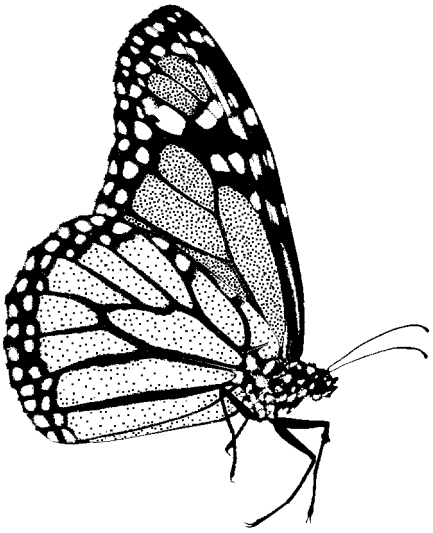
Monarch Tagging and Observation Summary 1993



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Monarch Tagging and Observation Summary 1993

Hello again Monarch Taggers!

First, we want to thank you for all your help in the second annual monarch tagging project. Once again, you have come through for us in our effort to study the monarchs' migration. This year we received a good response and sent out over 35 thousand tags to cooperators like yourself (see map in Figure 2). We estimate that approximately 4-5 thousand of these tags were applied to monarchs and most of you utilized the new tagging system we suggested. Tagging numbers were lower this year due to a decline in monarch sightings and a slight change in their arrival time. In most locations monarchs arrived a bit early this year and some of you did not receive tags at an opportune time. But, we still had some significant and very interesting recoveries. Over many years, Fred Urquhart (University of Toronto) and his associates had average recapture rates of 1 per 1000 tagged monarchs within the United States and Canada. Nearly 5000 butterflies had to be tagged to obtain a single recovery at the roost sites in Mexico. This year 13 of your tagged monarchs were recovered, there were 5 significant recoveries found within the U.S. and two were at overwintering roosts in Mexico. Thanks to your efforts it appears that the recovery rates this year were higher than those obtained in the past. Surprisingly, these rates although low, are still higher than those of most bird-banding studies. A lot of energy has to be expended for every bit of information but, as you will see, the network of taggers and observers is producing some interesting information.

The record recoveries for the year were butterflies tagged by Kansas students. A monarch tagged by Susan Schoen of Wamego Central High School in Wamego, Kansas under the direction of Terry Callender, was recovered at the Rosario colony near Angangueo, Michoacan by Roberto Contrerras. This butterfly flew 1400 miles before succumbing to bird predators! Similarly, a tag applied by middle school students from Piper High School near Kansas City, Kansas, under the supervision of Becky Knetter, was found at the Chincua roost which is also near Angangueo. Considering that approximately 20 million monarchs overwinter in each roost, it is amazing that any tags are recovered, particularly at Chincua which is visited by relatively few people. An implication of these recoveries, and those of other tagging programs, is that a substantial proportion of tagged monarchs arrive at the roost sites. See Table I for a summary of recoveries.

Another exciting bit of news comes to us from Texas. Due to the efforts of taggers and observers around the state, our Texas collaborators were able to identify two major monarch flightways through Texas. One, by far the largest, was about 250 miles wide and was centered along a line from Eagle Pass through Abiline and on into Oklahoma (see map Figure 2). Reports of the migration through this area from late September to mid-October were unequivocally massive. Bill Calvert, monarch researcher and coordinator of the tagging project in Texas, described the migration of monarchs in places around Uvalde, Brackettville and Del Rio, as "awesome". And only a little less spectacular was the migration along the Texas coast from High Island to Corpus Christi which, as Dr. Calvert reports, was especially intense during the period of 22-27 of October.

Perhaps the most remarkable discovery made in Texas is that the flyways are very distinct. There was no specific information about these flyways prior to 1993. We will need

to observe the monarch migration for many more years to determine if there are similar pathways in other locations. It will also be valuable to establish whether the Texas pathways meander from year to year.

In most of the country, taggers and observers reported fewer monarch aggregations and sightings, and many participants were unable to tag monarchs in places in which they had tagged hundreds of butterflies in the previous year. A series of weather fronts, separated by 3-5 days in September may have contributed to rapid movement of monarchs through the midwest last fall. These weather conditions may have reduced the tendencies of monarchs to accumulate in large numbers at roost sites. Such environmental factors may also have significant effects on the pathways of migrating monarchs. To detect such effects, we need the observations and reports of many observers. Even if you are unable to tag monarchs, we still appreciate receiving information on sightings and other relevant observations.

This year Bill Calvert also established that there is a strong inverse relationship between the weights of the butterflies and the distance they are from their destination in Mexico. Unlike birds, that feed extensively and build up a large fat reserve before they take off on their migration, monarchs seem to gradually accumulate weight as they approach their overwintering areas in Mexico.

Yearly Summary of Monarch Populations (1991-1994)

Summer 1991

Butterfly counts on the 4th of July indicated good numbers of monarchs in many northern areas. In some cases, the numbers recorded were unusually high relative to those from previous counts. In general, the population numbers were normal or higher than normal, and a good fall migration was expected.

Fall 1991

The fall migration was excellent, and large numbers of monarchs were counted passing given points by observers along the East Coast and in the Midwest. In mid November ORT saw tens of thousands of monarchs flying in a southeasterly direction parallel to the mountains near Linares, Nuevo Leon in northern Mexico. Apparently normal numbers of monarchs reached the roosting areas in the Transvolcanic mountains west of Mexico City. In January, which is usually the middle of the winter dry season, a weather pattern attributed to "El Nino" created a two week period of cold, wet conditions in the roosting areas, followed by freezes and even snowfall. Lincoln Brower and Bill Calvert estimated mortality to be 70% at several roosts. According to Bill Calvert, mortality at the roost sites is normally 15-20%, so a 70% loss was very alarming. This loss, coupled with usual threats to the integrity of the roosting sites, such as deforestation, once again drew considerable media attention to the problems of monarch conservation.

Spring 1992

Very few monarchs were reported along the Texas and Louisiana coasts in March and April, and the number of monarchs reaching the eastern third of the United States was extremely low. Conditions in the Midwest were much better. Dick Walton reported seeing good numbers of monarchs in the vicinity of Uvalde, Texas in mid-April and in May there were reports from Minnesota, Wisconsin, and Michigan of the appearance of monarchs

earlier and in larger numbers than usual. In retrospect, it appears that substantial numbers of monarchs moved northward through Texas west of San Antonio; from there they fanned out to colonize the upper Midwest.

Summer and Fall 1992

The summer of 1992 was one of record low temperatures through most of the northern states. Cloudy and rainy weather was such a memorable feature of the summer that many "ol' swimmin holes" were hardly visited, berry crops failed, and bears went hungry, and so on. Nevertheless, the monarchs did well , and the fall migration In the Midwest, at least, was excellent. In the East, where systematic monarch counts were made by Dick Walton and his colleagues at Cape May, the number of monarchs was approximately 5% of what it had been the previous year. Clearly, from this report and many others, the number of monarchs in the northeastern United States was unusually low in 1992.

Several observers reported that extremely large numbers (perhaps millions) of monarchs reached the United States/Mexican border area near Del Rio, Texas in the last few days of September. This occurred at the same time that large numbers of monarchs reached Austin, and southeastern Texas. Reports from Austin indicated that monarchs were abundant from the end of September until the first week of November. Overall, the pattern of reports from Texas seemed to indicate that the fastest-moving front of the southward migration was in west Texas, and that monarchs funnel into northeastern and eastern coastal Texas from the North and East over much longer periods.

Winter 1992-1993

Observations made by Mexican authorities and other observers indicated that some monarchs reached the roosts by the first week of November.

In February, a team of scientists and Mexican authorities visited all the known monarch roosting areas. Members of this group estimated that 85-93 million monarchs overwintered at these roosts in '92-93. Whether these are high or low numbers is not clear, because in previous years not all the roosts were surveyed at the same time. Estimates of populations at the best known roosts, "El Rosario" and "Chincua", seemed to indicate that these overwintering populations were of "normal" size. Even though the monarch population was low in the eastern United States, this reduced population did not have a clear impact on the number of overwintering monarchs.

Spring 1993

In each of the last two years monarchs started to disperse from the roosts by the end of February. This breakup of the roosts was 2-4 weeks earlier than usual. Factors such as warm winters or drifting smoke from spring fires might cause monarchs to leave the roosts early. The effects, if any, of this early migration northward are not yet clear.

Normally, a few overwintering monarchs reach Lawrence, Kansas, by mid-April, but none were seen by ORT until May and only a few were spotted by other Kansas observers in early May. In much of the Midwest the spring was cold and wet and it seems probable that overwintering monarchs died out before reaching the lower Midwest (Kansas, Missouri, Nebraska, southern Iowa and Illinois).

Summer and Fall 1993

In Lawrence, Kansas monarchs arrived on the 9th and 10th of September. These dates are within normal arrival times for the migration but were a little earlier than last year. Monarchs reached their peak population from 20-22 September.

In many locations, known pathways and roost sites were not productive this year. However, normal or above-normal numbers of monarchs were reported by Dick Walton and his tagging group at Cape May, and by Don Davis and other observers at Point Pelee National Park. In fact, one report from Point Pelee indicated that the migration was the largest seen in many years.

Harriet Clark reported that the most abundant monarch flights in Milford, Ohio occurred the weekend of September 10-11, about two weeks earlier than in '92. She also noted that in her area there was a drought this year, which she speculates could have reduced nectaring flowers and thus changed the pattern and timing of the migration through the region. In Southern Maryland, John Fales reported that monarch populations, according to his counts, were much higher this year than in '92. In Rocky Face, Georgia, James Adams observed that wind had a definite impact on the direction of monarch flight and noted that weather fronts strongly influenced the timing of monarch migratory flights. As you can see, many factors including geography, weather, and food availability influence migratory patterns.

Winter 1993-1994

Alfonso Alonzo, a graduate student with Lincoln Brower at the University of Florida reports that 9 roosts were formed in the Transvolcanic mountain range west of Mexico City. In some years 11 roosts have been reported. The numbers of roosting monarchs at the 6 sites visited by Alfonso appeared to be average or slightly above average. However, these generalizations should be viewed with some caution until Alfonso summarizes the dimensions of the roosts and apparent density of the overwintering populations. If habitat degradation is concentrating the monarchs to fewer roosts than normal, the population could appear to be in good condition when, in fact, the numbers are actually lower.

Winter conditions at the roost sites were moderate and no unusual mortality was reported. According to Alfonso, the first monarchs began to move northward on March 6th but at Chincua, one of the main roosts, six trees still contained roosting monarchs on 10 April.

Spring 1994

Rains in northern Mexico and southern Texas in early March produced an abundance of flowers upon which northward bound monarchs could feed, and the spring migration has been progressing well. Monarchs are appearing at many locations "on schedule". Bill Calvert reported seeing his first monarch of the year on 12 March in Austin, Texas. In the following week, many observers along the Texas coast reported seeing good numbers of monarchs (30 per day). Mary Buford reported monarchs in Enid, Oklahoma at the end of March, and they were first reported from Buhler and Hutchinson, Kansas on 16 April by Linda Wilbanks. We sighted our first monarch in Lawrence, Kansas on 20 April. Normally, our first sightings in Lawrence occur between 7-21 April.

This year the northward migration is being monitored by "The World School" "Journey North" through Internet (see Internet address below). The same information can

be accessed through Prodigy. The pattern of the migration this year indicates a more rapid spread into the southeastern rather than the midwestern states. This is not surprising since the weather patterns were not favorable for movement of monarchs into states at the latitude of Kansas (37-40° N) until mid-April. In fact, at this writing (20 April), monarchs arriving in eastern Kansas are ahead of their host plants as no new growth has appeared so far (However, 6 days later the milkweed plants were 2-6 inches in height). In general, it looks like the 1994 populations are off to a good start.

Tagging in 1994

The tagging project ("Monarch Watch") will continue this fall and we hope to have more participants than ever! The "Monarch Watch" will be broadcast through National Public Radio and The Public Broadcasting Service in August. Numerous news releases will appear in outdoor and educational magazines asking for taggers and observers. A goal is to have enough observers so that we can create and disseminate on Internet, TV. and Radio, week by week progress of the monarch migration. School children will be able to communicate their observations through Internet and through one of the 56 PBS stations that will be cooperating with this project.

Enlarging the Monarch Watch will substantially increase the cost of the program. We estimate that we will need at least $25,000 to cover the costs of tags, instructions, mailings, maintaining the monarch culture, developing educational materials and answering communications. We are currently seeking funds from various foundations and are looking for corporate support as well. We are not experienced fund raisers and need all the help we can get. If you have any suggestions on how to raise these funds, please give us a call (913-864-4051).

As many of you are aware, for those who make contributions of $25 to the Monarch Fund, we are providing a premium in the form of a Monarch Kit that includes six 5th instar larvae along with artificial diet on which they will feed until they pupate. Instructions for maintaining the monarchs and starting a monarch culture are included in the kit. Thanks to all who have contributed so far. We hope you enjoyed the monarch kits and that they were successful for you. With recent developments and improvements in the artificial diet, we are now averaging larger sized larvae and survivorship is increasing. We hope to continue these improvements.

We are also developing curriculum materials based on the monarch for primary and secondary schools. We have seen enthusiastic responses to the monarch from both students and teachers in the last two years, and have received feedback from many teachers indicating that the monarch would be an effective and interesting subject for study in the classroom. The curriculum will be disseminated nationwide via electronic communications through Internet. Many schools can connect with Internet and these connections will allow students and teachers to communicate with one another throughout the country. If we can obtain the necessary funding, the curriculum will take the form of multimedia materials including CD ROMs, VHS videos and a Monarch Handbook. Our goal is to get students and teachers interested and actively participating in scientific inquiry and discovery.

We have enclosed a postcard regarding tagging in the fall. If you are interested in tagging, please return the postcard after having filled it out with the appropriate

information. The standard tagging kit for the fall will consist of 20 tags, complete instructions, and a vial of adhesive for tag application. If you are an expert tagger, are working with a large class and anticipate doing lots of tagging, or are in an area where there is an abundance of monarchs, you may wish to order more than 20 tags. If you are a beginning tagger or do not expect to tag more than 20 monarchs, we will send you the standard kit.

By returning this postcard and letting us know about your plans, you are helping us organize the tagging project and determine how many tags we will need to produce. We are working on a very limited budget, so it is important that we estimate the expected demand for tags and supplies. If you order the standard kit with 20 tags, you may call (913-864-4051) and request more tags if you run out. If we do not receive a postcard from you, we will assume that you are not participating in tagging this year.

Results of the Vector Analysis Exercise

Thanks to all of you who participated in the monarch flight direction exercise this year. We have summarized your findings in Table II as well as some of the findings of a graduate class taught by ORT at the University of Kansas. The class conducted research on monarch vanishing bearings in Lawrence, Kansas. They recorded vanishing bearings simultaneously at four sites in close proximity in Lawrence and found that mean vectors calculated from the vanishing bearings of migrating monarchs differed significantly between sites, days and hours confirming that monarchs exhibit a variety of flight strategies. The class suggested that although the monarchs' overall orientation may be determined by a compass mechanism, their specific local course is highly dependent on weather and features of the landscape. (taken from an abstract of a paper by Dana M. Price, a student in the course).

Acknowledgments:

We would like to thank all of you who participated in tagging this year, especially the children! We recognize that the number of butterflies tagged by you, our volunteers, is partly due to where you happen to live. Those within the main butterfly flyways had far better opportunity to tag large numbers than those in the periphery or outside the flyways. By listing those who tagged 20 or more butterflies, we do not wish to slight those of you who worked very hard but were not so favorably situated.

Some of you didn't tag butterflies, but carefully kept a daily calender of monarch presence and abundance. This was the crucial information that allowed us to define the migration pathways in Texas. To those of you who recorded your observations daily, even when butterflies were absent or present in low numbers, we are especially grateful.

Cooperators who tagged 25- 49 monarchs:
Bob Barber
Barb Barton
Dan Beck

Cooperators who tagged 50- 200:
James Adams
Calvin Cink
Sandy Collins

Tony Blackwell
Harriet Clark
Julia Clemens
Raydell Clett
Sherry Fisher
Becky Goodwin
Cherry Irwin
St. James Episcopal School 4th grade
Drew Janeksela
Erin and Whitney Kane
David Kehres
Allen Knutson
Sharon McBride
Deb Meyer
students of Kimberly Rose
Barry Schartz
Suzette Slocomb
Gayan Stanley
Carol Stock
Sylvia White
Caroline Womack
Don Davis
Lyndal Fisher
Karen Fulk and Family
Cheryl Haley
Shaun Heavey
Jane Hershberger
Becky Knetter
Jane McDonald
Mark Mello
Alta Montgomery
Dixie Quincy
Marvin D. Schwilling
H.M. Settle
Fern and Joanna Smathers
Susan Throckmorton
Patrick Wakeman
The Weigel Family
Kenny Whitehead
George Winkler

Cooperators who tagged over 200 monarchs:

John Fales (approx. 250 tagged)
John Wachholz and Salina Middle School (approx. 300 tagged)
Ken Highfill and Lawrence High school (approx. 489 tagged)
Brad Williamson and Olathe High school (approx. 800 tagged)
Terry Callender and Wamego High school (887 tagged)
Dick Walton

* All names were taken from returned data sheets; we apologize if anyone is left out and would appreciate hearing from you if this is the case.

Newspapers in which the project appeared in 1993

The Kansas City Star, Kansas City, Kansas
El Dorado Times, El Dorado, Kansas
Saint Paul Pioneer Press, St.Paul, Minnesota
The Lawrence Daily Journal World, Lawrence, Kansas
Wichita Eagle, Wichita, Kansas
Omaha Herald Omaha, Nebraska

*We would appreciate more information from you about newspaper articles, t.v. programs, and other types of publicity in your area which covered the monarch tagging project.

In October, CNN featured the Monarch Project on their Science and Technology Week. The program featured tagging by a Lawrence high school class taught by Ken

Highfill and a middle school class taught by Sandy Collins. Students from Olathe East High School, under the direction of Brad Williamson, were shown conducting vector studies. Included in the coverage were the basics of the monarch annual cycle, and how to rear them. Some of the footage was obtained in ORT's lab. All the life stages including the emergence of adult butterflies from their pupae or chrysalis were shown.

Watch those monarchs!

USEFUL SOURCES

In the past we received many requests for information about monarchs and other Lepidoptera and we listed some resources in last year's season summary. If you are interested in finding out more about monarchs or other Lepidoptera please let us know and we will be glad to send you a list of references and useful sources (equipment and references for scientific papers).

Organizations

The Lepidoptera Research Foundation
c/o Santa Barbara Museum of Natural History
2559 Puesta Del Sol Road
Santa Barbara, CA 93105
(805) 682-4711

Publishes The Journal of Research on Lepidoptera.

The Lepidoperists' Society
Dr. William D. Winter, Secretary
257 Common Street
Dedham, MA 02026-4020
(617) 326-6053

Annual dues: $25.00; open to anyone interested in Lepidoptera. Publishes News of the Lepidopterists' Society, Journal of the Lepidopterists' Society.

The Xerces Society
10 Southwest Ash Street
Portland, OR 97204
(503) 222-2788

Annual dues: regular membership, $25.00. Publishes Wings: Essays on Invertebrate Conservation *three times a year, the results of the North American Fourth of July Butterfly Count, and* Atlala, *a journal of invertebrate ecology, published occasionally.*

Young Entomologists' Society
International Headquarters
1915 Peggy Place
Lansing, MI 48910
(517) 887-0499

Annual dues: $10.00. Publishes Young Entomologists' Society Quarterly.

(The "Trading Post" column in Young Entomologists' Society Quarterly *includes live stock offered for sale and exchange.)*

Monarch Migration Association of North America
c/o R. Walton
35 Stacey Circle
Concord MA 01742
Members of this organization monitor fall monarch populations at selected sites (Cape May, NJ).

The Monarch Program
P.O. Box 178671
San Diego, CA 92177
Publishes a monthly newsletter from October through May. Subscription $15.00.

Electronic Sources (on Internet)

Donnelly, Elizabeth
Ordway, Cassy
Journey North Program
World School for Adventure Learning
Monarch Project
125 North 1st Street
Minneapolis, MN 55401
by e-mail: w_school@jriver.jriver.com
by fax: 612-339-7056

Contributions to support the 1993 Monarch Project have been made by:

Kansas City Power and Light
Texas Parks and Wildlife Department- Non Game and Urban Program
Toni L. and Orley R. Taylor
Carol and Brad Williamson
Alicia and William Calvert

Frequently Asked Questions (FAQ's):

Part of the monarch curriculum that will be incorporated on the Internet and in various other multimedia materials are FAQs, which are Frequently Asked Questions about monarchs. We plan to create a Monarch Archive on the Internet that will include FAQs and enable teachers and students to get answers to their monarch questions. We also plan to initiate a Monarch List through which participants can pose questions. Answers will be incorporated in the Monarch Archive. The following are some examples of some basic questions we are frequently asked along with their answers.

Q: What happens to the monarchs that migrate to Mexico in the fall? Do they make the trip back to the area from which they started the migration in the fall?

A: After clustering in the roosts in Mexico for 5 months in the winter, monarchs begin to make their way back north. Before leaving the roosts, they become sexually active and mate multiple times. As the female monarchs move northward, they lay eggs on milkweed plants along their flightway. Most of the northward migrants complete their reproduction in the southern states, but each spring relatively small numbers return to the Midwest, sometimes as far north as southern Iowa. However, very few if any, reach the area from which they originated. It is generally believed that monarchs maturing from the first eggs laid on milkweeds in the southern states in late March and early April continue the migration northward in May, eventually reaching the northern limits of the breeding grounds in central and eastern Canada. After 2-3 summer generations, monarchs will again migrate to their winter roosts in the fall without having any previous experience with locating the roosts or "knowing" where the roosts are. How do they do this?! This is one of the mysteries of the monarchs.

Q: Why do monarchs have only 4 legs?

A: Monarchs actually have 6 legs like all other insects, but their two front legs are very tiny and folded up so that you cannot see them.

Q: How long do monarchs live?

A: In captivity, monarchs can live up to 6 weeks. In the wild, they live varying lengths of time depending on the time of year. Summer monarchs probably live 2-6 weeks; overwintering monarchs may live up to seven months.

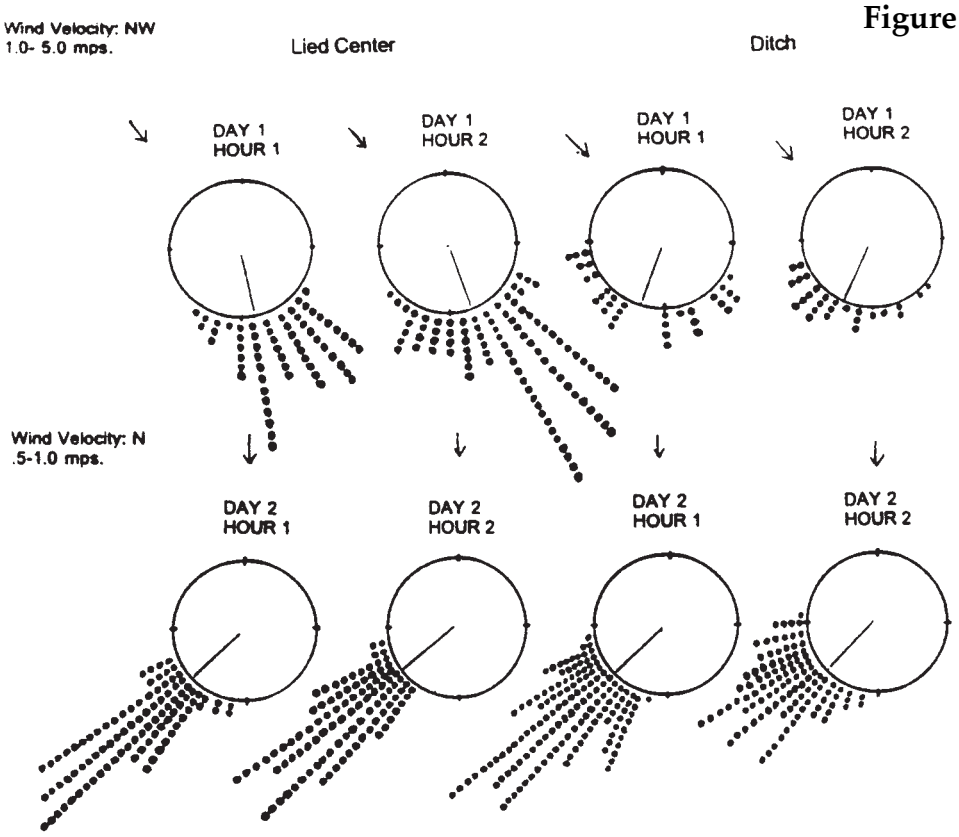
Q: What are those things sticking out of the head and tail of monarch caterpillars? Are they antennae?

A: The black tentacles protruding from behind the head and near the end of the abdomen of the larvae are not antennae, but may serve some tactile function such as alerting the larvae when they are close to an object. Also, it seems that the tentacles respond to sound; try clapping your hands or playing some music with heavy bass, and their tentacles will "jerk" in response to the sound. Does this mean that caterpillars "hear" with these tentacles? Probably not, but it might be fun to do some experiments to determine how and why those caterpillars "dance" to the music. The caterpillars do have antennae that are located on the head but they are very small and inconspicuous.

Table I: Summary of Tag Recoveries for 1993-1994

Tag. No.	Tagger	Location	Date tagged	Date recovered	Location	Observer	Interval	Distance
873 AG male	Ken Highfill c/o Lawrence High School, 921 W.28th Terrace, Lawrence KS 66046	Lawrence, KS	Sept. 17	Sept. 18	Zeandale, Riley County, KS	Heidi Holle c/o Wamego High School 801 Lincoln Wamego, KS 66547	1 day	65 mi. NW
442 AN	John Wachholz/ Chris Sexton Salina Central High School, 650 E. Crawford, Salina, KS 67401	Salina, KS at Salina Central High School	Sept. 27	Sept. 28	Salina KS	Cory Borthwick 2209 Wesley Salina, KS 67401	1 day	—
787 AU	Sharon McBride P.O. Box 1648 Albany, TX 76430	Albany, TX	early Oct.	Oct. 4	Albany, Texas	Christopher McCauley Rt. 1 Box 229 Albany, TX 76430	1 or more days	—
519 AN	John Wachholz /Stephen Weller c/o Salina Central High School, 650 E. Crawford, Salina, KS 67401	Salina, KS at Salina Central High School	Sept. 28	Sept. 29	Nickerson, KS	Cindy Beshore Box 273 Nickerson, KS 76561	1 day	60 mi. SW
975 AG male	Dixie Quincy c/o Iola Middle School 600 East Street Iola, KS 66749	Iola, KS	Sept. 20	Sept. 27	Iola, KS	Jack Vincent P.O. Box 221 Iola, KS 66749	7 days	—
731 BF female	Ron Turner c/o Andover Middle School 1747 Andover Rd. Andover, KS 67002	Andover, KS	Oct. 14	Oct. 20	Andover, KS	Hazel A. Hilyard 1512 N. Church Box 391 Andover,KS 67002	6 days	—
730 BF male	Ron Turner c/o Andover Middle School 1747 Andover Rd. Andover, KS 67002	Andover, KS	Oct. 10	Oct. 29	Wichita, KS	Mrs. L.O. Luther 1431 Wooddale Wichita, KS 67230	19 days	20 mi. SW
554 AE	Elizabeth Dickson 1128 Cordell St. Denton, TX 76201	Aubrey, TX	Oct. 18	Nov. 2	Dallas, TX	Robin O'Brien	15 days	40 mi. SE
486 AH male	Brad Williamson 1209 Willow Olathe, KS 66061	Olathe, KS	Sept. 17	Oct. 10	Gun Barrell City, TX	Linda Gstohl P.O. Box 350 Mabank, TX 75147	23 days	455 mi.SSE
242 BL male	Terry Callender/ Eric Willette c/o Wamego High School 801 Lincoln, Wamego KS 66547	Wamego, KS	Sept. 21	Sept. 21	Wamego, KS	Jeremiah Winsler 706 Oak Street Wamego, KS 66547	----	----
353 AF	Terry Callender/ Susan Schoen Wamego High School 801 Lincoln, Wamego KS 66547	Wamego High School, KS	Sept. 16	Sept. 20	Wamego, Pott Co., KS	Travis Park Wamego, KS	4 days	----
160 AF male	Terry Callender/ Susan Schoen c/o Wamego High School 801 Lincoln, Wamego KS 66547	Belveu, Pt.,KS	Sept. 15	Feb. 15 (not exact)	Rosario colony, near Angangueo, Michoacan	Roberto Contrerras	approx. 5 months	1400 mi.
169 AJ male	Becky Knetter Piper High School 4400 N. 107th Kansas City, KS 66109	Kansas City, KS	Sept. 10	Jan. 14	Sierra Chincua colony Michoacan	Alfonso Alonso-Mejia 2223 Bartram Hall, Dept. of Zool. Univ. of FL Gainsville, FL 32611	125 days	1450 mi.

Figure 1: Monarch Vanishing Bearings

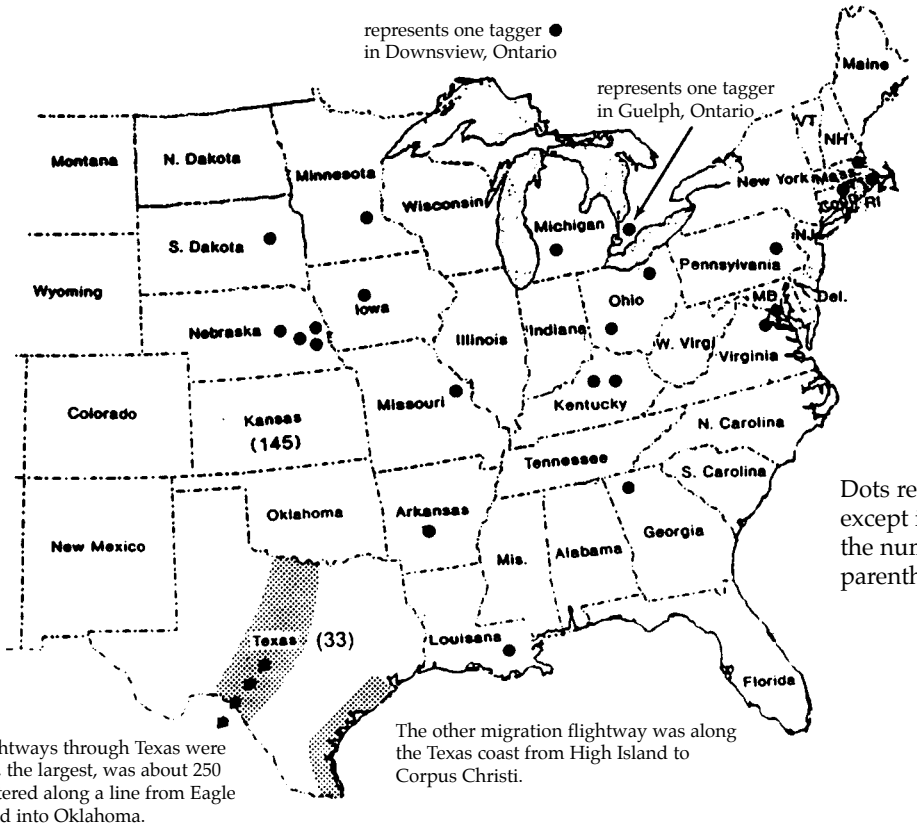


Vanishing bearings of individual monarch butterflies were recorded on two consecutive days (20-21 September 1994) in Lawrence, Kansas. The data are summarized for each hour; observations were made from 2-4 pm on teh first day and 8:30-10:30 on the second. Each dot represents an individual vanishing bearing. Mean vectors are given internally. Wind directioni is indicated by the centripetal arrow at the periphery of each diagrem. Wind speed is given in m/s.

Observations at the Lied Center were made on an exposed hilltop and those in the Ditch site, in a location well-protected from the wind. Strong Northwesterly winds on the first day appeared to deflect the monarchs to the southeast at the Lied site but less-so at the more wind-protected Ditch site. On the second day, with low wind speed the differences between these sites were minimal. All values were corrected for declination.

Figure 2: Locations of Taggers Across the United States and Canada*

(*Number of individuals to whom tags were sent in each state. Since many of these individuals were teachers, this does not reflect the number of student participants.)



Dots represent individual taggers except in Kansas and Texas where the number of taggers is given in parenthenses

Two major Monarch flightways through Texas were identified this year. One, the largest, was about 250 miles wide and was centered along a line from Eagle Pass through Abilene and into Oklahoma.

The other migration flightway was along the Texas coast from High Island to Corpus Christi.

Table II: Flight Vectors of Monarchs in Various Parts of the United States and Mexico

Observer	#sighting	Date	Time of day	Compass direction	Wind Speed	Direction
The Atkins Family Lawrence, KS	15	Sept. 16	4:30pm-5:15 pm	229° average	5-10 mph	SSE
M.K. Williams Fremont, NE	5	Sept. 20	4-5 p.m.	230°	5-10 mph	W-NW
Barb Barton	18	Sept. 15	6:50 p.m.-7:30p.m.	183° average	NA	NA
Middletown, PA same	1	Sept. 24	12:25 p.m.	230°	light breeze	North
James Adams	3	Oct. 1	9:45 a.m.	180°	calm	
Rocky Face, GA						
" "	22/3	Oct. 2	10:30-2:00p.m.	230°/95-115°	gusty	SSE/ESE
" "	15	Oct. 4	off and on all day	125-160°	strong	NW
" "	4	Oct. 7	10:45-11:30 a.m.	155-170°	relatively calm	
" "	7	" "	12:45-1:30 p.m.	180-190°	same	
" "	12	" "	3:30-4:30 p.m.	200-225°	same	
" "	3	Oct. 8	1:20-2:00 p.m.	215°	calm	
N. Florida	several	Oct. 10	throughout day	no strong direction	NA	NA
Bill Calvert						
Harper, Texas	9	Oct. 11	12:20 p.m.	216°	NA	155°
Goose Isl. SP shore	30	Oct. 26	10:15 a.m.	255°	5 mph	20°
Goose Isl. SP ,TX	15	Oct. 26	2:35 p.m.	239°	10 mph	10°
Goose Isl. SP,TX	6	Oct. 27	12:30 p.m.	168°	5 mph	30°
S. Copano Bay, TX	13	Oct. 27	2:15 p.m.	214°	10 mph	20°
Indian Point, TX	24	Oct. 28	9:30 a.m.	239°	no wind	
S. Nueses Bay, TX	16	Oct. 28	10:40 a.m.	216°	1 mph	310°
Port Mansfield, TX	7	Oct. 29	10:00 a.m.	297°	5 mph	160°
Victoria, Mexico	29	Nov. 1	11:15 a.m.	215°	8 mph	130°
same	34	Nov. 2	10:40 a.m.	140°	2 mph	355°
same	129	Nov. 2	11:30 a.m.	165°	10 mph	
Brad Williamson's class Olathe, Kansas	105	Sept. 17	3:30- 4:15 p.m.	250 °average	5 mph	190°
Martha Badgett Horseshoe Bay, TX	14	Oct. 14, 21	3:00-4:30 p.m.	228°	10-20 mph	NNE

Observer	# sightings	Date	Time of day	Compass direction	Wind speed	Direction
Hubert Foster Tyler, TX	6	Oct. 4-9	10:00a.m.-2:00 p.m.	228°	5-15mph	variable
Diana Foss, Chuck Kowaleski, Robert Comstock Sheldon Lake St. Park,TX	13	Sept. 24- 4 Nov.	10:00 a.m.- 5:00 p.m.	192°	5-20 mph	variable
James Scanland Laling, TX	3	Oct.9	10:00 a.m.-5:00 p.m.	192°	5-20 mph	SSE

* Compass direction values are not corrected for declination ie. difference between true North and magnetic North
eg. the declination value for Lawrence, Kansas is -7° , so for the Atkins Family, the compass direction would be adjusted to 221.6°.