Focus Areas: Animal Lifestyles; Science, Social Studies, Language Arts, Art  
Focus Skills: understanding a map, understanding life cycles, using data to draw conclusions, using mathematical computation to solve problems

Objectives

• To understand the purpose of monarch migration  
• To understand the pattern of monarch migration  
• To increase map reading skills  
• To compute accurately and make reasonable estimates based on data

Essential Questions

• Why do monarchs migrate?  
• What migration patterns do monarchs follow?  
• Why can the annual monarch migration be considered a relay race?

Essential Understandings

• Monarchs, which summer in the temperate zone of North America, are not able to survive winter temperatures and therefore migrate south.  
• Generation after generation, monarchs follow two basic routes to their overwintering roosts on the coast of southern California and the mountains of central Mexico.  
• No single monarch from the northern parts of the U.S. and southern Canada makes a complete migratory round trip.

Background

The annual migration of monarch butterflies is actually a journey involving four generations! No monarch from above the 45th parallel makes a complete round trip.
As the daylight hours lessen and nights in the north temperate zones of North America grow cooler, monarchs born in mid summer in the northern United States and southern Canada begin a migration of thousands of miles to their overwintering roosts along the southern coast of California or a few prime mountain tops in Central Mexico.

The new adults are fourth generation descendents of the monarchs who made the same journey the year before. They may look like their parents and grandparents, but these young adults are the unique diapause generation, born to fly! Their life span is longer; 8 to 9 months as compared to the mere month of their ancestors and descendants. Unlike the preceding three generations that mated almost immediately after reaching the butterfly stage of their development, these monarchs will not produce offspring until the following spring.

Only one generation in four belongs to the diapause generation. Their grandparents and parents died before these butterflies emerged from their cocoons, and they had never been to where these butterflies are going. These butterflies will depend on instinct, and in all probability, the sun's positioning to guide them over the same route that other diapause generations, including their great-grandparents, have followed for centuries.

Beginning in the early fall, monarchs west of the Rocky Mountains in southern Canada and northern California flutter to the coastal areas south of San Francisco. Meanwhile, monarchs east of the Rocky Mountains funnel toward southwestern Texas in ever increasing numbers throughout the fall. From Texas, a virtual cloud of monarchs progress toward their final destination, several mountainsides in Central Mexico.

Both sites provide the environmental conditions the butterflies need to overwinter: trees where they can roost, forested canopies for protection from wind and snow, and ample water often in the form of fog. For added
comfort and protection, these usually solitary insects cluster by the millions in overlapping layers in their butterfly trees. Activity is limited. They live off the nutrients they gathered from the plants on their journey south, and wait.

In Central Mexico, temperatures warm and days grow longer in late February and early March. Wings that have been mostly still for months begin to stir. The monarchs of the diapause generation are on the move and flying north. This time they mate quickly, and the females lay as many as 700 eggs apiece as they cross from northern Mexico and flutter across the southern United States. By April, the first of a new generation of monarchs is ready to continue the journey. They too mate quickly, and lay their eggs as they continue north. Their offspring, generation two, reach adulthood in May, mate and begin the next generation, which mature a month later and continue the journey. However, like their parents, the generation two adults’ life span is a mere month and they will not travel far. Their children, generation three, are within reach of the original starting point. Flying between 30 and 50 miles a day, generation three mates and deposits eggs at the home sites in northern United States and southern Canada. Their offspring, which emerge as butterflies in late summer and early fall, are the monarchs which will undertake the next journey south to the overwintering sites of Mexico.

Left alone, Nature would continue the monarch cycle for centuries, but man has interfered. In Mexico, logging is deforesting the sites where monarchs have traditionally overwintered. In California, new homes and malls are destroying natural areas that the monarchs used to frequent. Even the grasslands and marshes that provide food sources for migrating monarchs are being reclaimed for agriculture and new homes. In addition, herbicides deplete the monarch’s food source, and insecticides target them by mistake. Pollution of the air and water also contributes to their diminishing numbers. If care is not taken to protect the natural habitats of these beautiful creatures, their great annual migration may become merely a memory.
Vocabulary

ancestor  a member of the same species (including humans) who lived any time before the current generation

chrysalis  the inactive third stage in a butterfly’s metamorphosis

cocoon  a case that contains the pupal stage of some insects during metamorphosis

descendant  the offspring of past generations

diapause  an interruption in the life cycle of an insect in which the production of offspring is postponed

generation  the measurement of time between the birth of an organism and the birth of its first offspring

instinct  unlearned behavior

larva  the second developmental stage of some insects (Example: caterpillar)

latitude  imaginary lines used to measure distance north and south of the equator

longitude  imaginary lines passing through the poles and used to measure distance east and west

map key  an explanation of the colors and symbols used on a map

metamorphosis  a series of changes through which insects go from egg to adult
offspring an immature animal resulting from the mating of two adult animals

overwinter to spend the winter season in a climate more suitable than that which is considered home

pupa the third stage of many insects’ metamorphosis

solitary insect an insect that provides for its needs without the help of others of its kind

temperate zone an area north and south of the equator between the torrid and frigid zones

Logistics

Time: minimum 3 periods of 40 minutes each
Group Size: 5 to 30
Space: a room with comfortable seating

Materials

Overhead 1 “Four Generations of Monarchs”*
Overhead 2 “Fall Monarch Migration”*
Overhead 3 “Spring Monarch Migration”*
Handout 1 “Spring Monarch Migration”*
Handout 2 “Monarch Migration Worksheet” with Answer Key*
Handout 3 “Overwintering Monarchs”*
Migration Poster*
physical wall map of the United States
political map of the United States (one per children's text book or atlas)
black/white board or chart paper
overhead projector

* single copy provided
Preparation

1. Make copies of Handout 1 (one color copy per child), Handout 2 (one per group of two or three children), and Handout 3 (one copy per child).
2. Procure physical map and display it.
3. Set up overhead projector.
4. Read the Background section.
5. Check websites.

Activity

Challenge: Analyze monarch migration.

(Display for group viewing)

Introduction

1. Review the learning from Unit 3 Section 1 Lesson 1, Extreme Makeover to check for understanding of the monarch life cycle.
   a. How many life stages are there in a monarch’s life cycle? (four)
   b. What is the average life span of a monarch? (approximately 2 months from egg to death. Adults usually live from 2 to 6 weeks.)

2. Show the group Overhead 1, “Four Generations of Monarch Butterflies.” Tell the children that one of these represents a very special generation of monarchs. Ask if they can tell which generation is the special one. (no, they all look exactly the same) Ask:
   a. What is the main job of adult butterflies? (to reproduce)
   b. How soon after emerging from the chrysalis do adult female butterflies lay eggs? (in approximately one week or less)
3. Point out the last generation on Overhead 1 and tell the group that these butterflies emerge as adults in late summer and early fall but will not mate and lay eggs until the following spring! This generation lives longer than their parents, grandparents, and even great great grandparents. They are the diapause generation, born to fly!

4. Display Overhead 2, “Fall Monarch Migration.” Ask the children:

a. What is the purpose of this map? (to show the route the butterflies take in the fall)

b. What are the destinations of the butterflies from our state? (Mexico and Florida)

c. What other destination do some of the butterflies have? (southern California)

d. What natural land form seems to determine to which destination the monarchs will travel? (the Rocky Mountains)

e. What general direction do the eastern monarchs fly? (southwest)

f. What general direction do the western monarchs fly? (south)

h. Why do you think the monarchs make this trip in the fall? (The weather is too cold for them to survive in the north.)

i. What is a long journey from one place to another and back again called? (migration)

5. Using a map of the same area as Overhead 3, which includes a scale of miles (in the children’s Social Studies text, atlas or individual print maps), help children estimate the number of miles the Connecticut monarchs fly. (over 2,000 miles)

6. Present the mathematical word problem: If a butterfly flies 40 miles a day, how long will it take a butterfly to reach a destination 2,500 miles away? Solve the problem with the children. (2,500 divided by 40 = 62 days or 2 months) Ask: Based on what you learned in the lesson Extreme Makeover, could the average butterfly make the trip? Do the computation with the children.
(5 week life span X 7 days per week = 35 days; no)

7. Reintroduce the diapause generation. Print the phrase on the board. Explain that this generation, the last generation born in a given summer (usually the fourth), has an adult life span of 8 to 9 months, plenty of time to fly to Mexico!

Involvement

1. Review the time span of the daipause generation of monarchs. (8 to 9 months)
2. Call attention to the mathematical solution for question #6 in the Introduction. Ask the question: If the monarchs arrive at their overwintering sites in November, when must they begin their journey south? (Sept. to Oct.)
3. Estimate the remaining time the monarchs that reached Mexico have in their life span. (6 months)
4. Explain that if temperatures dip below 45°F, the butterflies can’t survive, and that in order to fly, the temperature has to be at least 55°F.
   a. Ask the children to hypothesize when the monarchs will begin the journey north. (late March to early April)
   b. Ask the children how long these emerging monarchs have left in their life span. (approximately 4 to 5 weeks)
   c. Ask if this is enough time to fly back home. (no)
   d. Speculate on what these monarchs will do. (mate and lay the eggs of the next generation, who will continue the journey north)
6. Invite the children to chart the butterflies’ journey north.
7. Display the Migration Poster and distribute Handout 1, “Spring Monarch Migration.”
Unit 3 Section 1 Lesson 2: Migration Relay

a. Using the title of the map, determine its purpose. (to show the pattern and progress of the monarchs’ migration north)
b. Point out the map key and ask the children how it will be used to answer the questions WHEN and WHERE the butterflies migrate. (The time is shown in approximately two week intervals, and the colored dots will locate where.)
c. Ask which map feature will help determine how far the butterflies migrate. (the scale of miles)
d. Indicate the latitude and longitude lines and ask what they are and how they are used. (see Vocabulary section.)

8. Review the life span of the developing butterfly (4 weeks) and the adult butterfly (4 weeks), and call the children’s attention to the time span of the map key.

a. Ask if the colored dots on the map represent the same butterflies seen in different locations or new generations of monarchs. (new generations, because the adults live just a month and the map key covers a three-month time period)
b. Tell the children to assume that the adult monarchs have laid eggs in the locations at which they were spotted. When will these eggs emerge as adults and continue the journey north? (4 weeks later. Example: the eggs laid between March 15 and April 11 will become adults between April 15 and May 11)
c. Help the children to estimate how many generations are represented on the map.

i. Call their attention to the white dot and the symbol < . These are butterflies sighted prior to March 15. Ask which generation this would be. (the generation that flew to Mexico, the diapause generation)
ii. Remind the children that the life span of these adults is 8 to 9 months (from late summer through early spring), and the remaining time in their lifespan is approximately 4 to 5
weeks. Ask how many dots in the map key are most likely the dipause generation. (the first three)

iii. Ask which colored dots probably represent the first new generation. (the orange and brown, the next two)

iv. Ask how many generations are represented by the remaining 4 dots in the map key. (Two additional generations. The second and third are represented by two dots each.)

9. Divide the group into pairs or triads and distribute Handout 2, “Monarch Migration Worksheet.” Allow time for the children to answer the problems. Circulate and offer help as needed.

10. Share and discuss the answers to the questions asked on Handout 2.

Follow Up

1. Ask the questions:
   
   a. Why do the monarchs go to specific overwintering spots?
   b. What happens at the overwintering locations?

2. Distribute Handout 3, “Overwintering Monarchs” and allow children time to read the information.
   
   a. Call on volunteers to share facts they learned about monarchs overwintering. List these in complete sentences, and use only one fact per sentence on black/white board or chart paper.
   b. Based on at least 3 facts as supportive evidence, have children draw conclusions on the life style of overwintering butterflies. Be sure that they list the details (facts) they used to draw their conclusions.
Assessment

Evaluate children’s answers to Handout 2, “Monarch Migration Worksheet” to determine their ability to interpret maps.

Answer Key

See Answer Key for Handout 2, “Monarch Migration Worksheet.”

Follow Through

Additional Focus Areas: Language Arts, Art
Additional Focus Skills: communicating with a different ethnic population, two dimensional design

1. Invite the children to join the Symbolic Monarch Migration.
2. Go to www.jnorth.com for specific directions to involve your group in this wonderful cross cultural project.

Resources

Special thanks to these experts and organizations that allowed us to use their visuals and research in the preparation of this lesson:

Monarch Watch
Monarch biology and conservation from the University of Kansas
www.monarchwatch.org

Monarchs in the Classroom (Monarch Lab)
Especially for K-12 educators from an entomologist, Karen Oberhauser
www.monarchlab.umn.edu
Journey North: Monarch Butterfly Migration and biology
Features yearly migration data, activities, and project participation
www.learner.org/jnorth/

Internet Websites

There are numerous websites that can be accessed by searching the topic “monarch butterflies”. The three listed above are invaluable, as well as user friendly.

Suggested Reading

*The Prince of Butterflies* by Bruce Coville and John Clapp

*Madalynn, The Monarch Butterfly, and Her Quest to Michoacan* by Mary Baca Haque and Francisco Lancaster Jones (translated by Emily du Houx)

*The Great Butterfly Hunt* by Ethan Herberman

*Four Wings and a Prayer* by Sue Halpern

*Extraordinary Life* by Laurence Pringle and Bob Manstall