Monarch Larva Monitoring Project

ACTIVITY #1: MONARCH DENSITY DATA

Objective: Obtain a count of monarch eggs and larvae at the site by examining a known number of milkweed plants. The result will be a per plant density measurement of the monarch population at the site. We can use this measurement to see how monarch densities vary within a year, between years, and among different sites and locations.

If you use **Datasheet #1C**, you will also keep track of the number of monarchs you observe on individual plants, instead of just reporting the total numbers of plants and monarchs that you observe. **Datasheet #1A** and **Datasheet #1B** only ask for the total numbers of plants and monarchs—for example, 4 eggs on a total of 100 plants observed. **Datasheet #1C** will allow you to report if these eggs were on 4 separate plants, or if they were all on the same plant, or somewhere in between. This information will be useful in understanding potential impacts of crowding on monarch survival. Because you will also record the milkweed species, we'll be able to assess how female monarchs make egg-laying decisions when they have more than one milkweed species in a single site. Your data will be added to overall monarch densities, but will also be analyzed separately.

Method: Examine as many milkweed plants as possible, keeping track of the number of plants examined. Record the number of monarch eggs and larvae of each instar that you find. Try to monitor on the same day and at the same time each week, if possible, throughout the time that milkweed is growing in your area. It is critical that you record the number of milkweed plants that you examine. The result will be a weekly estimate of monarch density at your site, measured as a proportion of milkweed plants with monarchs. It is also important to examine an unbiased sample of milkweed plants. In other words, you should not just look at the milkweed plants that you think are most likely to have monarchs on them because you will overestimate the monarch density at your site. You can avoid bias by following the directions below.

1. **Walk one or more random, straight-line transects, or paths, through your site.** First, choose a random direction to walk. You can do this by tossing a pencil or stick, and walking in the direction it points, or using some other random sampling method. After choosing a direction, hold your arms out to your sides as you walk. Stop and examine every milkweed plant that falls along your path between your fingertips. As you examine these plants, **keep track of the number of plants you look at**, whether they have monarchs or not. Record the total number of plants you examine on **Datasheet #1A** (which only has rows for one date) or **Datasheet #1B** (which has rows for several days).

Note: you do not need to use the transect method if you are able to examine all of the milkweed plants at your site.

2. **Search for monarch eggs and larvae on each plant.** To examine a milkweed plant, remember that monarch eggs and larvae can be hard to find! Look carefully at all parts of the plant, including the bottoms of the leaves and the area within the very small leaves at the top of the plant. Keep an eye out for caterpillar clues, such as chew marks on the leaves. Try not to handle the plants roughly, to avoid knocking any larvae off the plant. Remember, not all eggs and caterpillars that you find on milkweed are monarchs; use the pictures of each instar below and our Field Guide to Monarch Caterpillars to help you distinguish monarchs from other insects.

3. **Keep track of the number of monarch eggs and larvae that you find, and the instar of each monarch larva.** Record the totals on **Datasheet #1A** (one week per sheet), **Datasheet #1B** (every week of season on one sheet), or **Datasheet #1C** (monarchs per individual milkweed plant). Note that there is also a space to record the number and stage of any dead monarch eggs or larvae that you find.

4. **Scan for adult monarchs.** Note any adult monarchs you observe, and their gender, if known. To avoid counting individuals more than once, count the maximum number of adults that you observe at any one time. Record this number, indicating how many are males, females, or unknown.

5. **Note what plants are blooming each week.** This information will help us know something about the diversity of plants at your site and tell us if there were any nectaring plants there to attract adult monarchs. You do not need to record the numbers of each kind of plant that is blooming, just the species.

6. **Note any disturbances at the site.** Record the date and type of disturbance, which might include mowing, herbicide spraying, haying, or anything else that might affect the milkweed plants or monarchs.

7. **Record the rest of the required data**. Record the date you monitored, the temperature in the shade (indicate Fahrenheit or Celsius), start and stop times, etc.

8. ***Aphis nerii* presence or absence**. If desired, note if you saw any of the bright yellow Oleander Aphids (*Aphis nerii*) while you were monitoring. You don't need to record numbers of aphids or plants with aphids, just whether they were there or not. If you didn't look, just check "didn't look".

NOTE: Beginning in 2009, we are only requesting MLMP volunteers to record temperatures in the shade (and not temperatures in the sun). Shade temperatures are more accurate and relevant to data analysis since larvae are usually found on the underside of leaves.

GENDER

Male and female monarchs can be distinguished easily. Males have a black spot (indicated by a red arrow) on a vein on each hind wing that is not present on the female. The ends of the abdomens are also shaped differently in males and females, and females often look darker than males and have wider veins on their wings.

Male Monarch Butterfly
(photo courtesty of Michelle Solensky)

Female Monarch Butterfly
(photo courtesy of Barbara Powers)

CATERPILLARS AND MONARCH EGGS

Monarch egg on milkweed leaf — The egg is a little more than 1 millimeter tall.
(Photo courtesy of Lynda Andrews)

Close-up of monarch egg — Note the pointed shape, the glossy color, and the vertical striping.
(Photo courtesy of Michelle Solensky)

Good (live) monarch egg
(Photo courtesy of Valerie Evanson)

Dead monarch egg – Note the "puddle" of dead larva in the bottom of the egg.
(Photo courtesy of Valerie Evanson)

Monarch first instar consuming eggshell — Note the dull greenish-grey color, and the size (not much bigger than the egg).
(Photo courtesy of Mary Holland)

First instar feeding damage — This circular feeding pattern is an indication that a monarch first instar was on the plant at some point.
(Photo courtesy of Tom Collins)

Monarch fifth instar — Older monarch larvae have bright yellow, black and white striping and 2 pairs of tentacles (on front and back ends).
(Photo courtesy of Richard Hicks)

APHIS NERII (APHID)

Aphis nerii – the only bright yellow aphid found on milkweed.
(photo courtesy of Anurag Agrawal)

Aphis nerii – hundreds of aphids on one milkweed plant.
(Photo courtesy of Grant Bowers)

DATASHEET #1A: WEEKLY MONARCH DENSITY

Use this information to fill in **Datasheet #1B Season Summary of Monarch Density**.

Date: _____ **Observers:** _____ **Site Name:** _____ **City, State:** _____

Start Time: _____ **Stop Time:** _____ **Temp in Shade:** _____

Eggs	1st Instars	2nd Instars	3rd Instars	4th Instars	5th Instars	# of Adults (F = female M = male U = unknown)	# Dead (egg or larval stage)	# of Milkweed Plants Observed (use tick marks to represent 1, 5, 10, or 20 plants and record total at end of session)

Plants in bloom at site (species, not numbers of plants!):

_____

_____

Note any disturbances that occurred at the site over the past week (mowing, herbicide spraying, haying, etc.):

_____

_____

Did you see any *Aphis nerii* at your site this week? Circle one: Yes No Didn't look

Other Notes:

DATASHEET #1B: SEASON SUMMARY OF MONARCH DENSITY

Year: _____ **Observers:** _____ **Site Name:** _____ **City, State:** _____

Date	Temp in Shade	Start Time	Stop Time	Live Monarch Eggs & Larvae						# Dead (& larval stage)	# of Adults (F = female M = male U = unknown)	# of Milkweed Plants Observed	Plants in Bloom	*Aphis nerii*? (Yes / No / Didn't Look)
				Eggs	1st	2nd	3rd	4th	5th					

Were there any disturbances (such as mowing) at your site during the monitoring period? Please describe the kind and timing of any disturbance.

ACTIVITY #1C: MONARCH DENSITY PER MILKWEED PLANT

New in 2010

Objective: Activity #1C, like the simpler Activity #1, results in an estimate of monarch density at your site. The difference is that you will keep track of the number of monarchs you observe on individual plants, instead of just reporting the total numbers of plants and monarchs that you observe. Whereas in the simpler activity you would report seeing, for example, 4 eggs on a total of 100 plants observed, this protocol will allow you to report if these eggs were on 4 separate plants, or if they were all on the same plant. This information will be useful in understanding potential impacts of crowding on monarch survival. Because you will also be recording the milkweed species, we'll be able to learn help us to assess how female monarchs make egg-laying decisions when they have more than one milkweed species in a single site. Your data will be added to overall monarch densities, but will also be analyzed separately.

Method: Follow the directions for Activity #1, with these modifications. When you look at a plant with no monarchs, place a tick mark in the box labeled "0 monarchs/plant." When you see one monarch on a plant, write "e," "1st," "2nd," "3rd," "4th," or "5th" (depending on whether you see an egg or a first, second, etc instar) in one of the boxes under the words "1 monarch/plant." When you see 2 monarchs on a plant, write "e,e" or "e,1st," or "1st,1st," etc., depending on the stage of the two monarchs you see. Do the same in the boxes under the words "3 monarchs/plant," "4 monarchs/plant," and ">4 monarchs/plant" as needed. Note if an individual is dead; for example, if you see a dead first instar and a live first instar on a plant, you would note "dead 1^{st},1^{st}". At the end of the session, add up the total number of plants (being sure to include those with no monarchs), eggs, and larvae you observed, and tally this below the box.

If you have only one species of milkweed on your site, you'll use one table per monitoring session. If you have more than one milkweed species, you should keep a separate table for each species. There are two tables for two milkweed species per sheet.

DATASHEET #1C: MONARCHS PER MILKWEED PLANT

Year: _____ **Observers:** _____ **Site Name:** _____ **City, State:** _____

Key
e = egg
1st = 1st instar
2nd = 2nd instar
3rd = 3rd instar
4th = 4th instar
5th = 5th instar
p = pupae

Date: _____ **Start Time:** _____ **Stop Time:** _____ **Temp in Shade:** _____ **Milkweed Species:** _____

0 monarchs/plant	1 monarch/plant					2 monarchs/plant		3 monarchs/plant	4 monarchs/plant	> 4 monarchs/plant

Total plants observed: _____ **Total 3rds observed:** _____ **Dead monarchs (list stages):** _____

Total Eggs observed: _____ **Total 4ths observed:** _____ **Adult monarchs:** _____ males, _____ females, _____ unknown

Total 1sts observed: _____ **Total 5ths observed:** _____

Total 2nds observed: _____ **Total Pupae observed:** _____

Date: _____ **Start Time:** _____ **Stop Time:** _____ **Temp in Shade:** _____ **Milkweed Species:** _____

0 monarchs/plant	1 monarch/plant					2 monarchs/plant		3 monarchs/plant	4 monarchs/plant	> 4 monarchs/plant

Total plants observed: _____ **Total 3rds observed:** _____ **Dead monarchs (list stages):** _____

Total Eggs observed: _____ **Total 4ths observed:** _____ **Adult monarchs:** _____ males, _____ females, _____ unknown

Total 1sts observed: _____ **Total 5ths observed:** _____

Total 2nds observed: _____ **Total Pupae observed:** _____

Plant species blooming:

Note any disturbances at your site this week: