

The Crabs, the Birds, the Bay

Theme: Natural History

Author: Loris J. Chen

Teacher, North Arlington Middle School

Subject Areas

Science, Social Studies

Duration

Two 42-minute class periods

Setting

Classroom

Skills

Observation, speculation, evaluation, analysis

Charting the Course

The ecological phenomenon that occurs each spring in the Down Jersey region is introduced in the film *Down Jersey*. This activity utilizes another video, *The Crabs, the Birds, the Bay*, to take an in-depth look at this unique and spectacular occurrence.

Vocabulary

Shorebird, migration, ecosystem, management

Review the five themes of geography — location, region, place, movement, human-environment interaction.

Correlation to New Jersey Core Curriculum Content Standards

Science

5.2 (1, 2)

5.6 (2, 4, 6, 11, 17)

5.7 (1)

5.12 (1, 2, 3, 4, 5, 6, 7)

Social Studies

6.7 (8)

6.9 (3, 5, 6)

The Crabs, the Birds, the Bay

■ Objectives

At the end of the lesson, students will be able to:

1. Answer geographic questions regarding the location, region, place, movement, and human-environment interactions of the Delaware Bay
2. Evaluate and analyze the impact of human activity in the Delaware Bay on the horseshoe crab-shore bird interaction
3. Speculate on the impact of a reduced horseshoe crab population on a migratory shorebird

■ Materials

Video:

The Crabs, the Birds, the Bay

To obtain a copy of the video, please call New Jersey Audubon Society, Center for Research and Education at (609) 861-0700.

Copy Me pages 1 and 2

■ Making Connections

The horseshoe crab harvest is a New Jersey environmental issue. This activity provides students with background information about the interaction between the shorebirds and horseshoe crabs. It provides a framework for discussing solutions to the problem of a declining horseshoe crab population.

■ Background

Read *The Crabs, the Birds, the Bay* Supplemental Reading.

For older students this can be copied and handed out as homework reading.

The Crabs, the Birds, the Bay — Supplemental Reading

Horseshoe crabs are not really crabs at all. They are the living fossils of a line of nearly extinct arthropods most closely related to modern spiders and mites. Horseshoe crab fossils have been found as far back as 360 million years in the fossil record. Their anatomy hasn't changed much over time.

Horseshoe crabs have ten legs that they use to hold and crush prey. They feed on mollusks along the bottom of the bay. To breathe, the horseshoe crab relies on a book lung similar to that found in land spiders. The book lung is a series of membranes that extract oxygen from water. The membranes are arranged much like the pages of a book, hence the term book lung. Unlike terrestrial spiders, the horseshoe crab cannot breathe for long out of water. The book lungs must stay moist.

Horseshoe crabs mate in mid-May. The full moon in May guarantees a high tide which carries the horseshoe crabs onto beaches for spawning. The warm waters and warm sunny days of May are just the right conditions for incubating the horseshoe crab young. A single female horseshoe crab can lay up to 7,000 eggs in a single deposit. Over the course of three weeks, she may lay 88,000 eggs.

Not all horseshoe crab eggs hatch or reach maturity. One of the truly incredible migratory spectacles occurs each May along Delaware Bay. Thousands of shorebirds stop on their migration from South and Central America to feast on the horseshoe crab eggs. It takes about four horseshoe crabs to support the dietary needs of one hungry shorebird. Semipalmated sandpipers, ruddy turnstones, red knots, and sanderlings scurry across the wet sandy beaches in search of horseshoe crab eggs. However, migratory shorebirds are not the only consumers. Laughing gulls, ring-billed gulls, dowitchers, and dunlins compete for the rich nutrition that the horseshoe crab eggs provide. The search for the tiny eggs in the sand is a frenzied blur of flying feet, feathers, and beaks. The ruddy turnstone actually turns over the sand with its beak to find the eggs. The sandpipers move methodically along in a sewing-machine-needle motion, meticulously picking up the eggs from near the surface of the sand. Laughing gulls who nest in nearby marshes contribute the most noise as they comb the shoreline for eggs. As their name implies, they make a loud, shrieking, high-pitched laughing sound.

Horseshoe crabs that survive the feeding frenzy on the beach face more predators as they are swept out to sea. Immature horseshoe crabs are a favorite food of juvenile loggerhead turtles and finfish. It takes 10 years for a horseshoe crab to reach maturity. During that decade, an individual



must survive natural predation and human predation. Horseshoe crabs have been harvested for at least the past century. They were used in the 1880's for bait and fertilizer. The availability of cheaper artificial fertilizers (that didn't smell like dead horseshoe crabs) lead to a decline in horseshoe crab harvesting around the 1940's. As horseshoe crab populations increased, shorebird populations increased. The peak of shorebird migration during the late 1980's coincided with a peak in the Atlantic horseshoe crab population.

Delaware Bay is complex ecosystem that is heavily used by humans for shipping, fishing, and boating. Off-loading of oil tankers is a constant threat to the bay ecosystem. Loss of habitat to developments along the Delaware Bay has potential impact on organisms that depend on the food web of the Bay. Although horseshoe crabs have no food value for humans, they are harvested as bait for eel and conch. Habitat loss along the Japanese coastline has placed the Asian horseshoe crab on the endangered species list. Commercial fishermen along Delaware Bay have found a lucrative business selling horseshoe crabs to eel and conch harvesters. Most of the eel and conch finds its way to Japanese markets. There is some concern that if prudent management is not followed the Atlantic horseshoe crab will join the endangered species list along with the migratory species who rely on its annual cycle of spawning in the Delaware Bay.

■ Procedure

Warm Up

Explain to students that they will be watching a video about the horseshoe crabs and migratory birds of Delaware Bay. Quickly sample for prior knowledge regarding the location of the Delaware Bay, horseshoe crabs, and shorebirds. Tell students that they will be answering questions about the location, region, place, movement, and human-environment interactions taking place in the Delaware Bay.

The Activity

1. Watch the video.
2. Distribute the Copy Me pages.
3. Have students work in pairs to answer the questions. Check answers.
or
If students have difficulty working without directions, complete the questions together as an entire class.
4. Assign Copy Me page 2 for homework and discuss the next day.
or
Use the Copy Me page 2 for classwork the next day.

Wrap Up

Use the writing activity sheet (Copy Me page 3) as an assessment.

■ Assessment

Check student responses to geographic questions. Evaluate writing activity for understanding of how human activity regarding horseshoe crab harvesting can be both the cause and solution to the problem of declining migratory shorebird populations.

■ Extensions

Do the Shorebird Migration Activity.

■ Resources

New Jersey Audubon Society, Center for Research and Education

600 Route 47 North
Cape May Court House, NJ
08210

Phone: (609) 861-0700

Fax: (609) 861-1651

Visit their website at
www.nj.com/audubon

Wetlands Institute

1075 Stone Harbor Boulevard
Stone Harbor, NJ 08247-1424

Phone: (609) 368-1211

Fax: (609) 368-3871

Visit their website at
www.wetlandsinstitute.org

Endangered and Nongame Species Program

P.O. Box 400
Trenton, NJ 08625

Phone: (609) 292-9400

Visit the Division of Fish,
Game and Wildlife website at
www.state.nj.us/dep/fgw

The Crabs, the Birds, the Bay

Student Worksheet

The Crabs, The Birds, The Bay

Name: _____ Date: _____

Instructions: After viewing the video, answer the questions below using complete sentences.

Location

1. Where is the Delaware Bay?

Region

2. Could the Delaware Bay be considered a region? Why or why not?
Is it part of a larger region? If so, what region.

Place

3. Describe the Delaware Bay.

Movement

4. Considering geographic location, why is the Delaware Bay the spawning grounds for 90% of the Atlantic horseshoe crabs?

Human-Environment Interaction

5. What are some threats to the Delaware Bay horseshoe crab population?

Analyze and Evaluate the Consequences

It takes four million horseshoe crabs to support one million shorebirds. What would happen to the shorebird population if the number of horseshoe crabs continues to decline? Consider the fact that it takes 10 years for horseshoe crabs to reach maturity.

Speculate

Pretend you are a shorebird (a red knot, ruddy turnstone, semipalmated sandpiper, or sanderling). You've flown four days nonstop. It's mid-May. The full moon has raised tide levels. The sun has warmed the bay waters. The horseshoe crab mating season will last about three weeks, which is as long as you will stay in New Jersey before flying nonstop to the Arctic Ocean shoreline. Describe your experiences at the Delaware Bay. Assume that there are fewer horseshoe crabs spawning than there were last year.

Writing Prompt based on
“State Seeks to Lengthen Ban on Horseshoe Crab Harvesting,”
Record, July 27, 1997

In 1997, Governor Christine Todd Whitman proposed a plan to limit horseshoe crab harvesting along the Delaware Bay. The plan extended the 60-day moratorium (ban) on horseshoe crab harvesting that had been in effect during the mating season.

Richard Kane, director of conservation for the New Jersey Audubon Society, said “We need a moratorium on the horseshoe crab harvest to protect the shorebirds, given the collapse of eggs (horseshoe crab eggs).” Conservationists supported the limited horseshoe crab harvest because the number of horseshoe crabs was in decline and so were the number of shorebirds that depend on the horseshoe crab eggs for food during migration to the Arctic. Each shorebird needs about three to four grams of eggs per day in order to build up the body fat needed to finish migration. It takes four horseshoe crabs to support one shorebird during the three-week stay in New Jersey. Approximately 90% of east coast horseshoe crabs spawn along the Delaware Bay region.

Judy Wilderstrom, president of the Families and Friends of Commercial Fishermen, felt that Governor Whitman was “ignoring the commercial fishermen because it’s an election year and she’s trying to look like an environmentalist.” To make the new plan more attractive to commercial fishermen, hand harvesting was allowed on Tuesdays and Thursdays with the total catch each day limited to 100 horseshoe crabs. Harvesting was restricted to back bay and marsh areas. Open water trawling was strictly prohibited. Port Norris fisherman Jack King expressed concern that the limited ban was actually a total ban since by mid-July most of the horseshoe crabs had already returned to deeper waters. Commercial fishermen harvest horseshoe crabs to use as bait for conch and eel that are caught and sold mostly to Japan. For some, the profit from horseshoe crabs exceeds the profit from traditional fishing.

Should the horseshoe crab be protected from commercial harvesting?

Write a letter to Governor Whitman stating your opinion about this conservation issue. Include your suggestion for action. Give at least three reasons to support your opinion and a closing statement that summarizes the outcome if your call to action is heeded.

Answer Sheet

The Crabs, The Birds, The Bay

Location

1. Where is the Delaware Bay?

The Delaware Bay is formed by the southern tip of New Jersey and the east coast of Delaware. It is where the Delaware River meets the Atlantic Ocean. Students will need to consult an atlas to find the absolute location.

Region

2. Could the Delaware Bay be considered a region? Why or why not? Is it part of a larger region? If so what region?

The Delaware Bay is a large, distinctive area of land and water that could be considered a region. The Delaware Bay is also part of the Mid-Atlantic region that includes New Jersey, Pennsylvania, and Delaware. Some references also include New York as a Mid-Atlantic state.

Place

3. Describe the Delaware Bay.

Description will vary. Some things that students might include are: active harbor habitat for birds, fish, and horseshoe crab; place where freshwater and salt water combine; and sandy shoreline.

Movement

4. Considering geographic location, why is the Delaware Bay the spawning grounds for 90% of the Atlantic horseshoe crabs?

The Delaware Bay juts out into the Atlantic Ocean. It is a natural scoop for collecting horseshoe crabs along a protected sandy shoreline.

Human-Environment Interaction

5. What are some threats to the Delaware Bay horseshoe crab population?

Answers will vary. Some things students should point out are: loss of habitat to development.