



Lesson 3: Flight Direction Analysis

Key Concepts:

- Monarchs use directional flight during the fall migration.
- Flight direction can be measured by observing flying monarchs and assessing their “vanishing bearing.”
- The combined data from many people can help us to understand more about monarchs’ annual flight patterns.

Skills:

- Use of compasses and binoculars (binoculars are optional)
- Data collection
- Data organization and analysis

Materials:

- Compass
- Binoculars
- Clipboard
- Pencil
- *Flight Direction Analysis* data sheet (student handout page)
- Information on wind speed, wind direction, air temperatures, and cloud conditions (obtained by personal observation and measurement or from the local weather station)

Objective

Students will observe monarchs in flight, and measure the vanishing bearing of those that are using directional flight. They will learn to distinguish directional from variable flight, and gain an understanding of the ways that scientists collect data to answer questions.

Background

Monarch migration is a well-known phenomenon, but much needs to be learned about how monarchs find their way to overwintering sites in the fall. Monarchs fly from central and eastern U.S. and southeastern Canada in a southwesterly direction to reach Mexico. However, many monarchs recovered from the *Monarch Watch* tagging program are found due south of the location at which they were originally tagged. If they fly in a southwesterly direction, why are they often recaptured directly south of the site at which they were tagged?

An even greater mystery is: How do monarchs from Colorado to New England find the same roosts each year? What environmental information is used by monarchs to guide their migratory flights? By making systematic records of the directions monarchs take on their migratory flights, you can help us find some clues to this monarch mystery.

The *Monarch Watch* homepage has a map of the flight paths of tagged monarchs that have been found. Studying this map would be an excellent introduction to this research.



Procedure

Note: In order to obtain accurate data, observations of flight directions should be made in open areas such as large fields where flight behavior of the butterflies is not modified by hills, buildings, trees, or other such obstructions. Locate a field through which monarchs are passing and select an observation point from which you can easily observe and record their flight directions. Migratory monarchs have a distinct directionality to their flight and do not mill about randomly.

1. Select butterflies that show clear directionality. If butterflies are not moving in a distinct direction, record their flight direction as “variable” and include the temperature and other weather information. More needs to be learned about the time of day and physical conditions that restrict or favor migratory behavior.

2. Position yourself directly under the flight path of the butterflies whose directions you will be recording.
3. Record the compass directions in which they are headed. Do so by setting the compass due north and determining the angle away from due north that the butterfly is flying (see figure above). For example, a butterfly heading due south would be flying in a direction 180 degrees from due north. West would be some angle greater than 180 degrees. These compass headings, when referring to flying insects or birds, are known as “vanishing bearings”. If you have difficulty accurately tracking the direction the butterflies are moving, sight on an immobile object on the horizon like a tree, hill, or pole that corresponds to the compass bearing of the butterfly. Then, measure the compass bearing of the object you’ve sighted and record this compass direction.
4. During each observation period, try to obtain vanishing bearings for 20 monarchs.
5. If possible, make observations on several days at different times and in different weather conditions. After several periods or days of observations, the data can be summarized for each observation period. The average vanishing bearing can be calculated for each period, and differences between periods examined to determine if environmental factors might influence flight direction.
6. Please send your results and any comments on your data collection to:

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We will compile results from all over the country.



