

Migration Math Madness

Adapted with permission from "Seasonal Wetlands." Santa Clara Audubon Society. "Salt Marsh Manual: An Educator's Guide." San Francisco Bay National Wildlife Refuge.

Grade Level: upper elementary/middle school

Duration: one 30-minute class period

Skills: collection, comparison, and interpretation of data; using technology (with additional activity)

Subjects: science, math, and social studies; geography and technology (with additional activities)

Concepts:

- During each year of their lives, most shorebirds migrate between habitats located in different geographic areas.
- Shorebirds migrate between northern breeding areas and southern wintering areas to take advantage of seasonal food resources.
- Arctic-nesting shorebirds undertake some of the longest migrations of any animals.
- Migratory shorebirds depend on habitat in at least three areas: breeding, nonbreeding, and migratory stopover sites.
- Shorebirds concentrate in great numbers at their stopover sites.

Vocabulary

- Central Flyway
- Atlantic Flyway
- Pacific Flyway
- isotherm
- flyway
- stopover site
- wintering area
- nesting area
- wetland
- migration

Overview

Students discover that shorebirds migrate long distances between northern breeding grounds and southern breeding habitats, using

five corridors or “highways” in the sky. By using the migration map provided, they measure and calculate the distances some shorebirds travel and come to understand why shorebirds must stop to feed and rest along the way.

Objectives

After this activity, students will be able to:

- Define the term isotherm.
- Describe the routes of the shorebird flyways that run along or through the continental United States.
- Calculate the migration distances of two shorebirds.
- Explain why wetland stopover sites are critical to shorebird migration.

Materials

- Twenty-centimeters pieces of string (one per student or group)
- One set of *Migration Math Map Worksheets* and the *Migration Madness* reading for each student
- Pens or crayons for each student

Introduction

Shorebird *migration* is perhaps one of the most spectacular wildlife events known to biologists today. It is now thought that the seasonal movement of shorebirds, from their warm, winter habitat world to the brutal environment of the Arctic tundra, is an adaptation for survival. Their migration to the Arctic allows them to take advantage of the abundant, seasonal invertebrate food resources in an area of the world relatively low in predators and competitors. In addition, the vast open space of the Arctic provides much more habitat for breeding and nesting than their wintering area, and there are many more hours of daylight to feed.

There would have to be an advantage to shorebirds for them to expend so much energy. Consider

the American Golden-Plover that flies 4350 miles nonstop, twice each year, between South America and Northern Canada and the Alaskan tundra. Physical feats like this are common in the world of shorebirds. Pectoral Sandpipers winter in Southern South America but breed as far west as Central Siberia. Some plovers, curlews, and tattlers fly nonstop from Hawaii and other Pacific Islands to Alaska in two or three days, a distance of over 3500 miles!

To migrate successfully, many shorebirds stop to rest and feed along the way at wetlands and grasslands. These *stopover sites* provide critical food resources that give the birds energy to continue the race to their northern breeding grounds.

To learn more about shorebird migration, read *Magnificent Shorebird Migration* found in the *Shorebird Primer*.

Activity Preparation

1. Review the *Migration Math Map Worksheets* provided. Decide which flyway(s) you will emphasize. You may choose to have each student complete all three worksheets or divide the class into three groups, each focusing on a different flyway.
2. Make photocopies so each student has at least one activity sheet.
3. Make one photocopy of the *Migration Madness* reading for each student.

Procedure

1. Have your class review *Migration Madness*.
2. Pass out one piece of string 20 centimeters long to each student. Instruct the student to place the end of the string at the start of one of the migratory paths drawn on the map. He or she

should lay the string along the path so that it follows it exactly. At the end of the path, mark the string with a crayon or marker.

3. This string is now marked at the same length as the line on the map. Instruct the students to compare this piece or pieces of marked string with the mileage scale to estimate how many miles the bird traveled.
4. Ask the students to convert the mileage into kilometers. Remember that 1 mile = 1.609 km. If you start with kilometers (km), 1 km = 0.621 miles.
5. Repeat steps 2 and 3 for the other paths shown on the map. Students should write their answers in the spaces provided.
6. Now have them calculate how long it would take these birds to reach their nesting habitat at 40 miles per day, at 72 miles per day, at 150 miles per day.

Additional Activity

Geography Along the Flyway

As students plot the migration of the birds on the migration map, have them also include what countries the birds fly through.

World Migration Map

While Migration Math Madness focused on the three flyways in the Western Hemisphere, there are actually five shorebird flyways. The two additional flyways are in the Eastern Hemisphere, but some of the shorebirds in those flyways breed in the North American Arctic of Canada and Alaska. Introduce these additional flyways to your students by referring to the map in this activity and flyway descriptions located on the Shorebird Sister Schools Web site at <http://sssp.fws.gov>.

Have students work together to draw a world map on butcher paper. Hang up the map on a classroom wall. Next divide the students into five teams. Assign each team to one of the five flyways. Instruct each team to select three to five shorebirds that use the flyway it is assigned and then research the migration routes of each shorebird and add to the world map.

*Note: Students who study shorebirds in the Eastern Hemisphere will have to do additional Web searches for information on those species because they are not included in the Shorebird Profiles. A short list of species that use the East Asian-Australasian and Central Pacific Flyways can be found in the flyway section of *The Shorebird Primer*.

Ask them to write a short biography of the bird that includes the following and add it to the wall.

- a picture or drawing of the shorebird
- the distance they travel during migration
- the critical stopover sites they use along the way (if known)
- its food preferences
- the types of wetland habitat they use

Resources Students

Can Use Include:

- Bird identification guides recommended in the Appendix of this guide
- Shorebird Sister Schools Web site <http://sssp.fws.gov>; go to the “Flyways” link
- Prairies to Patagonia Web site <http://www.manomet.org/WHSRN/Prairies/index.htm>
- USGS Biogeographical Profiles <http://www.mesc.usgs.gov/products/pubs/555/555.asp> (then scroll down and click on “species profiles.”)

- Australasian Wader Study Group Web site <http://www.tasweb.com.au/awsg/index.htm>
- Birds of Australia Web site www.birdsaustralia.com.au
- Shorebird Education of Australia Web site <http://www.wetlands.org.au/shorebirds/>
- Japan’s Shorebird Education Project Web site <http://www.chidori.jp/education/>



Migration Madness

Migrating birds travel long distances between wintering and nesting areas. Most birds do not fly nonstop between these areas, although many are capable of doing so. Timing of the migration is related to seasonal temperature changes but is first triggered by changes in the amount of daylight.

During the spring, most birds do not *migrate* north faster than the 35°Fahrenheit (F) *isotherm* moves. This isotherm is an imaginary, moving line that represents air temperature at any one specific time. The area north of this line is cooler than 35°F, and the area south of it is warmer than 35°F. Migrating behind the isotherm ensures that when the birds reach their nesting areas, the water and ground will not be frozen.

In the fall, temperatures affect the amount of food available to shorebirds. Insects and plants die off in cooler temperatures, so the birds keep moving south to where warmer temperatures mean abundant food.

The migratory routes of birds, referred to as *flyways*, are not specific, narrow “highways,” but general routes that most migrants tend to follow. Most shorebird flyways follow the shoreline habitat the birds prefer.

- In North America shorebirds also migrate inland along the *Central Flyway* that follows freshwater river systems.
- Many other shorebirds migrate on the *Atlantic Flyway*, traveling from the southernmost tip of Argentina, along the American Atlantic Coast up to Canada.
- One of the major routes used by Alaskan Arctic-nesting shorebirds is the *Pacific Flyway*, a path between South or Central American wintering areas and nesting areas in the Arctic regions of Alaska and Canada.
- The *Central Pacific Flyway* extends across the ocean from New Zealand to Pacific islands like Hawaii and up through the Alaskan Arctic.
- The *East Asian–Australasian Flyway* runs from Australia to Japan, China, and Korea, and to the Russian and the Alaskan Arctic.

Wetland stopover sites are important to shorebirds because they provide areas to feed and rest along their migration routes. If a bird flies between Argentina and Alaska, it will cover between 7000 and 8000 air miles. Without local wetlands, many birds would not get enough food energy to make the entire trip.

Birds, like fish, can move in three-dimensional space. This means that besides moving across the earth they also can change altitude. About 15 percent of shorebirds migrate at elevations below 10,000 feet. However, pilots have observed many shorebirds flying at about 29,000 feet!

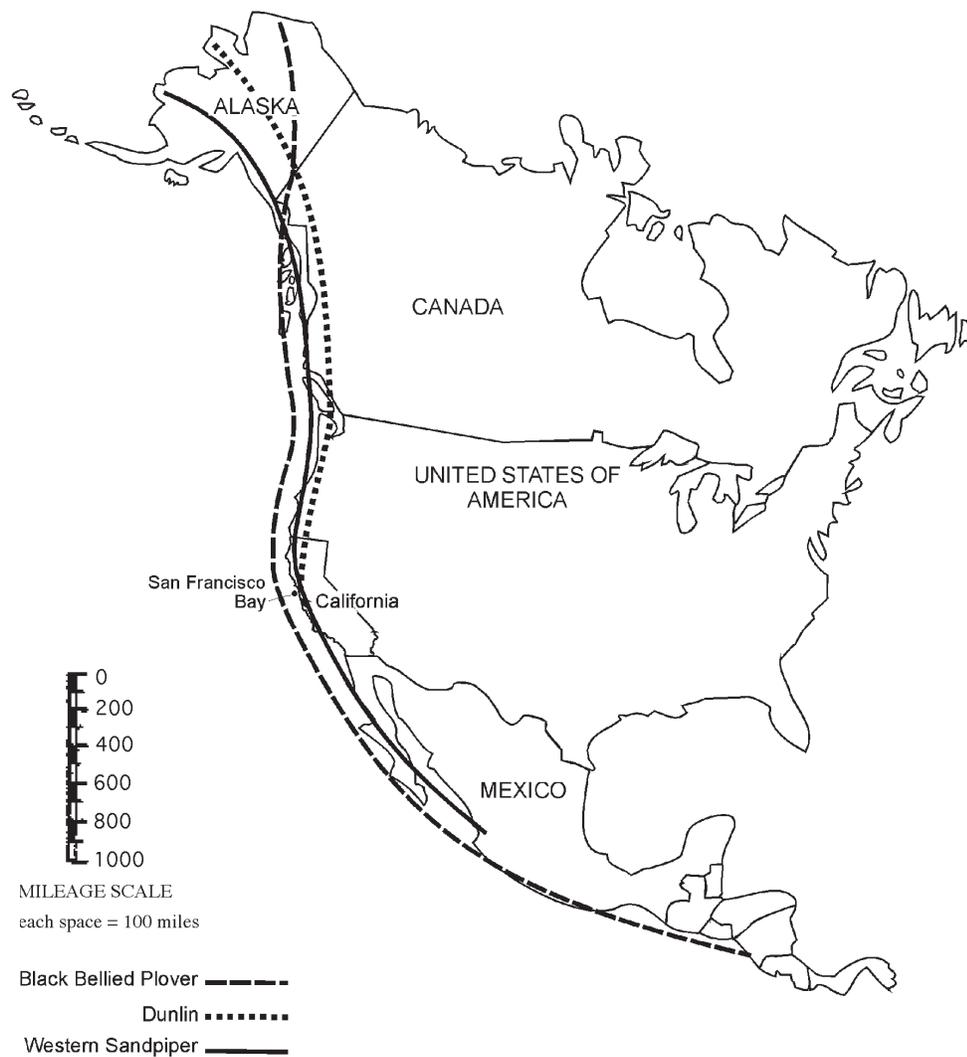
As they get closer to their northern nesting grounds, shorebirds begin to fly faster. Weather and timing become critical factors in getting nests built and young raised in the short two to three months of Arctic summer. Otherwise, migrating shorebirds generally fly for a few hours, rest and feed for one to three days, and then continue. Birds migrating along the Central Flyway have been recorded flying 23 miles per day (mpd) up the Mississippi Valley, 40 mpd across southern Canada, 72 mpd to northern Canada, 116 mpd to Arctic Canada, and those going on to Alaska-150 mpd!



Shorebird Migration Map Pacific Flyway

Directions:

Measure and record the number of miles traveled by each bird.

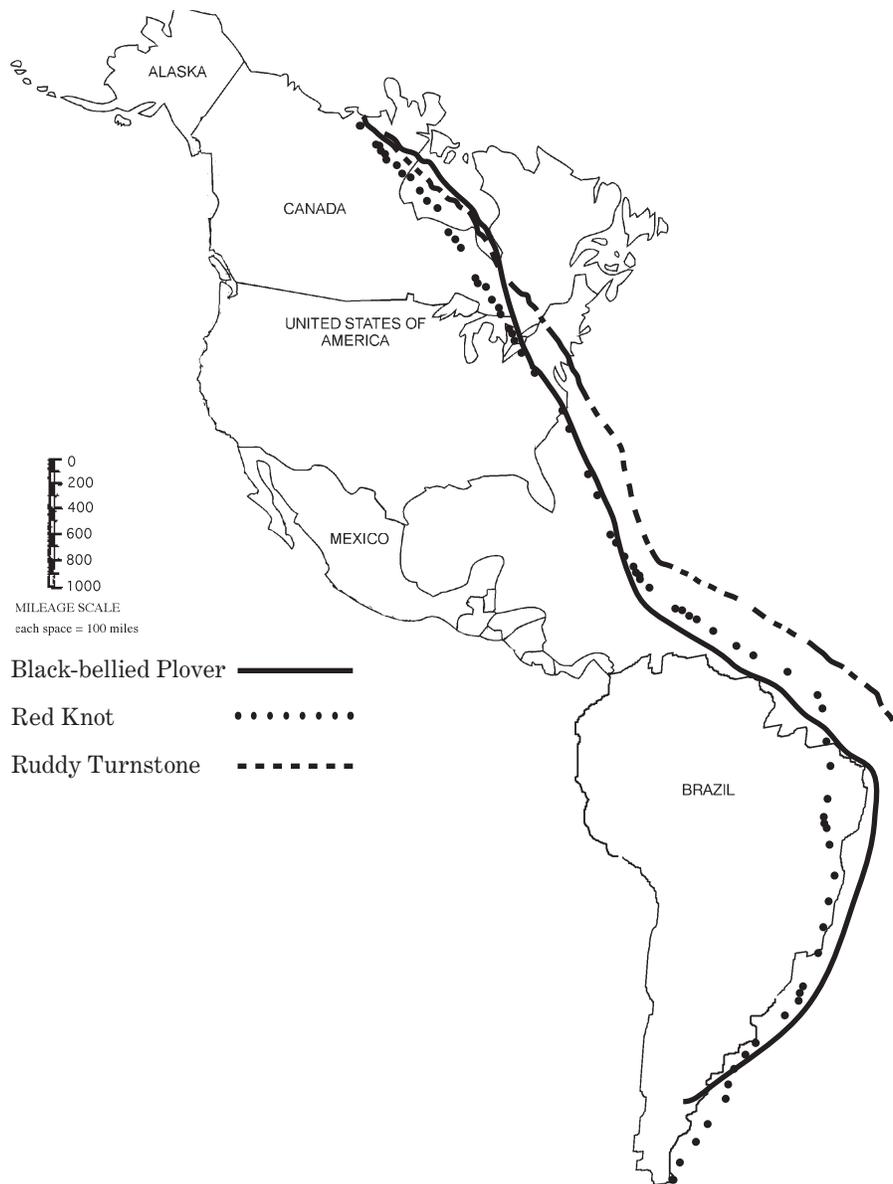


Pacific Flyway

	<i>Miles</i>	<i>Kilometers</i>
<i>Western Sandpiper</i>		
<i>Black-bellied Plover</i>		
<i>Dunlin</i>		

Shorebird Migration Map Atlantic Flyway

Directions:
Measure and record the number of miles traveled by each bird.

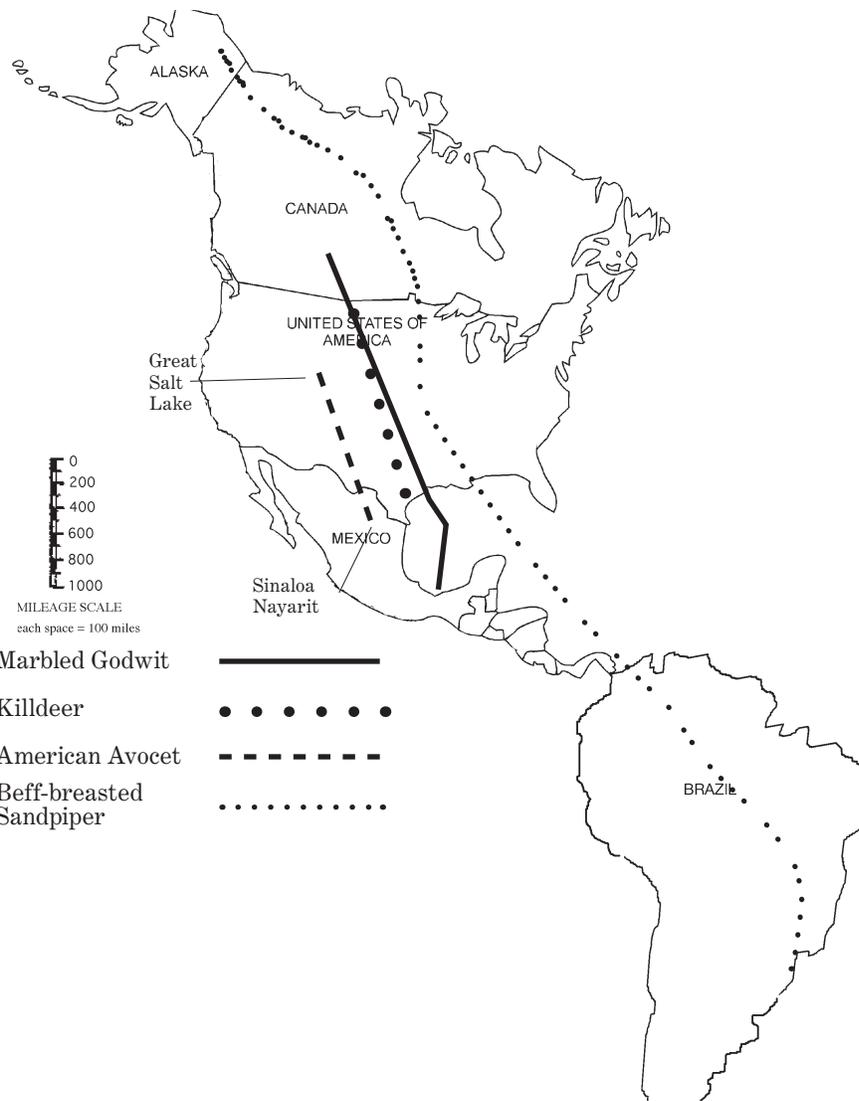


Atlantic Flyway

	<i>Miles</i>	<i>Kilometers</i>
<i>Black-bellied Plover</i>		
<i>Red Knot</i>		
<i>Ruddy Turnstone</i>		

Shorebird Migration Map Central Flyway

Directions:
Measure and record the number of miles traveled by each bird.



Central Flyway

	<i>Miles</i>	<i>Kilometers</i>
<i>Marbled Godwit</i>		
<i>Killdeer</i>		
<i>American Avocet</i>		
<i>Buff-breasted Sandpiper</i>		