8 Sep	9 Sep	Mifflinburg, PA	Pam Fisher	1 d	0 m
CJ 946	Ron Turner Andover Middle School	M	Andover, KS	24 Sep	25 Sep	Andover, KS	Steven P. Carl	1 d	0 m
AQ 103	Linda Cooper Lincoln Elementary School	?	St. Cloud, MN	?	24 Sep	St Cloud, MN	Todd Dale	?	0 m
BN 789	John Wachholz Salina Central High School	F	Salina, KS	17 Sep	20 Sep	Salina, KS	Jerome Koger	3 d	0 m
CH 262	Dennis C. Rausch	F	Austin, TX	21 Sep	28 Sep	Austin, TX	Betty Downes	7 d	0 m
CW 347	Jamie Kanode/Terry Callender Wamego High School	F	Wamego, KS	20 Sep	20 Sep	Wamego, KS	Brandon J Depew	0 d	0 m
AQ 443	3rd graders Rexford-Longfellow School	F	Clintonville, WI	14 Sep	15 Sep	Clintonville, WI	Bonnie Justman	1 d	0 m
AR 833	Pat Owen -distributed to local tagger	?	Wichita, KS	?	27 Sep	Wichita, KS	A. P. Hill	?	0 m
CI 706	Gene Lamb	F	Olathe, KS	24 Sep	29 Sep	Olathe, KS	Wendell Burg	5 d	0 m
CA512	Allen Bellinder/Lu Shirley	F	Wamego, KS	7 Sep	7 Sep	Wamego	Terry Callender	0 d	0 m
BD 004	Sue Sorenson's class Lily Lake School	F	Stillwater, MN	2 Oct	16 Oct	Stillwater, MN	?	14 d	0 m
MJ 356	Carlene Johnson	?	Corpus Christi, TX	?	11 Oct	Corpus Christi, TX	Jerry Seams	?	0 m
CN 555	Sarah Vollmer Gaithersburg MD 20878	?	Gaithersburg, MD	?	22 Oct	Gaithersburg, MD	Marge King	?	0 m
CQ 903	Parkside Community School	F	Austin, TX	10 May 1996	12 May 1996	Austin, TX	Richard A. Jordan, Jr.	2 d	0 m
AK 132	Judy Ryan	?	?	?	15 Oct	Oakdale, MN	Chris Schmidt	?	?
393 KG	?	M	?	?	18 Aug	20 miles W of Iowa City, IA	John L. Anderson	?	?
AU 742	Dianna Poindexter?	?	?	?	3 Oct	Brookline, NH	Emelia J Fleck	?	?

1995 Monarch Watch Summary

Number of tagging kits sent out1100
Number of tags distributed80,000
Estimated number of monarchs tagged17,000
 (Number based on returned data sheets: 14,000)
Most monarchs tagged by one group or individual in fall 19951995
 (Al Neufeld and students of Moundridge High School (KS)... GOOD JOB!)
Number of recovered tags59
 (Recovered in Mexico: 11)

Monarchs in the News

Monarchs were the subject of a series of news stories this past year. Some of our readers may not have seen these stories, so brief summaries will be provided here. Additional information can be found on the Monarch Watch web site.

SNOWSTORM KILLS MONARCHS IN MEXICO

On the 30th of Dec 1995, National Public Radio broadcast a report which described an unusual snowstorm at the Monarch overwintering sites in the Mexican states of Michoacan and Mexico. This report included claims made by local authorities that a large proportion (30% or 20 million) of the overwintering Monarchs were dead or dying as a result of the storm. Subsequent to this account there was a "blizzard" of news accounts most of which repeated the same information. In the following weeks, several Monarch experts, including some who visited the roosts after the storm, provided different interpretations of the significance of this event. However, all observers seemed to agree that the number of Monarchs was much less than first estimated and that continued logging within and near the roosting sites located within the five Mexican reserves poses the greatest threat to Monarch populations.

CANADA AND MEXICO ESTABLISH INTERNATIONAL MONARCH RESERVES

Canada and Mexico signed a bilateral agreement in October 1995 to establish International Monarch Reserves. The Mexicans have designated the Bosque Modelo Mariposa Monarca (Monarch Butterfly Model Forest) in Michoacan, for their component of the agreement. In Ontario, Point Pelee National Park, Long Point and Prince Edward Point (all peninsulas that jut out into the Great Lakes) have been selected as Canadian Sites. It is also proposed that Presqu'ile and Rondeau Provincial Parks be part of this network. The Canada-Mexico agreement provides for more research and better monitoring of Monarch migration. Work will begin on identifying habitats that the government hopes will be supported by a network of volunteers. Protection and perhaps even propagation of milkweeds might be considered as an alternative to the Ontario Weed Act which treats milkweeds as noxious weeds which property owners must destroy.

BILATERAL AGREEMENT : RESEARCH COMPONENT

The following information describes some of research that will be carried out in conjunction with the recent bilateral agreement between Mexico and Canada:

Stable-isotope analysis of Monarch butterflies and feathers of neotropical migrant songbirds wintering at the Bosque Modelo Mariposa Monarca (Monarch Butterfly Model Forest) in Michoacan, Mexico will be conducted in order to link breeding and wintering grounds of these species. This will be twinned with similar sampling in Canada and the United States to isotopically map individual populations. (see Tracking Monarch Migration With Hydrogen Isotopes.)

Rationale for the study

Migrant songbirds and butterflies are important components of the biodiversity of Canada's boreal forest that may be threatened by habitat loss on breeding and wintering grounds. Essential to the conservation of these and other migratory species is an ability to link breeding and wintering sites so that conservation efforts may be directed appropriately at both ends of migration routes and at migratory stopover sites. Recent developments in stable-isotopic research have indicated that stable-hydrogen isotope abundance in rainfall show continent-wide patterns and these are translated through food webs to birds, butterflies and other organisms. By measuring isotope profiles (fingerprints) in species on wintering grounds in the tropics, it will be possible to better delineate their origins in North America. Preliminary research by Hobson and Wassenaar of Environment Canada has shown the potential of this technique (Oecologia, in review). Our proposed isotopic work on Monarch butterflies and migrant songbirds represents the first major application of the technique and would be a major breakthrough in the way we approach international conservation of biodiversity. The development of the isotope technique and the linking of breeding and wintering areas of populations of butterflies and selected song bird species will contribute to knowledge acquisition and this will in turn support Canada's foreign policy objective of conserving biodiversity at a national and international scale (see page 19).

This report is based on e-mail received from Don Davis, Harold Spanier, Christopher Majka and discussions with Gerry Lee.

MONARCHS IN EUROPE

One of the most intriguing biological events of 1995 was the sudden appearance of Monarchs in Europe. Monarchs are not native to northern Europe. Yet, they have been recorded in England, and elsewhere in Europe, periodically since 1876. This year, Monarchs were reported from July through October in England and one was sighted in the Netherlands and several in France in October. These sightings generated a small burst of email messages and considerable speculation concerning the origin of these butterflies.

Monarchs in the News continued

How did they get there? There seem to be three possibilities: 1) these Monarchs were escapees from a captive breeding program, 2) they originated from North America and 3) they were carried northward from the Azores, the Canaries or possibly from Spain or even northern Africa. Surprisingly, the e-mail communications contained information, both pro and con, concerning each of these possible origins.

The strongest case, based on the distribution and timing of the sightings, favors a North American origin. But how did they get there? Were the Monarchs transported by ship or were they carried by jet streams, hurricanes or strong and continuous winds that occasionally sweep from North America to Europe?

It is easy to speculate, but it is another matter to obtain "hard" evidence and there is none in this case. It is all circumstantial but how do we get the hard evidence? Its not impossible. And, in two long messages to dplex, I promoted the idea that this situation could be used to engage students in discussions concerning tests of the

alternatives hypotheses. The questions and guidelines I suggested for such discussions are too lengthy to give here but they will be posted soon to a Best of Dplex section on the Monarch Watch web site.

MONARCH RECOVERIES IN THE UNITED STATES



Prospective Monarch Migration Reserves

The Canadian Government set a good example of how to forward Monarch conservation by designating Long Point and Point Pelee as "Monarch Migration Reserves". These reserves are areas of government property at which large numbers of Monarchs are known to congregate each fall at the beginning of the migration. With the idea that similar reserves could be established in the United States, we (Taylor, Calvert and Walton) assembled a short list of possible migration reserves. This list was forwarded to the Department of Interior and a spokesperson from Interior expressed an interest in the concept but their jurisdiction is limited to Federal lands. Federal property is relatively scarce in the eastern U.S., so, we will have to do some research. If you know of Monarch roosting sites on Federal lands, please contact the MW with this information. Designation of Monarch reserves within states is an alternative to federal protection and this is a realistic objective. Wildlife programs in many states are anxious to promote conservation issues that are highly visible and non-controversial and it shouldn't be too difficult persuade states to protect Monarch roosting areas. Again, if you know of such locations on state property, please contact the MW and we will promote discussions with state officials.

Devil's River State Natural Area
HCR 1 Box 513
Del Rio TX 78840

Landmark Inn State Historical Park
402 Florence St
Castroville TX 78009

Colorado Bend State Park
Box 118
Bend TX 76824

Dinosaur Valley State Park
Box 396
Glenn Rose TX 76043

Seminole Canyon State Historical Park
PO Box 820
Comstock TX 78837

Kickapoo Canyon State Natural Area
PO Box 705
Bracketville TX 78832

South Llano River State Park
HC 15
Box 224
Junction TX 76849

Possum Kingdom
Box 36
Caddo TX 76429

Cape May Point, New Jersey 08212

Baker/Haskell Wetlands, Lawrence, Ks.
Baker University
Baldwin, Ks. 66006

KANSAS MONARCH WATCH



Flowers of a giant milkweed (>10'), *Calotropis procera*, introduced from Africa to many Caribbean islands. This plant is high in cardenoloids (toxins) but is used as a hostplant by monarchs. Photo: Linas Kudzma



Danel Vickerman

Chip Taylor

Jim Lovett

Photo: Sharon Hagen

The Best of DPLEX

Dplex-L is a list server, an electronic mailing list which is managed by Chip Taylor for the Monarch Watch. The list provides a means for dissemination of news, posting observations and reports, asking questions and initiating discussions of topics related to Monarchs. Occasionally, questions are posed which don't seem to have an answer and sometimes Chip rises to these as trout to a fly. Be patient with him. He gets excited about unanswered questions and tries to get you excited as well. He's hoping that others will be inspired to pose questions and hypotheses and design experiments which can be conducted in the classroom. Subscribe to dplex-l and join the fun. The following paragraphs contain some of the reports and questions discussed on dplex.

TRIP TO MEXICO

A report from Dr. Karen Oberhauser, University of Minnesota Department of Ecology, Evolution and Behavior

University of Minnesota Ecology graduate students Sonia Altizer and Liz Goehring and I just returned from the Sierra Chincua Monarch overwintering colony near Angangueo, Michoacan. We studied several aspects of Monarch biology during the week of February 22-29, 1996. After 11 years of working with Monarch butterflies in the northern part of their range, it was incredible to finally see the overwintering colonies in Mexico; it was truly an experience that will change my perspectives on an organism I thought I understood fairly well.

The Sierra Chincua colony is only open to researchers; it is near El Rosario, a colony open to the public. About 14 separate Monarch colonies form in the transvolcanic mountains west of Mexico City each fall. Last November, when the Monarchs first returned to Mexico, there were three congregations on Sierra Chincua, in places named Camino del Japonés, Mojonera Alta, and Rincon Villalobos. All of these were near the top of the mountain. In January, just after the infamous snowstorm, the butterflies moved lower, to two spots called Barranca Honda and Llana del Toro. We worked in Barranca Honda, which contains the largest concentration. The butterflies were in an area approximately 100 meters in diameter, and covered the trunks and branches of all of the large trees. The trees were mostly oyamel fir, but there were also some pines and deciduous trees.

When we arrived at the colonies early each morning, before the sunlight warmed the butterflies, there was very little movement. But when the sun bathed the roosting butterflies, many of them poured off the trees, moving down the slope of the mountain toward an open

area where they could drink nectar from flowers and dew that had collected on the ground. Our Mexican companions, Eneida Monteninós, Eduardo Rendon, and Manuel Riveria, all students at the University of Mexico, told us that they often fly up to a kilometer from the central roosting area to find nectar and water. At the end of the day, these butterflies returned to their roosts. Some Monarchs stayed on the roosts throughout the day, while still others flew around in the center of the colony.

Substantial evidence supports the hypothesis that nectaring and roosting Monarchs are in very different condition. Alfonso Alonso, at the University of Florida, and Eduardo Rendon are studying these differences, and our measurements confirmed their finding that nectaring butterflies tend to be in much worse condition; their wings are tattered and they are much thinner. These butterflies are running out of the lipid reserves that they stored up as larvae and during their southward flight last fall, and may not survive the winter. Roosting butterflies, on the other hand, are in beautiful condition - fat and with pristine wings. The butterflies flying around in the colony seemed to be mostly males that were attempting to mate. Mating occurs during the last three to four weeks of the overwintering period, and our observations confirmed those made earlier by Tonya Van Hook at the University of Florida that mating males tend to be in worse condition than non-mating males. These males may be mating because they will not live much longer, and are trying to assure that they will have at least a few progeny in the next generation. Males that wait longer to mate, or even fly north with the females, will probably be more successful, since the last male to mate with a female fertilizes most of her eggs. I will compare mating behavior in the colony with that I have observed in summer populations of butterflies.

We were amazed to observe the incredible number of dead butterflies littering the forest floor. Many of these have been killed by black-backed orioles and black-headed grosbeaks. The orioles slit open the abdomen and extract the insides, avoiding the cuticle which contains the toxic cardenolides from milkweed. Grosbeaks don't need to be so careful; they can tolerate the cardenolides and simply chomp of the abdomen and head. Eneida Monteninós is studying the numbers of Monarchs killed by each kind of bird. Other dead butterflies are called DWACS (dead without apparent cause), and researchers are trying to learn more about other causes of mortality in the colonies. Manuel Riveria is studying the number of Monarchs that were likely to have been killed in the December snowstorm, and Sonia Altizer tested hundreds of dead Monarchs for the presence of a protozoan parasite that causes high mortality in captive Monarchs.

We have brought back some butterflies to our lab, where Liz Goehring is studying the environmental cues that trigger the development of eggs in females. The work will add to her previous studies of the cues that trigger the onset of migration and reproductive diapause in fall Monarchs.

This visit made us aware of the vast number of unanswered questions concerning this amazing biological phenomenon: how do the Monarchs return to these mountains every fall, what causes the differences in condition and survival probability, what physiological changes occur during the winter, how do microclimatic features of the mountains affect the butterflies, are there preferred roosting sites within the colonies, what determines where the different colonies form. . . These and other questions could keep Monarch biologists busy for several decades!

However, the continued existence of the colonies for the decades needed to understand them is not assured. While the Sierra Chincua colony held millions of butterflies, and is in a relatively intact part of the forest, the oyamel trees are also valuable to humans for their lumber. Many of the landowners (ejidatarios) do not feel that they receive enough benefit from the presence of Monarchs, researchers, and tourists on their land. Sites of other colonies are in even more jeopardy. It is very important that humans find some way to work together to preserve the livelihood and lives of the people and the butterflies.

DO THEY MIGRATE?

What is the relationship between day length, temperature and migration? Are the classroom conditions such that the reared

butterflies do not enter diapause and fail to migrate?

These questions were prompted by the following postings to dplex:



Spores of a protozoan, *Ophryocystis electroscirra*, on Monarch scales.
Photo: Danel Vickerman

In the first posting, a teacher asked if she could send her Monarchs to someone further south for release since it had become too cold to release them in her area.

First response:

"Curious - were they raised in natural light? If not, they won't migrate anyway"

and these two responses:

" Is daylight from a window considered natural light? In our school system about 50 teachers raised Monarch caterpillars, and we tagged about 8. The length of time the caterpillars were in a lighted room was the same as a school day.

Do you think these will migrate?"

"re: question about natural light - Do you mean that if we "hatch" Monarchs in the classroom at any time of the year they won't migrate?? Oh, dear! All of ours were

classroom raised."

Will they or won't they migrate if reared in the classroom? We don't know the answer to this question. We do know that Monarchs begin to migrate when day length decreases (3 min/day) in late August in the northern states and



Female BP*359 (tagged by J. Leiker, Hays, KS) found "in copula" at Sierra Chincua. Note that this tag was placed over the hindwing discal cell as per the tagging instructions. Photo: Karen Oberhauser

Canada. The temperatures are also decreasing at this time and the quality of the late season food plants declines as well. One, or perhaps an interaction of two or all, of these factors leads to the development of "reproductive diapause," a condition in which reproduction is suppressed. When in diapause, carbohydrates taken up in nectar, that would normally be used to further reproduction, are converted to lipids which are stored in an extensive fat body in the abdomen.

Diapause is difficult to "break" in most insects;

however, in Monarchs, migrant butterflies can easily be induced to become reproductive by

PDF Version - Optimized for Online Distribution increasing the photoperiod to 14 hrs and raising the

temperature to 75-80°F. The conversion from diapause to females that initiate egg laying (after mating) is as little as 6 days. We maintain our continuous culture under these conditions. On the other hand, it seems to be difficult to induce diapause and there are no published accounts of the exact conditions required to produce migratory/diapausing butterflies. Karen Oberhauser, who is working on diapause induction with one of her students, Liz Goering, assures me that it's quite complicated but that decreasing day length is probably a factor.

What are the conditions in most classrooms? Are lights on longer than the natural day length? And, what about temperatures, especially at night? Aren't most classrooms cold at night and on the weekends? Can diapause be induced in the classroom or will the Monarchs reared indoors be reproductive and non-migratory? Let's find out. But how? There are at least two ways: through returns of tagged Monarchs reared indoors under known light and temperature conditions and through experimentation.

Returns of tagged Monarchs reared indoors will help resolve this question. Last year (1994) three of the recovered butterflies had been reared, two of these were reared outdoors (one in Montreal and the other in MN). Both traveled considerable distances, 150 and 1970 miles respectively. The third was reared by a teacher (presumably in her classroom) in Virginia. This butterfly was found at El Rosario in Mexico and had traveled at least 2200 miles.

Experiments could also be designed to test hypotheses concerning the factors responsible for the initiation of diapause and/or migration. But how would we design such experiments, how would we determine whether reared Monarchs are in diapause and what would we use as controls? (see Challenge to Students page 18).

In the above description, I linked diapause and migration together and they seem to be linked for the main body of fall migrants. But are they? Maybe not. Diapause and migration are not linked when the butterflies are moving in the spring - they are migrating, mating and egg laying on their way north.

Also, in mid-August in Kansas, there is a conspicuous southward movement of reproductive Monarchs, a full month before the arrival of the northern migrants. Obviously, that there are still lots of things we need to learn about Monarchs.

DOES THE SIZE, PIGMENTATION AND SEX-RATIO OF THE MONARCHS CHANGE DURING THE MIGRATION?

There may be slight changes in wing pigmentation (as well as size and sex-ratio) as the season progresses. My

impression is that the later migrants are somewhat smaller and darker; however, I am not aware of any data that support this observation. Generally, the deposition of melanic (black) pigments increases in insects exposed to colder conditions.

This is common in pierid butterflies but I'm not sure this is the case for Monarchs. This question could be modified and developed into several testable hypotheses that could be explored by students. For example, students could ask the question: Does the size (wing area and mass), coloration and sex-ratio of the Monarchs change throughout the migration?

The null hypothesis to be tested is that there is no change. The hypothesis could be tested by systematically collecting live Monarchs throughout the migration. The live Monarchs could be placed in glassine envelopes in the field and stored in a cooler for transport to the classroom. The live (chilled) Monarchs could be measured, massed, sexed, graded for condition and color (degree of melanism) and then released (or tagged and released).

The wing area and color can be measured in several ways, an excellent approach is to use a scanner, a computer and a program known as NIH image. However, this question can be answered without this hardware and software. Another approach to this question is experimental. Monarchs, preferably groups of siblings, could be reared at different temperatures to determine if melanism increases with decreasing temperature. The same photoperiod would be used in all tests. In a separate set of tests, temperature could be held constant and the photoperiod could be varied. In several species of pierid butterflies (sulphurs), short day photoperiods are correlated with increased melanism.

Frequently Asked Questions

Q: Why do Monarchs have only 4 legs?

A: Monarchs have 6 legs like all other insects, but their first pair of legs is very reduced and folded up tightly beneath the thorax, making them difficult to see. Sensors extending from the tip (tarsus) of these forelegs appear to be used by females in choosing host plants. Gravid females rapidly extend their forelegs several times during short intervals (1-2 seconds) when first coming in contact with a milkweed plant. The rapid extension of the forelegs has been referred to as "drumming".

Q: If caterpillars can chew leaves why can't adult Monarchs do this?

A: In the pupal or chrysalis stage, the Monarch goes through many transformations. One of the most interesting changes is the alteration of the mouthparts. In the larva, the mouthparts are designed to taste, cut, chew and ingest the leaves they feed on. During development in the pupal stage these mouthparts are modified to form a long tubular proboscis which the adults use to obtain nectar and water. These changes from chewing to sucking mouthparts during metamorphosis are unique to the Lepidoptera and Siphonaptera (fleas). (Curiously, one small group of primitive moths (Micropterygidae) retains chewing mouthparts in the adults and in several other groups the mouthparts are reduced and non-functional.) Why and how these changes from leaf feeding to sucking mouthparts evolved is not clear but an obvious advantage is that the adults are able to use other resources and are not dependent on their larval hostplants. Adult butterflies obtain carbohydrates and small quantities of amino acids and minerals from nectar; a sparse diet compared to the protein, lipid, carbohydrate and vitamin rich leaf materials consumed by larvae. This shift in diet from leaf to nectar feeding allows butterflies to range over broad areas.

Q: Why do Monarch butterflies rest in groups on branches during the migration and while they are at the roost sites in Mexico?

A: The advantages of clustering behavior by migrating and overwintering Monarchs are not well understood. There are several possible explanations. Clustering could simply be an artifact of too many butterflies having a preference for the same type of resting spot. Or, perhaps, it's a follow-the-leader type of behavior in which some butterflies find a good spot and others join them. Temperature and predation may also influence clustering. This past fall ('95) we observed that clusters which formed late in the day appeared to be tighter on evenings with

cooler temperatures. Why? Once Monarchs are on the roosts, and have cooled to ambient temperature, no heat is generated by the cluster. So, what are the advantages of such tight clusters? Is heat gain from the sun or from "shivering" the next morning greater in clusters? And, are tightly clustered Monarchs therefore able to become active earlier in the day than those Monarchs which are isolated? What about predation? Is there a "startle effect" and an improved chance of escape if predators attack a large cluster rather than a small one? Clustering could have several advantages but so far there are no studies of this behavior. This is an example of the many unanswered questions we have about insect behavior.

Q: Besides milkweed, what do Monarchs eat?

A: The larvae only eat plants in the milkweed family (Asclepiadaceae). There are 106 species of milkweeds in North America. Many of these species have become uncommon and some rare and endangered (e.g. *Asclepias meadii*) due to destruction of habitats. For more information on milkweeds see the "Milkweed Handbook" section of the home page. The adult Monarchs obtain nectar from flowers. Nectars in butterfly flowers typically contain 15% or less dissolved sugars, trace amounts of vitamins and minerals and in some cases small quantities of amino acids. Monarchs in captivity can be feed dilute sugar or honey water, diluted fruit juices and slices of fresh watermelon. For more information on the care and feeding of Monarchs see the section on "How to raise Monarchs" .

Q: What did Monarch butterflies evolve from?

A: Fossil moths, identified from imprints of wings, in shale and limestone deposits, date back to about 208 million years ago (early Jurassic). Butterfly fossils have been found in deposits which have been dated as 48 million years old (middle Eocene). Because butterflies have many advanced characteristics, they are thought to have evolved from moths. The fossil beds in The Florissant

PROPAGATION OF MILKWEEDS

We have prepared a short handout for those interested in propagating milkweeds. This information is included in all orders for seeds and is also available through the web site. Topics covered in this handout include, storage of seeds, vernalization and stratification, transplantation, propagation from cuttings and advice on when and where to plant.

Fossil Beds National Monument in Colorado have produced 12 species of fossil butterflies. These fossils are thought to be 35 million years old and two species, *Chlorippe wilmattae* and *Vanessa amerindica* are so similar to modern butterflies in pattern and wing shape that they have been classified as belonging to modern genera. In fact, *Vanessa amerindica* is similar to the Old World Painted Lady (*Vanessa indica*) and to the Painted Lady (*Vanessa cardui*) which is common in North America, Europe and northern Africa. Monarchs and other milkweed butterflies are not represented in the fossil record, so we can't be certain when they evolved, but they are part of a large family called Nymphalidae and this group was one of the earliest to appear in the fossil record.

MONARCH ON THE WEB

Monarch tagging projects by students, and observations and reports submitted by students can be found on the following web sites.

Baker Wetlands Monarch Butterfly Activity
Lawrence High School, Lawrence, KS -Ken Highfill
<http://ukanaix.cc.ukans.edu/~seec/wetlands.html>

Project Monarch Butterfly
Fredstrom Elementary School, Lincoln ,NE - Rosemary Thornton
<http://ngp.ngpc.state.ne.us/monarch/monarch.html>

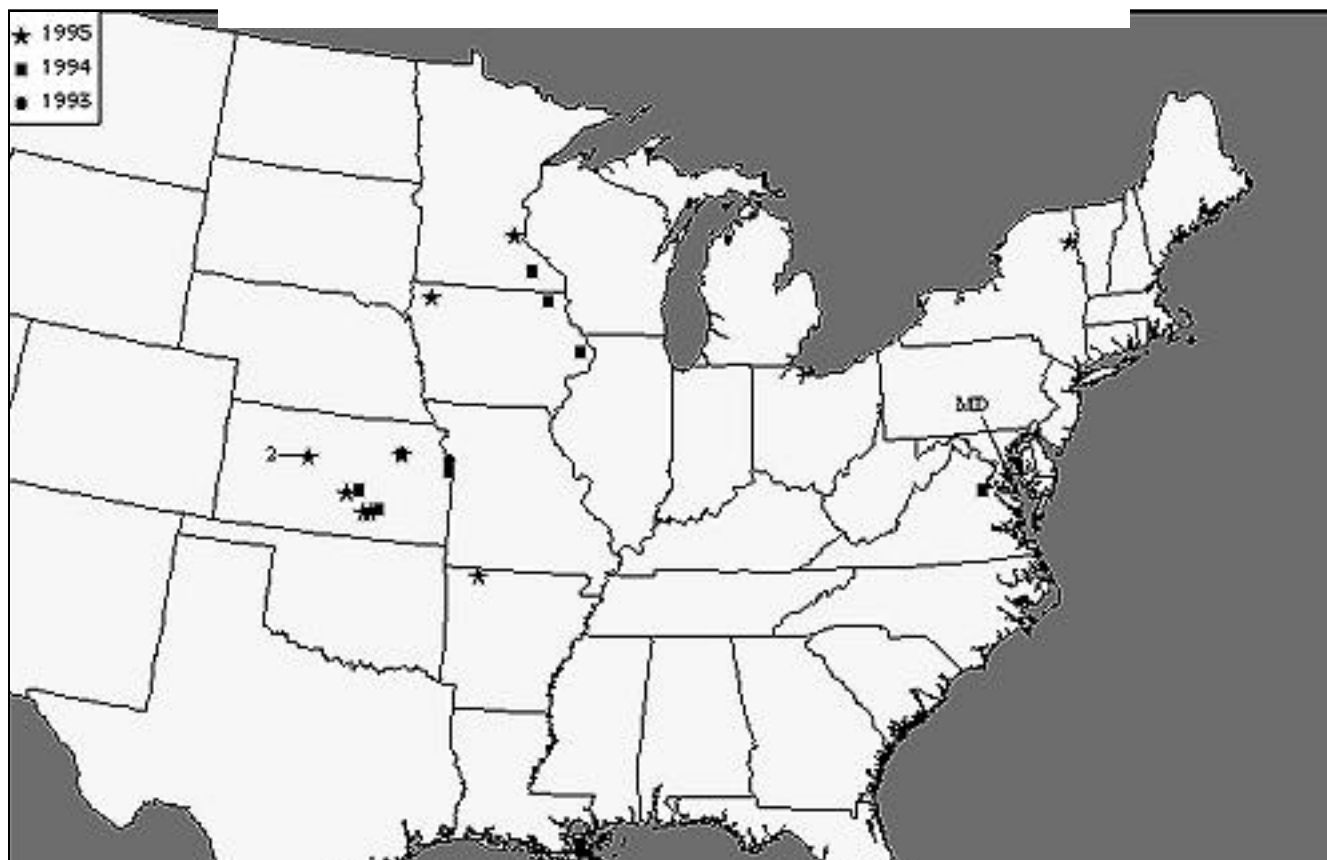
'Netting Butterflies
First Colony Middle School - Naomi Brown
<http://chico.rice.edu/armadillo/Ftbend/butterfly.html>

The Blake/Journey North Monarch Butterfly Project
Blake School, Minneapolis, MN -John Dicus
<http://www.blake.pvt.k12.mn.us/campus/projects/upper/monarchs/index.html>

Ms. Hillard's Class Tags and Releases Monarchs
Manzano Day school - Mrs Hillard
<http://www.rt66.com/~mds/Sec/Sec.html>

Journey North
Minneapolis, MN- Elizabeth Donnelly
<http://www.ties.k12.mn.us/~jnorth/critters.html>

TAGGING SITES OF MONARCHS RECOVERED IN MEXICO



Classroom Discussion

We received many queries about the numbers of Monarchs seen this past fall. Many reports emphasized the difficulty of finding larvae and several observers reported seeing very few adults in areas and at times when they are normally common. Most of the reports of extremely low numbers came from the northeast, in regions where there was a pronounced drought this past summer. Many have asked whether the low numbers due to the drought.

My answer, slightly modified, to one such query is given below. As you will see, my response turns the question into a potential classroom exercise which focuses on those factors which influence Monarch populations.

"One of the long-term goals of the Monarch Watch is to compile enough information on the year to year variation in Monarch numbers, together with data on the seasonal conditions, so that we will be able to develop a predictive model sufficient to yield reasonably good estimates of the numbers of Monarchs in the fall migration. Ecologists always look to those factors that have the strongest effects on birth and death rates. If you are working with students, it might be productive to ask them to list all the factors which might influence population size. When doing this

kind of exercise with students I start with a list of biotic factors (predators-ants to birds, parasitoids-wasps and flies, and pathogens-bacteria, viruses, and protozoa; and resources for adults and larvae). When discussing abiotic factors I try to get the students to recognize that factors such as temperature and rainfall have direct and indirect effects on the Monarchs - indirect because some of the abiotic effects have a stronger impact, positive or negative, on the Monarch's parasites and predators than they do on the Monarchs. It's also important to integrate some of this information by asking questions such as "what are the most favorable conditions for egg laying, mating and larval development?" This exercise gets complicated, but very interesting for students, because it forces them to consider the entire annual cycle and major positive and negative events over several years."

Let's see what the students consider to be the factors which are most likely to limit Monarch populations.

CONSERVATION DILEMMAS

One of the most frequently visited sections of the web page is titled "Conservation dilemmas" This is a curriculum designed to increase student awareness of the complexities of conservation issues. The curriculum includes instructions to teachers (short) and discussion exercises for the students. The discussions are based on "dilemmas" associated with conservation of the Monarch. These exercises are presented as a series of "dilemma cards". In each dilemma the students are presented with a realistic scenario and each scenario has several, often conflicting, outcomes. The students are asked to place themselves in the scenarios and discuss how the situations might be most favorably resolved. The curriculum is designed for grades 4-8 but could easily be adapted for older student groups. These materials were developed by teachers who worked with Karen Oberhauser last summer.

WHO'S LOOKING AT US

We've been surprised to find out who's looking at the Monarch Watch web site. A program on our server allows us to see the address of our visitors and the files on our site they've examined. The addresses indicate the country of origin and in the US, the type of internet connection, i.e. commercial, governmental, educational, or organizational. We started up the web site in late November 1994 and the number of visitors was modest (15 per day) through March of 1995 and most of the addresses indicated that our visitors were from universities. After March, we began to notice an increase in visits through commercial internet providers and in August the number of visitors from foreign countries began to increase. At present, its not uncommon to have 50-150 visitors and 1500 connections to files each day. There are usually several visits from foreign countries each day and more than 60% of the access is provided by commercial providers. Just for fun we've kept a log of the foreign addresses, 39 countries so far, including - Latvia, Lesotho, Malasysia, Slovenia, Slovakia and Zaire! Do you know where these countries are? There really is a World Wide Web out there!

Challenge to Students

The questions posed for young scientists in last years' season summary are still unanswered - at least nobody has sent us a report telling us of their findings. We'd like to start a research journal for students on the web page. There are some pretty neat questions to investigate and they are not as hard as they look. Give them a try and send us your report.

The challenges this year are in the form of proposals. In other words, propose how you would test a particular hypothesis.

NECTAR AND FLOWER COLOR

Scientists usually ask questions that are derived from observations and known facts. For example, Monarchs feed on nectar and we know that nectars vary among flower species in the amount of sugar and amino acids they contain. However, flowers also differ in color. In the field you observe that Monarchs visit blue/purple flowers more frequently than white flowers. Why? Could it be the differences in nectar or color, or even something else, that determines the differences in visitation rate? How would you find out? Hint: Think of a series of simple experiments that involve only artificial nectar and color. Your first objective is to determine whether Monarch choose to visit flowers based on color. Once the role of color is established, you can design tests to determine if Monarchs can discriminate between nectars of different qualities.

BIOHOUSE



DO THEY MIGRATE?

Here's a tough one. Do Monarchs reared in the classroom in September join the migration if released outdoors? Read the they migrate section on pages 13-14 and propose experiment determine the conditions that induce diapause and/or migration (they may not be completely linked). Hint: Light duration and temperatures are variables you can manipulate in the classroom but to really know what is going on you need "natural" control.

MILKWEED APHIDS

There are several species of aphids that feed on milkweeds and a lot of things feed on the aphids, except those yellow/orange aphids. Nobody seems to feed on them. Is this true? And, if so why aren't they attacked by predators? To answer this challenge you will need to make some first hand observations, learn some milkweed chemistry, and propose a number of hypotheses and experiments with typical aphid predators such as ladybugs and lacewings. Of course, you could easily get sidetracked doing some nifty experiments on aphid population growth. They're amazing! Have you ever seen an aphid give birth to baby aphids? It's cool.

A "BIOHOUSE" IS BUILT

Last year we added a new facility to our program - a 20'x30'x12' outdoor flight cage. This structure is similar to the temporary greenhouses seen in the parking lots of supermarkets and discount stores each spring. The metal frame is prefabricated and the framework is covered with a 60% black plastic shading cloth. Jim Lovett was largely responsible for assembling the structure and the end result has been very satisfactory. We now refer to this structure as the Biohouse since every organism we've introduced into it has adapted quite well to its confines. In the future the "Biohouse" will be used for experimental studies with Monarchs, bumblebees, damselflies, other insects and for outreach education as well.

"For every fact there is an infinite number of hypotheses." Phaedrus in "Zen and the art of motorcycle maintenance" (1974) Robert M. Pirsig

New Research Project - Volunteers Needed!

TRACKING MONARCH MIGRATION WITH HYDROGEN ISOTOPES

Local and long distance movements of organisms have been tracked by biologists with a wide variety of marking systems. All of these methods require an initial capture and usually some form of recapture. The amount of data recovered per unit effort is often very limited. It would be ideal to be able to obtain information on the origin and movement of every individual. This may now be possible. Recently, a new and promising means of tracking migratory species using stable hydrogen isotopes as a chemical signature has been developed by researchers at Environment Canada. However, to apply this technique to Monarchs, we need volunteers to raise Monarchs in 35 eastern states and provinces.

Deuterium, a stable isotope of hydrogen occurs naturally in rainwater across North America. The deuterium content of rain varies predictably from region to region, depending on climate and the prevailing source of moisture that makes up the rainfall. A strong deuterium concentration gradient in rainwater occurs across the North American continent as a result of climatic and hydrologic patterns. Previous studies have shown that the deuterium content of rain is reflected in tissues of shallow rooted plants. In turn, insects that feed on these plants incorporate that deuterium signal in their body parts. This is pretty nifty, and means that plants and insects raised in Minnesota will have different deuterium contents in their body tissues from those raised in Kansas, Georgia, or Quebec. These differences in deuterium contents should be very useful in helping to establish the geographic origins of Monarchs, as has already been demonstrated by Environment Canada researchers for migratory songbirds.

To use deuterium for tracing Monarch origins we need information from both controlled experiments and field studies. We are currently completing controlled experiments to define the hydrogen isotope dynamics between water, milkweed and Monarch body parts. But, we need your help in obtaining the field data or "ground truth".

Full use of hydrogen isotopes to answer biological questions requires that we determine deuterium contents of Monarchs raised under natural conditions across the eastern U.S. and Canada. This information will be used to calibrate "home signals" for Monarchs. This field study requires that Monarchs be reared on naturally occurring milkweeds over a wide latitudinal gradient, from the Canadian Maritimes to Texas. It is essential that these Monarchs are reared under natural conditions which are isolated from external

influences that can affect the natural water cycle (e.g., inside cities, watered gardens, irrigation districts, etc.). The best locations would be in rural or relatively undisturbed countryside. To successfully complete this experiment we need volunteers to rear Monarchs and to send us the emerged butterflies together with a sample of the milkweed (3 or 4 leaves) on which they were raised.

This project integrates information from a number of subject areas and should be very interesting for students. It is also one in which students, teachers and parents can work together to contribute to a unique scientific study. Adult volunteers are welcome to apply as well. We prefer to work with volunteers who have experience rearing Monarchs, but we will be pleased to work with others as well.

Once the "home signals" for Monarchs throughout eastern North America are established, the deuterium content of Monarchs will be used to answer questions about the geographic origins of the Monarchs that reach the discrete roosting sites in Mexico and perhaps, whether Monarchs attempt to return to their region of origin. Results of the project will be provided in the Monarch Watch Season Summary and on the World Wide Web at the Monarch Watch Web Site - <http://Monarch.bio.ukans.edu>

PROJECT SCIENTISTS

This project is being funded by Environment Canada and Monarch Watch. The scientists collaborating on this study are Drs. Leonard Wassenaar and Keith Hobson (Environment Canada) and Dr. Orley Taylor (Monarch Watch). The Mexican component of the project is sponsored in part by the Monarch Butterfly Model Forest Project (Michoacan, Mexico).

MONARCH REARING KITS

To support this project, we will provide Monarch rearing kits to selected volunteers. The kit will contain 20-30 Monarch eggs, envelopes in which to return the adult butterflies, paper towels in which to dry the milkweed leaves, ziplock bags, labels, data sheets, an addressed return mailing box, and relatively simple rearing and handling instructions. The kits will be sent in July and August by Federal Express to arrive on a prearranged date. Volunteers must agree to rear the Monarchs on naturally occurring milkweeds that are watered only by rainfall and to return at least 3 male and 3 female Monarchs to the Monarch Watch together with a sample of the dried milkweed leaves (identified to species) on which the larvae were reared. The samples must be labeled with the name of the volunteer,

location and date.

Each kit will cost us at least \$15 dollars (U.S.) to prepare and send by Fed Ex. The only costs to volunteers will be their time and return postage, about \$2. We will provide phone, (toll free 1-888-TAGGING), fax (913-864-5321), and e-mail (Monarch@falcon.cc.ukans.edu) support for volunteers who have questions about the project.

HOW TO PARTICIPATE

If you wish to raise Monarchs for this project, please fill out the application form below and return it to us as soon as possible. We will select three qualified applicants in each state and province on the 1st of July. Successful applicants will be notified shortly thereafter and arrangements will be made to send the Monarch rearing kit to arrive on a specific date.



Becky Blevins of Lawrence, KS captures a Monarch for tagging in the "Biohouse". Photo: R. Steve Dick

SNOWSTORM: THE BOTTOM LINE

Estimate of Monarch Mortality Due to Winter Storm in Mexico

To: Journey North (<http://www.learner.org/k12>)
From: Dr. Lincoln Brower, University of Florida

I was in Mexico in the middle of March at the Sierra Chincua overwintering site. We now know that the early January, 1996 estimates of the severity of the storm damage were mistaken. Eneida Montesinos Patino and Eduardo Rendon Salinas, our Mexican student researchers, have hard numbers: Only 6 to 7% of the butterflies were killed by the late December, 1995 snowstorm.

The error was generated from assuming that all the butterflies that were knocked down by wind on top of the snow had been killed. However, most were not. When it cleared, they gradually opened their wings and absorbed the warmth from the sun until they could fly back up into the clusters.

Nevertheless, the thousands of butterflies knocked out of the trees by this storm *was* a bad omen: Thinning and deforestation is increasing the exposure of the overwintering butterflies. This makes them more vulnerable to the frost, snow and rain that accompanies these heavy winter storms.

Note: These estimates are very similar to those made by several Mexican authorities who visited the roost areas shortly after the snowstorm.

Correction: The following was incorrectly reported in the 1994 Season Summary as being tagged by Greg Munson in Rochester, MN on 8 Sep:

082 KZ Tagged by: Janet Lindstrom, Rockwell IA, 13 Sep 1994
Found dead at El Rosario Roost in March 1995

Interval: 6 m; Est. Distance: 1790 m
Monarch Sex: F

1996 Monarch Watch Programs

Tagging memberships in 1996

The annual membership fee is \$10, which helps to defray some of the cost of the materials and postage. Monarch Watch members receive: (1) a tagging kit containing 20 tags, 5 practice tags, adhesive, instructions, and short pre-migration newsletter - sent in August and (2) the season summary - sent the following April. If you expect to tag more than 20 Monarchs, additional 100-tag sheets are available for \$5 each.

Please note: we do not ship tags west of the Rocky Mountains, but we will gladly direct you to similar programs in the West.

**All tag orders for the 1996 season must be received by October 10, 1996.

If you wish to become a member of the Monarch Watch, please completely fill out the order form with your name, address, and order information. Include a check or money order payable to Monarch Fund for the appropriate amount and send it to: Monarch Watch•c/o O. R.

Taylor•Department of Entomology•Haworth Hall•University of Kansas•Lawrence KS 66045. Please mail your responses as soon as possible in order to avoid delays in the shipping of the kits in August. If you have any other questions or requests, please contact us via Email or telephone (see "how to reach the Monarch Watch"). We welcome tax-deductible contributions and offer a choice of educational premiums in return. We also have several items for sale.

Monarch Rearing Kits (Educational Premiums)

The Monarch Watch is funded through contributions made by participants and by individuals and organizations interested in promoting science education in primary and secondary schools. For a \$25 contribution (\$15 is tax-deductible), we will send a Monarch Rearing Kit to the student or school of your choice. We offer two options:

Rearing Kit #1 contains six mature larvae which will pupate 2-3 days after arrival - these will require no additional feeding.

Rearing Kit #2 contains twelve 3-5 day old larvae which should be transferred to milkweed plants and reared in the classroom; these will pupate in about two weeks. Do not order Kit 2 unless you have plants available!

In both cases, the adult butterflies will emerge 10-14 days after pupation (formation of the chrysalis). The butterflies could then be released to join the spring or fall migrating populations or could be used to start a breeding population in the classroom. Instructions are provided in the kits.

Please note: we do not ship Monarchs to areas west of the Rocky Mountains. However, if you wish to raise western Monarchs, please contact us and we will direct you to suppliers in your area.

Other Items

For \$15 we will send a Monarch Watch "migration" t-shirt, printed both back and front in black and brilliant Monarch orange. For \$11 we will send seeds from 3 milkweed species (common milkweed, swamp milkweed and tropical milkweed) - these seeds take approximately 8-12 weeks to grow into mature plants. Additionally, for \$3 we will send an official "Gulliver" (our logopillar!) pin and for \$2 we will send a copy of the previous season's summary newsletter. All prices quoted include postage and handling.



Becky Blevins (Lawrence, KS) releases a tagged Monarch. Photo: R. Steve Dick

Regional Coordinators

During our first season (1992) we sent out two news releases asking for volunteers to tag Monarchs. The response to these notices, which appeared in several leading newspapers in the midwest and Texas, was overwhelming and we were soon putting in 16 hour days answering inquiries and sending out tagging kits. We needed help and decided to decentralize the work load with the assistance of regional coordinators. Bill Calvert, of Austin, Texas, became our first regional coordinator. Bill now works regularly with 700 MW volunteers throughout Texas and their combined efforts have produced an extraordinary description of the paths taken by Monarchs as they migrate through Texas in the fall. (see map). Bill's participation in the MW, and publication of the Texas Monarch Watch Newsletter, has been supported by Texas Parks and Wildlife and several grants. Last year we were lucky enough to have the assistance of a number of additional regional coordinators and each has agreed to help us again this year.

The following is a list of coordinators with information on how they can be contacted. If you live within a region covered by a coordinator, you should send your membership check to them and they will send you the basic membership and tagging kit in August. Please do this as soon as possible (before 10 July) so the regional coordinators know how many membership kits to order from us. However, if you wish to order other items from the MW in addition to your membership, you should send your request directly to us. This will save you some postage and be less confusing.

ARKANSAS

Jim Edson
Univ. of Arkansas
at Monticello
PO Box 3480
Division of Math and Science
Monticello, AK 71655
(501) 460-1966

KENTUCKY

Sondra Cabell
Audubon St. Park
PO Box 576
Henderson, KY 42420
(502) 826 4424

Laura Lang
Kent Dept. Fish & Wildlife
#1 Game Farm Rd.
Frankfort, KY 40601
(502) 564 4336

MAINE

Jim Moulton
MSAD #75
1 Main St
Topsham ME 04086

NEW YORK

Ken Brown
431 Maine
Lake Placid, NY 12946
(518) 523 1974

Jessica George
Cornell Corp. Ext.
73 N Main St
Gloversville, NY 12078
(518) 725 6441
(518) 725 3233 fax

Tracy Kay
Rye Nat. Cntr.
Boston Post Rd.
Rye, NY 10580
(914)969-5150

MINNESOTA

Dan Neubauer
Richardson Nat. Ctr.
8737 Bush Lake Rd.
Bloomington, MN 55438
(612) 941 7993

NORTH CAROLINA

Mike Dunn
NC State Mus. Nat. Sci.
PO Box 29555
Raleigh, NC 27626
(919) 733 7450

OKLAHOMA

Bob Melton
Putnam City Schools Adm
Coordinators Office
5401 NW 40th St
Oklahoma City OK 73122-3398
bmelton@ionet.net

PENNSYLVANIA

Jerry Zeidler
RR 1 Box 303A
Jersey Shore PA 17740
(717) 398 4744 office
(717) 398 3216 fax

OUEBEC

Nomad Scientists
Harold Spanier
Brian Visser
nosci@web.apc.org
1-800-265-6055 (english & french)

1769 St Laurent Blvd., Suite 189
Ottawa Ontario K1G 5X7
Fax: 613-526-4978

3285 Cavendish Blvd., Suite 605
Montreal Quebec H4B 2L9
Fax: 514-481-1319

TEXAS

William H. Calvert
Texas Parks & Wildlife Department
c/o Nongame & Urban Wildlife
Program
4200 Smith School Road
Austin, Texas 78744
Texas Monarch Hotline
(512) 326-2231
(800) 468-9719

Monarch Watch Contribution and Order Form

NAME _____

SCHOOL/ORG. _____

STREET ADDRESS* _____

CITY _____ STATE _____ ZIP _____

PHONE (_____) _____ - _____ FAX (_____) _____ - _____

E-MAIL _____

I am an educator. I teach grade(s) _____. I receive summer mail at:

the school address listed above -or- r the following address:

*** A street address (not a PO Box) is necessary for the shipment of live materials.**

I would like to become a Monarch Watch tagging member for \$10

I expect to tag more than 20 Monarchs; please send _____ additional 100-tag sheets @ \$5 each

I would like a total of _____ Monarch Watch migration T-shirt for \$15 each

Quantity and size: _____ XXL; _____ XL; _____ L; _____ M.

I would like four packets of milkweed seeds (4 varieties) for \$11

I would like a total of _____ Gulliver pins for \$3 each

I would like to receive a copy of last year's season summary for \$2

I would like to make a \$25 contribution (\$15 tax-deductible) As a premium, please send:

Choose 1: Kit # 1 (6 mature larvae) - or -

Kit # 2 (12 3-5 day old larvae) - must have milkweed available for Kit# 2!

To be sent: the week of _____ - or - ASAP

I would like to include an additional tax-deductible contribution of _____ to help fund public education and curriculum development.

Total amount included: _____.

Please make all checks payable to **Monarch Fund** and send to:

Monarch Watch•c/o O. R. Taylor•Department of Entomology•Haworth Hall•

University of Kansas•Lawrence KS 66045

Application for Participation in Hydrogen Isotope Study

Please fill out personal information on reverse before completing this side.

Note: A street address (not a PO Box) is necessary for the shipment of Monarch Kits.

Applicants must have access to naturally occurring milkweed in rural areas.

Please explain any experience you have had raising butterflies:

Please indicate the milkweed species you will use as a food source for the Monarch larvae:

All applications must be received by 20 June 1996. Applicants will be selected (3 per state/province) on 1 July 1996. Rearing kits will be sent in July or August.

Please indicate the week in which you would prefer to receive the rearing kit:

July: 1____ 8____ 15____ 22____

August: 1____ 7____ 14____ 21____ 28____

Send completed application to:
Monarch Watch
c/o O.R. Taylor, Dept. of Entomology
University of Kansas, Haworth Hall
Lawrence KS 66045-2106
Fax: 913.864.5321

- or -

Send e-mail with complete information to:
Monarch@falcon.cc.ukans.edu

Butterfly Plants - Chip's Top 13

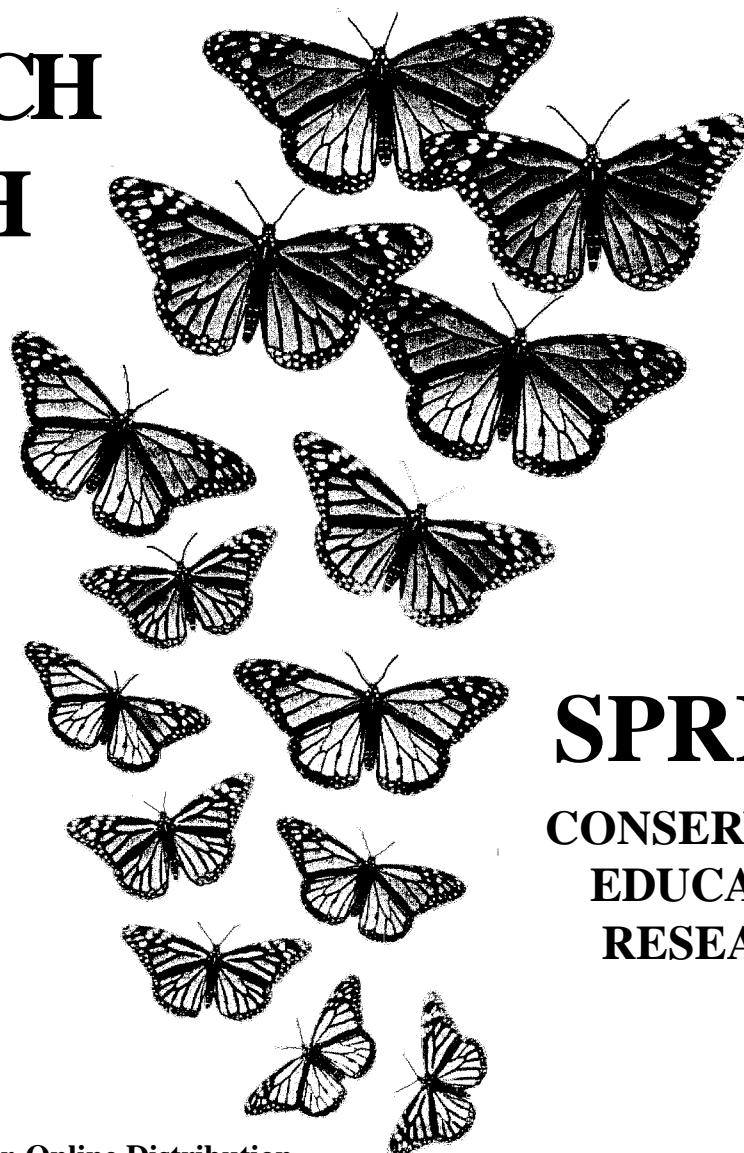
Here is a list of my favorite butterfly plants. These plants are selected on the basis of the duration of their bloom, their relative attractiveness to a broad range of butterflies and their appearance. Unfortunately, many of the species which bloom continuously through the summer, such as *Lantana*, *Stachytarphyta*, *A. curassavica*, *Pentas*, and *Verbena* are not freeze tolerant and must be replanted each spring, except in a few areas of the south. This also applies to annuals such as *Tithonia* and *Zinnia*. If you are new to butterfly gardening, you should be aware that many showy plants which are highly attractive to us, such as geraniums, pansies and petunias are not attractive to butterflies.

Species	Common Name	Life form	Comments	Hardiness
<i>Asclepias curassavica</i>	tropical milkweed	herbaceous, 3'	*best plant for rearing Monarchstolerant	not freeze
<i>A. incarnata</i>	swamp or pink milkweed	herbaceous perennial, 4'	showy, tall, needs water	winters well
<i>A. tuberosa</i>	butterfly weed	herbaceous perennial, 2'	showy, not a good Monarch host	winters OK
<i>Buddleia</i>	butterfly bushes (several species)	shrub, 3'-6'	*long, showy blooms	variable
<i>Caryopteris</i>	blue mist spirea	shrub, 2'-3'	fall bloom, attracts skippers	good
<i>Lantana camara</i>	lantana	shrub, 1'-4'	*many varieties, best overall butterfly flower	not freeze tolerant
<i>Liatrix sp.</i>	blazing stars	herbaceous, perennial, 1'-3'	blooms late summer	winters well
<i>Monarda didyma</i>	beebalm	herbaceous perennial, 2'-3'	summer bloom	winters well
<i>Penthas lanceolata</i>	pentas	herbaceous, 1'-2'	several color forms	not freeze tolerant
<i>Stachytarphyta jamaicensis</i>	blue porterweed	herbaceous, 2'-3'	*few flowers, butnot very attractive	freeze tolerant
<i>Tithonia rotundiflora</i>	mexican sunflower	herbaceous annual, 6'	fall bloom, very attractive	annual
<i>Verbena sp.</i>	verbena	herbaceous perennials and annuals, 1'-3'	some types have continuous bloom	some types not freeze tolerant
<i>Zinnia elegans</i>	zinnia	herbaceous annual, 1'-3'	many varieties, mid to late summer bloom	annual

c/o Orley K. Taylor
Department of Entomology
Haworth Hall
University of Kansas
Lawrence KS 66045

ADDRESS CORRECTION REQUESTED

MONARCH WATCH



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