

NATIONAL GEOGRAPHIC *Explorer!*

Teacher's Guide Pathfinder Edition April 2010

Dear Educator:

Water is one of Earth's most precious substances—an essential ingredient to life. In the April issue of *EXPLORER*, your students will travel down a mighty river, follow a sea turtle's ocean migration, and venture into supercell storms in the central United States. Readers also will learn about the interconnected elements of the water cycle and its impact on our lives.

"Turtle Travels" follows a female green sea turtle from tiny hatchling to 300-pound adult. Her perilous dash from sandy nest to open sea is the first of many dangerous journeys she makes. Readers follow her life cycle, including her remarkable return to the beach where she was born to lay her eggs. The activity master on p. T7 builds students' academic vocabulary. As they read, students can use the activity master on p. T9 to help them summarize the important phases in a sea turtle's life. You can use the "Below the Sea" classroom poster in your Teacher's Edition to extend students' learning about marine life. We are pleased to present it in cooperation with the DisneyNature film *OCEANS*.

The "Water Ways" feature provides a graphic look at the constant circulation and transformation of Earth's water. In addition to building background for the stories in the issue, you can use the feature to teach key concepts such as Earth systems, states of matter, conservation of matter, and the importance of resource management. Look for the water-cycle diagram reprinted on the classroom poster.

In "Storm Warning," meteorologist Dr. Harold Brooks explains what causes supersize thunderstorms in the central United States. He also describes the work he and other scientists are doing to forecast killer storms and save lives. The activity master on p. T19 prompts readers to make connections between the text and what they know from the world around them.

In "Troubled Waters," readers follow explorer Jonathan Waterman as he traces the Colorado River from its source to the sea. Waterman's mission is to study how the river has been affected by the millions of people who use and depend on it. The activity master on p. T28 will help students synthesize the key information and move from facts to larger issues and ideas.

I invite you and your students to immerse yourselves in the many wonderful resources related to water that National Geographic offers, including the April 2010 issue of *National Geographic* magazine! Also, please be sure to visit <http://environment.nationalgeographic.com/environment/freshwater>.

Sincerely yours,



Jacalyn Mahler
Editor in Chief



Turtle Travels

Teacher's Guide
Pathfinder Edition
April 2010



Curriculum Connections

- Language Arts
- Life Science

Standards Correlations

- Language Arts: Categorize Vocabulary; Preview Text Structure; Summarize Main Ideas; Author's Point of View
- Life Science: Life Cycles; Diversity of Living Organisms and Reproduction; Conservation

Literacy Skills

- Reading Strategy: Summarize
- Vocabulary: Specialized Words (Animal Names)
- Writing: Story Titles; Postcards

Activity Masters

Vocabulary, T7

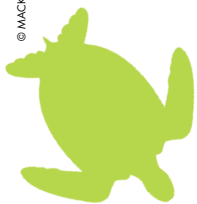
Vocabulary, Answer Key, T8

Access Science Content, T9

Access Science Content, Answer Key, T10

Comprehension Check, T11

Comprehension Check, Answer Key, T12





Turtle Travels



About the Story

In this story, readers follow the life cycle of a green sea turtle from baby hatchling on a beach in Costa Rica through years of growth in the Atlantic Ocean and coastal waters off Florida. As a full-grown adult, the sea turtle travels more than 966 kilometers (600 miles) to return to the beach where she was born and lay her eggs. Students will learn about the many threats green sea turtles face and their remarkable migration.

Fast Facts

- Green sea turtles are large, air-breathing reptiles. They are mainly plant eaters. Their average lifespan is about 80 years. They can reach five feet in length and weigh as much as 317.5 kilograms (700 pounds).
- All sea turtles are endangered. Destruction of feeding and nesting habitats and pollution of the world's oceans are having a serious impact on sea turtle populations.
- The green sea turtle gets its name from the color of its skin and fat, not its shell.
- Unlike land turtles, sea turtles cannot pull their heads into their shells.

Vocabulary

Academic Vocabulary Tell students they are going to learn about the ways a green sea turtle changes as it grows and goes through different stages in its life. Display the words *kitten*, *calf*, and *cub*. Ask students what the words have in common and what each one means. Help them to understand that each word names a type of baby animal. Instead of all animal young being called *babies*, we use specific words for certain young animals.

Next, direct attention to Wordwise on p. 9 and invite students to read the first three definitions to themselves. Say: *When a newborn sea turtle first comes out of its shell, it's called a hatchling. Can you guess why? (It just hatched.) You can see photos of sea turtle hatchlings on p. 4 of the story. Several years later in a sea turtle's life, it's called a juvenile. That's when it's young and not yet an adult. You can see a photo of a juvenile sea turtle on p. 5 of the story.* Explain that the word *juvenile* also can mean a young person.

Then say: *Think about the Wordwise definition for flippers.* Explain that while animal body parts may do a similar job, we use special names for the parts of different animals. For example: *legs and arms, flippers, wings, fins.*

Finally, distribute the activity master on p. T7. Students can work in pairs or small groups to fill in the information. Suggest they write what they know first and then use online or print resources to fill in the other baby animal names. You may want to differentiate the lesson for students wanting an extra challenge. Ask them to also list the group name for each type of animal. For example, *deer-fawn-herd.*

When the activity masters are complete, review answers and discuss any differences between responses. Then discuss how this knowledge can give students “power” in reading and writing.



Turtle Travels

(continued)

Preview Text Structure

Remind students that good readers preview nonfiction texts to get an idea of what the story will be about and what they might learn. Ask volunteers to describe the steps they take when they preview a story. As they mention each step, work through it with students. Then say: *Now that we've had a chance to look through the text and photos, let's think about the way the writer organized the story. This will help you know what to look for and how to track what the writer is saying.*

Based on their preview of the text and photos, lead students to understand that the story is told in **time order**. It follows what happens to a green sea turtle from the time she's born to the time she is an adult and lays her eggs. Ask students to name other texts they've read that were organized in time order sequence.

Access Science Content

Before students begin reading, ask them to imagine how small a newborn green sea turtle is. Have them hold up a ruler and show one-and-a-half inches. Explain that green sea turtles are about this size, or the size of a walnut. Ask students to find things in their desk or around the classroom that are about this size. Then ask: *What dangers do you think a sea turtle this small might face?* Allow time for student responses. Suggest they read the story to find out how a green sea turtle manages to survive different threats and challenges.

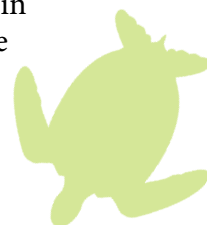
The activity master on p. T9 will guide students to stop, think, and summarize the main ideas as they read the story. Have all students who are able to do so read the story independently and use the activity master to record what they learn.

English Language Learners You may want to use the GIST strategy (Generating Interactions between Schemata and Texts) to help ELL students grasp the most important information in each section of the story. Students read each section as a group or in assigned pairs with more fluent classmates. They then pause at the end of the section and write 5-10 words or phrases they think are "most important" to understanding the text. Display the words students have written down. Then without the text, work together to develop a summary sentence or two using as many of the displayed words as possible. Repeat this process with each section and continue to guide student summary sentences until they are able to develop them independently.

Sum Up

Have students **summarize** the story by sharing the information they recorded on their activity master. See the Answer Key on p. T10 for a listing of key information. Discuss with students how they determined what was important to include in their summary.

Then ask students to stop, think, and sum up the many threats that sea turtles face during their lives. Use the cooperative learning Pair-Share strategy and ask students to turn to a partner and take turns answering the question. Then have pairs report their ideas to the class.



Turtle Travels

(continued)

Assess and Reteach

Materials: Comprehension Check, pp. T11 and T12; “Turtle Travels” story

Assign the Comprehension Check on p. T11. Use the Answer Key to score the assessment. Based on the results, you may want to reteach key concepts. For example, students may not understand the green sea turtles’ traits or their behaviors at different stages in their lives.

Using a Round Robin strategy, divide the class into four groups. Each group will review the text that describes a particular stage in the sea turtle’s life:

Group 1: Birth and First Days (“Out from the Sand” and “From the Sand to Sea,” p. 4)

Group 2: Early Years (“To the Open Ocean,” p. 5)

Group 3: Adulthood (“Growing Up Green” and “Return to Tortuguero,” p. 6)

Group 4: Next Generation (“The Next Generation,” p. 8)

After groups reread their assigned section(s) silently, have them take turns giving one important fact they learned. Allow several minutes so all students have an opportunity to participate. Next, lead a class discussion using these guiding questions:

What can you tell me about how baby green sea turtles are born? (A nest has over 100 eggs. A hatchling uses its caruncle (beak) to tear through its shell. If the sand is warm, more hatchlings will be female.) *What do the hatchlings do as soon as they leave the nest?* (They race across the sand to the ocean to avoid being eaten by predators. They swim for two days to the open ocean.)

During the early years, what do green sea turtles eat? (They eat shrimps, small jellyfish, and snails.) *Why are mats of seaweed important?* (Scientists think turtle hatchlings may float with the mats. The mats give the turtles a place to hide and find food.) *What dangers do hatchlings face?* (plastic, trash, and predators) *How does their shell protect them?* (Its colors blend in with their surroundings. This fools birds flying above and sharks swimming below.)

How do juvenile sea turtles change as they continue to grow? (They move to waters off the Florida coast. They have a bigger shell that protects them. They start eating mostly sea grass and algae.) *What happens next?* (They slowly grow larger and move farther offshore. They tend and eat plots of sea grass.) *How big are adult green sea turtles?* (They weigh about 136 kilograms (300 pounds) and their shells are over a meter (three feet) long.) *How do scientists think they find their way back to Tortuguero Beach to lay eggs?* (The sea turtles may sense changes in Earth’s magnetic field. They also may sense chemicals or odors in the water.)

How do green sea turtles go about making their nests? (They walk up the beach far from the waves. They use their flippers to make a deep pit. At one end, they dig a deeper hole where they drop their eggs. They lay over 100 eggs in each nest. Over two months, they make make several nests.)



Turtle Travels

(continued)

Assess and Reteach, continued

Finally, remind students that green sea turtles face many threats throughout their lives. Getting to the sea safely as a new hatchling is just the first challenge they face. In addition to natural predators such as birds and sharks, they face threats caused by people. Ask students to listen for three of these threats as you read aloud the section “Saving Sea Turtles” on p. 8. Invite volunteers to list the threats for the class. (1. People hunt sea turtles for food. 2. People injure sea turtles with fishing nets and boats. 3. People pollute the oceans where sea turtles live.)

Extend the Learning

Connect Text to Experience Remind students that the story mentions the work the Caribbean Conservation Corporation (CCC) is doing to protect sea turtles. Students can visit the CCC website at www.cccturtle.org to learn more about sea turtles and current conservation projects. Your class may enjoy following a tagged sea turtle on its migration. Live updates can be accessed at www.cccturtle.org/satelliteturtles.

Think Like a Scientist Tell students that scientists often use what they learn about an animal in a particular situation to form an idea that applies to many situations. They use what they observe, together with their personal knowledge and experience, and think about how the facts fit together.

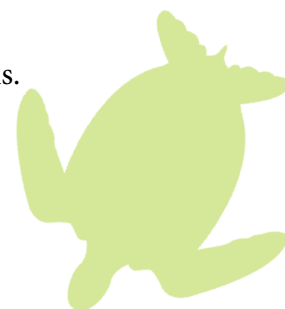
Invite interested students to work in groups to discuss the following “big” science questions. Encourage them to use what they learned in “Turtle Travels” as a starting point for their conversations.

- Why do some animals lay as many as 100 eggs at a time?
- How can light from buildings be a form of “pollution”?
- How does plastic and trash wind up in the middle of the ocean?
- Why would it be safer for a small animal to grow in the open ocean than near the coast?
- What kinds of information might scientists learn by tagging and tracking animals?

Author’s Point of View Remind students that all authors have a purpose for writing. The title they choose often gives us the first snapshot of their point of view. Ask why they think the author chose “Turtle Travels” for the title of this story. Challenge students to think of three other possible titles and prepare to defend their ideas. Invite the class to vote on their favorites.

Critical Thinking Plastic bags and plastic six-pack holders are two deadly threats to a sea turtle. If people could recycle or reuse these items, plastic would end up in our oceans less frequently. Ask students to consider the problem and work in small groups to recommend better ways to recycle or reuse these items. Then highlight student solutions with a classroom Design Fair where student ideas are shared.

Write a Postcard Tell students to imagine they are scientists observing sea turtles on Tortuguero Beach. Ask them to write a postcard. On the front of the card, they should include a picture. On the back, they should write a short note to a friend or family member telling what they found most interesting about sea turtles. Encourage them to include at least three important facts. You may need to help students practice addressing the postcard properly. If mailing postcards isn’t possible, students can personally deliver them.



Animal Names

Read the animal name in each row. Then write the name of its baby.

BONUS: If you know the name for a group of animals, write it in the last column.

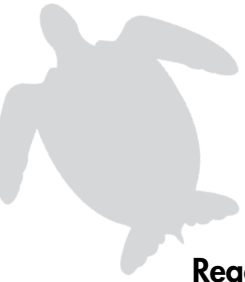
Animal	Name for Baby	Name for Group
bear	cub	sleuth
cow		
deer		
duck		
frog		
horse		
kangaroo		
penguin		
shark		
turtle		
whale		
wolf		

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Animal	Name for Baby	Name for Group
bear	cub	slleuth
cow	calf	herd
deer	fawn	herd/mob
duck	duckling	flock
frog	tadpole	army/colony
horse	foal	stable/herd
kangaroo	joey	troop
penguin	chick	rookery
shark	pup	school
turtle	hatchling	bale
whale	calf	pod
wolf	pup	pack



Turtle Travels



Read each section of the story. Then stop to sum up what you learn about green sea turtles.

STOP, THINK, SUM IT UP

Birth and First Days, p. 4

Early Years, p. 5

Adulthood, p. 6

Next Generation, p. 8



Turtle Travels

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STOP, THINK, SUM IT UP

Birth and First Days, p. 4

Clutch of over 100 eggs are buried in the sand; hatchlings use caruncle to tear their way through their shells; they struggle up through the sand and race to the ocean to avoid predators; hatchlings swim for several days to reach the open sea.

Early Years, p. 5

Scientists know little about these “lost years”; hatchlings may float with seaweed; seaweed provides food and a place to hide from predators; may eat small shrimps, snails, or jellyfish; hatchlings spend several years at sea growing into juveniles.

Adulthood, p. 6

Move to Florida’s coastal waters; feed mostly on sea grass (turtle grass) and algae; turtle fat turns green from their diet; sleep under rocks and ledges; can hold their breath for hours; grow slowly until 26 to 30 years old; shell is then 3 feet long and turtle weighs 300 pounds.

Next Generation, p. 8

Females return to beach where they were born to lay eggs; may find their way using Earth’s magnetic field or sensing chemicals and odors; make nests on beach, safe from high tides; dig for hours with flippers to make a wide pit with deep hole at one end; lay eggs in deep part; cover nest with sand; come back twice to lay eggs over 4 weeks; new hatchlings born in about two months.

COMPREHENSION CHECK

Answer these questions about “Turtle Travels.” For items 1–4, fill in the circle by the correct answer. Write your answer to item 5.

1. After it hatches, a baby sea turtle must—
 - (A) avoid being eaten
 - (B) get to the ocean
 - (C) swim for two days
 - (D) all of the above

2. How does a green sea turtle’s shell help it survive?
 - (A) It makes other animals sick if they touch it.
 - (B) It helps the turtle blend in.
 - (C) It helps the turtle sink to the bottom of the ocean.
 - (D) It scares predators away.

3. Which of these statements is not true about green sea turtles?
 - (A) They hatch in large groups.
 - (B) Their diets change as they grow.
 - (C) They spend their lives in the open ocean.
 - (D) They get their name from the color of their fat.

4. In the story, where does the green sea turtle make her nest?
 - (A) in the warm water near shore
 - (B) on the beach where she was born
 - (C) under rocks and ledges
 - (D) in a mat of *sargassum*

5. “Turtle Travels” follows one green sea turtle through the first 26 years of her life. Why does the author call her a “lucky traveler”?

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5. “Turtle Travels” follows one green sea turtle through the first 26 years of her life.
Why does the author call her a “lucky traveler”?

Sample top-scoring response: The author calls the turtle a “lucky traveler” because she faces dangers
at every stage in her life, and she survives them all. First she must crawl from her nest and avoid being
eaten. She has to swim for days until she reaches the open ocean. As she grows, she’s always in danger
of being eaten by predators or getting injured or caught by people. She finally finds her way back to
Tortuguero Beach when it’s time to lay her eggs.

STORM WARNING

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Curriculum Connections

- Language Arts
- Earth Science
- Geography

Standards Correlations

- Language Arts: Make Connections
- Earth Science: Understand the Water Cycle; Understand Causes of Hazardous Weather
- Geography: Interpret Maps; Understand Interaction of Landforms and Weather

Literacy Skills

- Reading: Plan and Monitor Your Reading
- Vocabulary: Hyphenated Adjectives
- Writing: Creative Writing; Safety Tips

Activity Masters

- Make Connections, T19
- Comprehension Check, T20
- Comprehension Check, Answer Key, T21

STORM WARNING

About the Story

TORNADO COMING! These words can be frightening, but meteorologists are working hard to understand how dangerous storms form and where they are likely to strike. In this story, Dr. Harold Brooks teaches readers about thunderstorms, severe storms, and supercells. He also introduces readers to the science of storm forecasting and storm-warning systems. Together with the “Water Ways” feature on pp. 10-11, you can use this story to help students explore the connection between Earth’s water cycle and weather patterns.

Fast Facts

- Tornadoes travel at an average speed of 48 kilometers per hour (30 mph) with occasional bursts of up to 113 kph (70 mph). They can last as long as one hour but rarely travel more than ten kilometers (six miles).
- A tornado’s funnel cloud is transparent. The cloud becomes visible when water droplets from the moist air condense or when dust and debris are taken up.
- Waterspouts are tornadoes that form over warm water. They can cause damage if they move onshore.
- These are among the signs of a possible approaching tornado: dark or green-colored sky; large, dark, low-lying clouds; large hail; a loud roar like a freight train.

Vocabulary

Hyphenated Adjectives Display the following sentence: *A fast-moving storm hit the Midwest.* After they read the sentence, ask students to tell what it means in their own words. Underline the hyphenated word. Explain that a hyphen can be used to join two words together such as *fast* and *moving*. When the words are combined, they form a new word. In this case, they form an adjective that describes a storm. Invite students to suggest other things that could be described as “fast-moving.” (Sample responses: a car, a jet, army, herd of animals, etc.)

Invite pairs of students to scan the story for other examples of hyphenated adjectives. Ask them to record each word with the noun that it describes. Have partners discuss what each adjective means. Then call on students to share their responses. (Hyphenated adjectives in the story: *58,000-foot-tall*, *hurricane-force*, *storm-making*, *wide-open*, *softball-size*, *baseball-size*, *high-tech*, *three-minute*.)

STORM WARNING

(continued)

Preview/Tap Into Prior Knowledge

Fast Write Have students preview the story by reading the headline and introduction on pp. 12-13 and viewing all the photographs and captions. Tell them they will be doing a Fast Write of all the things they know about storms. Explain that this is a way to tap into information they may not even realize they know and to make connections to their own experiences.

Before students begin to write, explain that they should not worry about writing complete sentences or using perfect spelling or punctuation. Say: *Just write down everything that comes to mind after looking at the title page, photographs, and reflecting on your own experiences with storms. Keep writing until I ask you to stop. You will have about two minutes.* **NOTE: This activity may not be appropriate for students who have had direct experiences with extreme storms and suffered personal loss.**

When their Fast Writes are completed, have students turn to a partner and read some of their thoughts and personal reflections. Invite several students to share their work with the class. Lead students to listen for repeated words, experiences, or ideas. You may want to display these for students to refer to.

Finally, have students turn their Fast Write papers over and set a purpose for reading this story. Say: *Think about why you want to read this story and what you want to learn. Write your answer in one or two sentences on the back of your paper.*

Access Science Content

Build Background You can use the “Water Ways” feature on pp. 10-11 to build background before students read “Storm Warning.” Ask students to raise their hands if they have ever been in a storm with thunder and lightning. Display the word *thunderstorm* in the center of a concept web and read it aloud. Then display these words in a cluster: *rain, hail, lightning, and thunder*. Say: *These are all ingredients of a thunderstorm. But let’s look at how these storms begin.*

Have volunteers take turns reading the text on p. 10 aloud. Then work through the diagram with students, beginning with precipitation. After you discuss the information in each label, invite volunteers to talk through the entire water cycle in their own words. You may want to use the following prompts to help students better understand the constant circulation and transformation of water:

- Where does water go when it disappears or evaporates?
- What role does the sun play?
- Where does water come from when it rains?
- How are clouds formed?
- What are some examples of surface water?
- At what points in the water cycle is water a solid, liquid, and gas?
- On p. 10, what does “There’s no more” mean?

STORM WARNING

(continued)

Access Science Content, continued

Invite students to read “Storm Warning,” keeping in mind their purpose for reading. Remind them that they learned about the water cycle and ask: *Where does the moisture in clouds come from?* As students respond, help them understand that as the sun heats water in rivers, lakes, or the ocean, water molecules evaporate, or turn into a gas and rise into the atmosphere.

Display the words *thunderstorm*, *severe storm*, and *supercell*. Then ask: *What are clouds made of?* Lead students to understand that as the evaporated water rises, it cools and condenses, or becomes a liquid again in the form of water droplets that collect and form clouds.

Next, ask: *What causes rain?* Tell students that as the water droplets in clouds grow, they become heavy. When they get too heavy they fall back to Earth in a form of precipitation. It might be rain, hail, sleet, or snow depending on the temperature of the air.

Point out that they learned that not all storms are the same. Refer back to the three displayed types of storms and explain that although all storms are part of the water cycle and most are beneficial, some storms can become quite violent and dangerous.

Below the phrase *severe storm*, display these related details: *winds at 58 mph, golf ball-size hail, tornadoes*. Explain that it takes the right ingredients for the worst thunderstorms to form, and in some parts of the United States, all these ingredients come together. The central United States provides the perfect location for severe storms because of the open plains, cold air from the Rocky Mountains, and the warm moist air from the Gulf of Mexico. To help students visualize these features, you may want to display a topographical map. You can access an interactive map at <http://maps.nationalgeographic.com/map-machine#s=h&c=21.28937435586042,%200&z=1>.

Below the word *supercell*, display these related details: *winds at 175+ mph, gigantic clouds, huge hail, spinning air currents, funnel clouds*. Explain that supercells can be deadly and destructive.

Finally, tell students that in the 1970s, Ted Fujita developed a scale to classify the intensity of a tornado. Display or share this scale with the class. Then ask: *What do scientists learn from rating tornado damage? How can we make people safer during a tornado?* Accept responses and invite deeper discussion.

STORM WARNING

(continued)

Sum Up

Distribute the activity master on p. T19. Ask students to think of five things they learned about storms and to list these in the first column of the chart. Then ask them to connect each thing they read to their own lives or to events in their community or the world. You may want to model **making connections** for students. For example, say: *I've seen movies and read about sirens that warn people that a tornado is coming. In the story, I learned that meteorologists now can warn people about 13 minutes before a tornado strikes. Now I understand how people know when to sound those warning sirens and how these warnings save lives by giving people time to get to a safe place.* When students have completed the charts, ask them to share one thing they learned and the connection they made.

Assess and Reteach

Materials: Comprehension Check, pp. T20 and T21; “Storm Warning” story

Assign the Comprehension Check for “Storm Warning” on p. T20. Use the Answer Key to score the assessment. Based on the results, you may want to reteach key science concepts. For example, students may be unclear about how a thunderstorm forms and the differences between severe storms and a supercell. Divide the class into four groups. Assign each group one of the sections on pp. 14-15. Ask each group to read and discuss the section. Group members should agree on the main ideas and select one student to report back to the class.

Use these questions to review the connection between storms and the water cycle:

- Where does water go from a puddle on the street?
- What happens to the water in wet clothes you put in the dryer?

Lead students to understand that the process of water disappearing into the air is called evaporation. Point out that it is heat that makes the water turn into a vapor or gas.

Next, ask students to consider what happens to the evaporated water.

- What happens to the evaporated water when it rises in the air and cools?
- What is inside a cloud?

Point out that as the water vapor rises and reaches cooler air, it condenses and turns into water droplets. This is what forms clouds. The droplets continue to grow and get heavy. This process is called condensation.

Then say, let's consider what happens next.

- How does rain happen?
- Why do clouds sometimes drop snow or hail?
- When can a severe storm or tornado occur?

Help students understand that when the water droplets in clouds become so large that the air or wind cannot keep them in the atmosphere any longer, they begin to fall as precipitation. This can be in the form of rain, sleet, hail, or snow depending upon the air temperature. Also, under the right conditions, tornadoes can develop when rotating winds are squeezed and start to spin faster. This creates a funnel of wind. When it touches the ground, it becomes a tornado.

Wrap up by emphasizing that scientists are still working hard to learn more about tornadoes to help warn people before they touch ground. Ask students what they learned about ways scientists currently follow storms.

STORM WARNING

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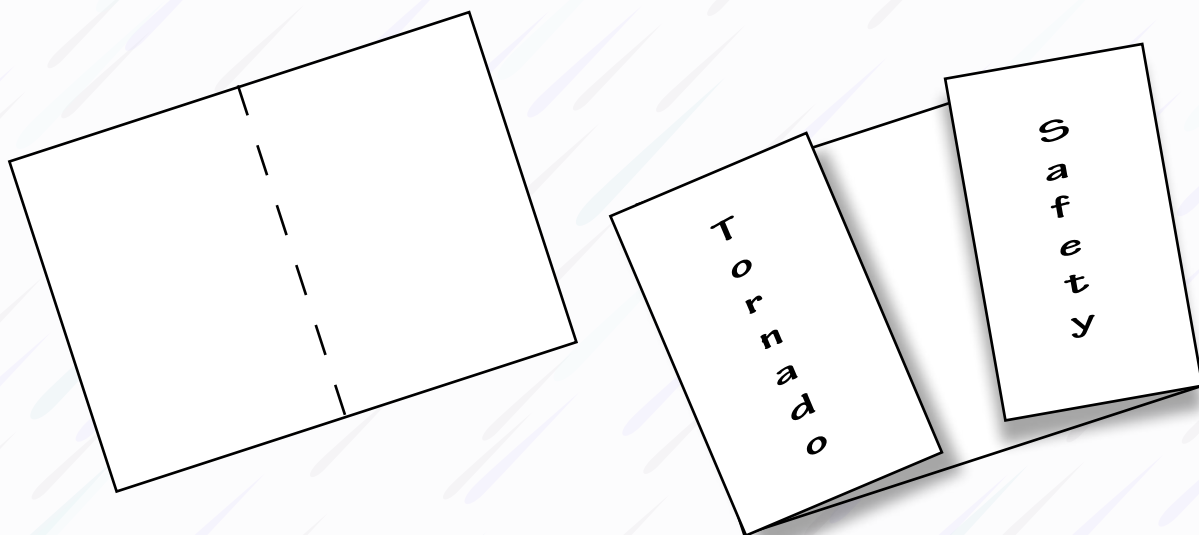
Extend the Learning

Creative Writing Encourage students to apply what they have learned about the water cycle by imagining they are a drop of water and writing a short “autobiography.” To learn more about the water cycle, they can visit the U.S. Environmental Protection Agency Water Sourcebook Series website at <http://www.epa.gov/safewater/kids/wsb/index.html> or Franklin Institute’s Water in the City website at <http://www.fi.edu/city/water/>.

Storm Safety Tell students that improving the warning system for tornadoes is very important. But equally important is knowing what to do in case you find yourself in a severe storm. Have students research the various safety tips that are recommended if a tornado or severe storm is approaching your area. You can adapt this activity for extreme weather that may occur in your state or region such as hurricanes or floods. Students can present these important tips in a Two-Fold Book. (See sketch below)

Instructions

- Fold an 8.5x11 or 11x17 plain paper in half horizontally. Do not crease the fold. Make a small pencil mark to show the mid-point.
- Fold the outer edges inward to meet at the mid-point, creating two flaps or outer doors.
- On the flaps, think of a title for your safety tips book.
- Inside the flaps on the large area of the paper, neatly list the safety precautions anyone caught in a tornado or severe storm should follow.



Tornado Safety Help students visualize the area that is most susceptible to tornadoes in the United States by having them label the states that make up Tornado Alley on a map. Using www.nationalgeographic.com/xpeditions/atlas, you can print out an outline map of the United States. Challenge students to find in the story the area described as Tornado Alley and outline that section in red.

STORM WARNING

In column 1, write five things you learned about storms. What does each one remind you of? In column 2, connect the information to your experiences or what you know from news stories, TV, school, or movies.

What I Learned	How It Connects
1.	1.
2.	2.
3.	3.
4.	4.
5.	5.

COMPREHENSION CHECK

Answer these questions about “Storm Warnings” and “Water Ways.” For items 1-4, fill in the circle by the correct answer. Write your answer to item 5.

1. Which of these is not true about thunderstorms?
 - (A) They make rain and lightning.
 - (B) They heat the air, which causes a loud sound.
 - (C) They start when moist, warm air rises.
 - (D) They occur only in the central United States.

2. What makes a supercell storm so dangerous?
 - (A) Its winds are fast and spin in a circle.
 - (B) It lasts longer than a typical thunderstorm.
 - (C) It drops a huge amount of rain.
 - (D) all of the above

3. How has better weather forecasting saved lives?
 - (A) It gives people more time to find shelter.
 - (B) It tells people exactly where the tornadoes will hit.
 - (C) It stops lightning from striking Earth.
 - (D) It prevents severe weather from spreading.

4. Which of these is most useful in helping meteorologists forecast killer storms?
 - (A) chasing storms
 - (B) following weather balloons
 - (C) observing radar
 - (D) observing clouds

5. Explain how thunderstorms are part of Earth’s water cycle. Use the information in “Water Ways” to help you answer.

COMPREHENSION CHECK

Answer these questions about “Storm Warning” and Water Ways.” For items 1–4, fill in the circle by the correct answer. Write your answer to item 5.

1. Which of these is not true about thunderstorms?
☐ (A) They make rain and lightning.
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5. Explain how thunderstorms are part of Earth’s water cycle. Use the information in “Water Ways” to help you answer.

Sample top-scoring response: Thunderstorms produce precipitation, which is part of Earth’s water cycle. In the water cycle, water evaporates from Earth’s surface and becomes water vapor.

The vapor rises and cools. Then it becomes water droplets that cling to dust. This forms clouds.

The clouds drop rain, snow, or hail on the ground. This is what happens in a thunderstorm.

Troubled Waters

Teacher's Guide
Pathfinder Edition
April 2010

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Curriculum Connections

- Language Arts
- Earth Science
- Geography

Standards Correlations

- Language Arts: Make Predictions and Set Purpose for Reading
- Geography: Understand How Human Actions Modify Physical Environment; Analyze Management of Natural Resources
- Earth Science: Recognize Earth's Surface Is Changed by Physical and Chemical Weathering, Erosion, and Deposition

Literacy Skills

- Reading Strategy: Synthesize Information and Form Generalizations
- Vocabulary: Develop Academic Vocabulary
- Writing: Critical Thinking; Journal Writing

Activity Masters

- Preview and Predict, T27
- Synthesize, T28
- Synthesize, Answer Key, T29
- Comprehension Check, T30
- Comprehension Check, Answer Key, T31

Troubled Waters



About the Story

In this story, students join explorer Jonathan Waterman as he follows the path of the mighty Colorado River from its source in the Rocky Mountains to the Gulf of California. Readers learn about the natural history of the river and how its water has been diverted and used to create reservoirs, irrigate crops, produce hydroelectricity, and control flooding. The story also examines how the river's ecosystems have been affected by reduced water levels and reduced amounts of silt.

Fast Facts

- To learn more about the issues related to fresh water, your class can visit <http://environment.nationalgeographic.com/environment/freshwater>
- Together with their families, students can read more about Waterman's expedition in the soon-to-be-published National Geographic book *Running Dry*. The National Geographic children's book *Not a Drop to Drink: Water for a Thirsty World* by Michael Burgan is another excellent resource.
- The Colorado River supplies water to over 25 million people and irrigates 3.5 million acres of farmland.
- The Grand Canyon took 3-6 million years to form and still is being changed by erosion.
- Within the Grand Canyon, the river averages 91 meters (300 feet) wide, 30 meters (100 feet) deep, and flows at an average speed of four miles an hour.
- Hydroelectric power is one of the cleaner sources of electricity. It offsets the burning of 22 billion gallons of oil or 22 million tons of coal. It doesn't produce air pollution or waste products.

Vocabulary

Teach Key Concept Vocabulary Display these key words from the story: *source*, *inherit*, *dam*, *resource*, and *canal*. Use the following steps to teach the word *source*:

1. **Pronounce** Tell students when they read "Troubled Waters," they are going to follow an explorer as he travels a river from its source to the place its waters end. Ask students to say the word *source* aloud with you. Then have students pronounce it again, clapping once for one syllable: *source*.
2. **Explain** Tell students that the source of a river is the place it begins. Say: *Based on what you learned about the water cycle, where does the water in rivers come from?* (melted snow and rainwater) *The source of the Colorado River is high in the Rocky Mountains where snow melts and runs down steep slopes into streams.*
3. **Engage** Ask students to help you complete this sentence: *The explorer wanted to start at the beginning of the river, so he went to the _____. (source)*
4. **Involve** Say: *Listen to this sentence and tell me if I'm using the word source correctly. For centuries, no one knew exactly where the source of the Nile River was.* Ask students for a thumbs-up or thumbs-down. Explain that those who voted 'yes' are correct because *source* refers to the place where a river begins and this is often a very remote place up in the mountains that's hard for people to reach.
5. **Elaborate** Ask: *In what types of texts would you expect to find the word source?* Accept responses from students. Reinforce logical answers such as geography textbooks, atlases, or adventure stories.

Repeat the process to introduce the other key concept vocabulary.

Troubled Waters

(continued)

Preview and Make Predictions

Display and discuss these questions: *How do you preview a story? Why is it good to preview a story before you read it?* Point out that the headline and opening photo are a good starting point. To get a real snapshot of what the story is going to be about, students should look at the headings, remaining photos and captions, and boldfaced words. Distribute the activity master on p. T27. Ask students to read the directions and follow the steps to preview “Troubled Waters.”

Review items 1-4 on the completed activity masters. Point out that students now have taken in many bits of information. Read aloud item 5 and explain that before they make their predictions they should ask themselves:

- What did I learn from the photos and captions?
- What clues do the section headings and story title give me?
- Why are the boldfaced words important in this story?

Have students complete item 5. Then say: *As you read, look for information that tells you your prediction is correct. You may also come across new information and need to rethink your original prediction.*

Access Geography Content

Have students read “Troubled Waters” independently or in pairs. Suggest that as they read, they think about how the information fits together. What big ideas can they take away from the story?

After they have read “Troubled Waters,” revisit the story to make sure students understand the key concepts.

Patterns of Earth’s Surface Have volunteers recount some of the writer’s descriptions of the river and the landscape it flows through, including the Grand Canyon. Explain the process of weathering and erosion: powerful rivers carve their way through layers of Earth, breaking off and carrying away rock and soil. The Colorado River has been eroding the walls of the Grand Canyon for millions of years. It is now the world’s largest canyon.

Use and Management of Natural Resources Ask students to think about rivers in your state and region and to tell how people have used the rivers. Lead them to understand that rivers provide people with transportation, food, water, and recreation. Explain that today, many rivers are managed in different ways to maximize their benefits. The Colorado River is a perfect example. Ask: *How do people use the Colorado River?* Students should mention that millions of people depend on it for drinking water, irrigation, and hydroelectricity. Going further, ask students what impact these activities have had on the river and the plants and animals that live near it. If necessary, remind them what they read about flooding being good for the ecosystem of a river and the role of silt in supplying nutrients to plants and animals. Finally, ask: *What did Waterman see on his journey that gave him hope for the river’s future?*

Troubled Waters

(continued)

Sum Up

As students read the story, they learned many different things about the Colorado River's natural history and the human activity along its course. Help them **synthesize** the facts and story content to identify the larger ideas and issues. Say: *Now's a good time for us to move from facts to ideas. Consider what the Colorado River was like in the past and how it is different now. This raises an important question and one that Waterman himself wanted to answer: How will the continued use of the river impact ecosystems and people?* Accept all reasonable responses and encourage students to elaborate.

Next, distribute the Pro/Con T-Chart on p. T28. Students can work with a partner to list the positive and negative effects of the dams that have been built along the river. Pairs then can use their completed T-Chart to answer the question at the bottom of the activity master. Invite volunteers to share their responses.

Assess and Reteach

Materials: Comprehension Check, pp. T30 and T31; "Troubled Waters" story

Assign the Comprehension Check for "Troubled Waters" on p. T30. Use the Answer Key to score the assessment. Based on the results, you may want to reteach key concepts.

To guide students' review, you can use the cooperative learning Jigsaw strategy. Divide the class into four groups, then number off students in each group from 1 to 4. Designate an area for students with the same number to meet and discuss their assigned question. Appoint a recorder and leader for each group. Explain that as they discuss the answers to the question, they should note the pages or sentences from the story that support their response.

1. How would you describe the path of the Colorado River from beginning to end?
2. What are the ways people depend on the Colorado River?
3. How do people use water to make electricity?
4. Is the Colorado River a healthy river? Explain why or why not.

After sufficient time is allowed for group discussions, students should report back to their original groups. There, students should take turns going through each question, sharing what they learned from their focus groups.

Finally, have each group consider this question: *What situations might come up in the future that could impact how the Colorado River is used?* (Possible answers: too many people needing water and electricity from the river, climate changes producing less snow and rain to support the river, water levels drop so the lakes cannot be used for recreation, etc.)

Troubled Waters

(continued)

Extend the Learning

An Explorer's Journal Ask students to imagine they are Junior National Geographic Explorers. Ask them to think about the journey Jonathan Waterman took along the Colorado River. Invite them to “retrace” his adventure by writing journal entries for two days of the expedition. Envisioning that they were there, have students describe where they were, what they saw, and what they did on those two days. Emphasize that explorers must rely on detailed notes to keep track of important information they learn in the field. Students may enjoy creating drawings or downloading photographs that illustrate their written “observations.”

Geography Riddles Tell students you are going to tell them a riddle with three clues. Say: *Knock, knock. Where am I? The first part of this place's name is something a dog wears around its neck. The next syllable is what people use to catch fish. The last syllable is what you need to make pizza crust.* Have students put the clues together to come up with the answer to the riddle (collar + rod + dough = Colorado). Challenge students to think of riddles for other places mentioned in the story. (Special thanks to Brady and Sam Ettenson and The Brain Puzzle Book for this activity idea.)

Interpret and Interact with Maps Display a map of the Colorado River Basin. Explain to students that the Colorado River is one of the longest rivers in the United States. Point out that there are other important rivers that extend across various parts of the country. Invite students to research online or in print the lengths and locations of the following ten rivers: Missouri (2,540 miles), Mississippi (2,340 miles), Colorado (1,450 miles), St. Lawrence (1,900 miles), Snake (1,040 miles), Ohio (1,310 miles), Rio Grande (1,900 miles), Columbia (1,240 miles), Tennessee (886 miles), and Yellowstone (692 miles). Then have students create a bar graph to compare the lengths of these ten important U.S. rivers.

To extend this activity, students can compare the lengths of these U.S. rivers to other major rivers in the world such as the Nile (4,132 miles), the Amazon (4,000 miles), and the Yangtze (3,915 miles).

Troubled Waters

Preview

Follow these steps to preview the story. Check off each step after you complete it.

- ☒ ☐ Read the headline and deck on p. 19.
- ☒ ☐ Read the headings and photo captions.
- ☒ ☐ Look for the words in bold type. Read their definitions in Wordwise on p. 22.

Now write 4 things you learned from your preview.

1. _____
2. _____
3. _____
4. _____

Predict

Make a prediction.

5. I think this story is about _____
- _____

Troubled Waters

After you read the story, think about how people benefit from the dams along the Colorado River. Write the benefits under Pro. Then think about the negative effects the dams have. Write these under Con.

Pro

Con

Now put together what you've learned to answer this question.

What can people do to make sure that the Colorado River is around for future generations?

Troubled Waters

After you read the story, think about how people benefit from the dams along the Colorado River. Write the benefits under Pro. Then think about the negative effects the dams have. Write these under Con.

Pro	Con
Make reservoirs for drinking water and recreation	Reduce water levels
Produce electricity	Trap silt
Prevent floods	Prevent floods

Now put together what you've learned to answer this question.

What can people do to make sure that the Colorado River is around for future generations?

Sample top-scoring response: People need to make sure they don't use more water than the Colorado can provide. They have to balance what they need for drinking, growing crops, and producing electricity with the water levels in the river. People also need to think about what is good for the plants and animals that live along the river.

COMPREHENSION CHECK

Answer these questions about "Troubled Waters." For items 1–4, fill in the circle by the correct answer. Write your answer to item 5.

1. Why does less and less water flow into the headwaters of the Colorado River?
☐ (A) Less snow falls in the Rocky Mountains.
☐ (B) The river floods sometimes.
☐ (C) Water levels in the river are falling.
☐ (D) Dams slow down the river's flow.
2. How do people use water from the Colorado River?
☐ (A) electrical power
☐ (B) water for crops
☐ (C) drinking water for cities
☐ (D) all of the above
3. Where does the energy in hydroelectric power come from?
☐ (A) steep canyons
☐ (B) ancient rocks
☐ (C) moving water
☐ (D) pipelines and canals
4. What signs of hope did Jonathan Waterman see along the Colorado River?
☐ (A) big dams and lakes
☐ (B) cliffs and white-water rapids
☐ (C) wildlife and restored wetlands
☐ (D) silt and red dirt
5. Think of one positive effect the dams on the Colorado River have had. Think of one negative effect the dams have had. Write a paragraph that explains these effects.

COMPREHENSION CHECK

Answer these questions about "Troubled Waters." For items 1–4, fill in the circle by the correct answer. Write your answer to item 5.

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☐ A big dams and lakes
☐ B cliffs and white-water rapids
☒ C wildlife and restored wetlands
☐ D silt and red dirt
5. Think of one positive effect the dams on the Colorado River have had. Think of one negative effect the dams have had. Write a paragraph that explains these effects.

Sample top-scoring response: One negative effect dams have on the Colorado River is

that they trap the rich silt in the lakes above the dams, so the silt can't be carried to the land

to nourish plants. One positive effect of dams is that they control flooding [or] they produce

hydroelectric power for many people.