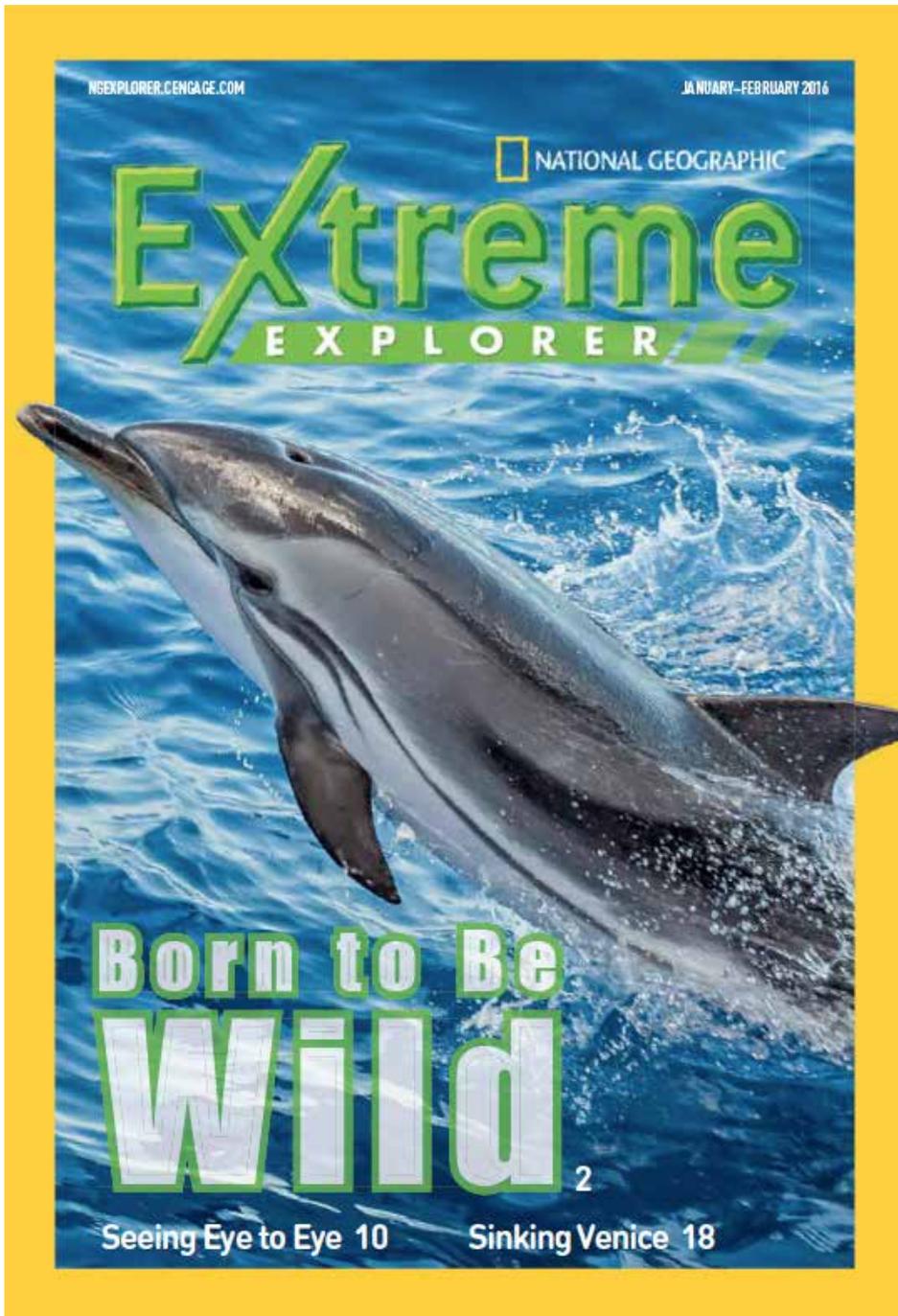


# TEACHER'S GUIDE



## Extreme January–February 2016

### In This Guide

In this guide, you will find language arts and science lessons for the stories in the January–February issue of *EXTREME EXPLORER*.

### Explorer Magazine

*EXTREME EXPLORER* magazine is a classroom magazine specifically written for middle school students. The magazine contains a grade-appropriate reading experience, develops literacy skills, and teaches standards-based science content. Great storytelling and stunning photographs teach your students about our planet and the people, plants, and animals that live on it. Use *EXTREME EXPLORER* in your classroom to encourage students to explore our world and make it a better place.

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## LANGUAGE ARTS

### Objective

- Students will use context clues to infer the meaning of unfamiliar words.
- Students will distinguish claims that are supported by reasons and evidence from claims that are not.
- Students will determine the theme or central message of a text and analyze its development.

### Resources

- Vocabulary Activity Master (page 6)
- Language Arts Activity (page 7)

### Summary

The article “Born to be Wild” examines the evidence for dolphin intelligence and features the re-training of captive dolphins that will be released back into the wild.

## BUILD VOCABULARY AND CONCEPTS

- **behavior**
- **echolocate**
- **captivity**
- **pod**

Display the vocabulary words. Remind students that using context clues such as the sentences before and after an unknown word and photographs on the page can help them figure out what the unfamiliar word means.

Give each student a copy of the **Vocabulary Activity Master**. Instruct students to add each vocabulary term from the article. Then, in the second column, have them scan the article and record text and photo clues that are related to each vocabulary term. They should then devise their own definitions in the third column.

Have students increase their depth of knowledge by joining in think-pair-shares of what they have written in column two. To promote higher order thinking and analysis, students should brainstorm about each vocabulary word in turn. The pairs can record their observations about each word in the fourth column.

As a summary, each student should fill in the last column of the **Vocabulary Activity Master** with a definition that is a synthesis of their observations and brainstorming and then compare it to the definition in the WordWise.

### READ

Remind students that this article explores the relationship between dolphin intelligence and the reasonableness of captivity. Throughout the article, the writer uses language to persuade readers of her point of view. Arguments revolve around claims that can be supported with evidence. Help students develop strategies to evaluate an author’s arguments by distinguishing between claims that are supported by evidence and those that are not.

Display pages 5 of the **Projectable Magazine**. If needed, model how to evaluate an author’s argument using the “A Day in the Life” and “Life Inland” passages. **Say:** *When I read the passage “A Day in the Life,” I get a feeling that a wild dolphin must live an exciting, busy life. The tone of the words the author uses is very light and sunny, such as frolic, dart away, give chase, game delights, zooms towards, and acrobatic leaps. Compare those positive, energetic words with the words found in “Life Inland,” including languish, captured, cramped, sick and underweight, forgotten how to, and stopped echolocating, which relays a message that the author believes that life in captivity is harmful in most every way.*

Remind students to find an author’s position they can ask themselves some questions:

- What main idea is the author trying to convince me about?
- Does the author provide support and examples to back up this point of view?
- Do the stated reasons and support persuade me to accept the author’s claims or point of view?
- What additional support might the author have included that would have convinced me to agree with the author’s point of view?

### READ

(continued)

Give each student a copy of the **Language Arts Activity Master**. Have students read pages 7–8 on their own. As they do, instruct them use text coding to identify passages in which the author makes a claim with a C and information that supports a claim with an S. Students should then use what they've learned to complete the chart.

### TURN AND TALK

Have students compare their **Language Arts Activity Master** with a partner to observe differences and similarities. If partners used the same information to come to different understandings, encourage them to reread the text and review the information together.

#### Supporting Claims

Remind students that individual reading passages should support the claims made in the article. Have students review their Language Arts Activity Master together. Did students find the same examples of claims that were strongly supported? Did they disagree on the level of support that a claim was given? Have students explain their reasoning to their partners. Most students will come to a consensus on how well the author supported the claims that were made in the article. Have students turn and talk to discuss how the author's claims influences the overall article.

#### Theme or Central Message

Have students turn and talk with these or other prompts:

- What is the theme or central message the author tries to get across?
- How does the main idea of each blue-headed section support the theme? Discuss an example.
- How do the main ideas of the individual paragraphs help build toward the theme?

**Say:** *One way to determine the theme or central idea of a text passage is to outline the passage. In the outline you would identify each main idea and the details that support it. After your outline is finished you would examine each of the parts to see how they support and lead to the theme or central idea of the article as a whole. Have teams of students outline the various sections of Born to be Wild. Display the group-derived main idea of each section and use them to discuss the author's development of the article's theme. What strategy did the author follow to build support for the theme or central idea? How effective was this effort? In which areas could the support have been stronger? How could the author have strengthened those areas?*

### WRITE AND ASSESS

You may want students to write about what they learned to assess understanding. Encourage students to reflect upon what they read and how it affected their ideas about the dolphins living in the wild and captivity.

- How are the daily lives of dolphins living in the wild and captive dolphins similar and different?
- What behaviors have to be changed before captive dolphins can be returned to the wild?
- What evidence can you cite about dolphins' ability to "figure things out"?
- What surprised you about what you read?

## SCIENCE

### Objectives

- Students will make generalizations about how dolphin adaptations aid survival in the wild.
- Students will compare and contrast behaviors of wild dolphins with those of captive dolphins.
- Students will identify challenges associated with retraining captive dolphins for the wild and solutions for those problems.

### Resources

- Science Activity Master (page 8)
- "Different Dolphins" poster (Teacher's Edition)
- Science Quiz Master (page 9)

### Science Background

Dolphins are marine mammals that mostly live in temperate and tropic zones where the waters are warmer, although some species prefer to live in colder waters. They live in all of the oceans and a handful of species live in freshwater. There are around 40 different species of dolphins ranging in size from the Maui's dolphin (1.7 meters and 50 kilograms) to the orca or killer whale (9.5 meters and 10 metric tons).

Dolphins are very social. They typically live in pods of ten or more individuals. When in areas of abundant food, they form superpods of up to a thousand dolphins. Dolphins have been known to teach their young how to use tools and other learned behaviors.

The question of keeping marine mammals is hotly debated at this time. Many reputable parks and aquariums do so, with very knowledgeable and skilled staff caring for the animals. These contrast greatly with the conditions from which the dolphins featured in the article were rescued.

Currently, 529 dolphins, including 25 orcas, are captive in the U.S., with about 80% of those being born in captivity. Japan holds similar numbers although fewer orcas, but most were born in the wild.

For more background, see the May and June 2015 issues of *National Geographic Magazine*.

### ENGAGE

#### Tap Prior Knowledge

Elicit from students their understandings about dolphins and how their characteristics fit in the class of mammals. Spark recall with prompts such as:

- Characteristics of mammals include....
- Dolphins are classified as mammals because....
- One thing I think is interesting about dolphins is....
- One thing I don't understand about dolphins is....

Explain to students that the article "Born to be Wild" examines the evidence for dolphin intelligence and features the re-training of captive dolphins that will be released back into the wild. Have students suggest reasons why they think it is or is not appropriate to keep dolphins in captivity.

### EXPLORE

#### Preview the Lesson

Invite students to read the headline and examine the photo on pages 2–3 and the blue heads and pictures on the remaining pages. Ensure students have a general understanding of the words *behavior*, *captivity*, *echolocate*, and *pod*.

Point out the callout on page 9. Challenge students to suggest reasons why it takes so much time and money to return captive dolphins to the wild. Discuss with students whether or not they think efforts to retrain dolphins are worthwhile. Encourage students to elaborate on their answers with some explanation. Prompt students to think about whether their explanations are based on fact or opinion.

#### Set a Purpose and Read

Have students read the article in order to examine how behaviors adopted in captivity may not support survival in the wild.

## SCIENCE

### EXPLAIN

#### Adaptations Aid Survival

Elicit from students what adaptations are and claims about how adaptations might help mammals that live in the ocean. Have students cite specific information from the article as evidence for their claims. Encourage students to use the photos in the article as a basis for identifying other adaptations of dolphins, such as high rate of travel, echolocation, use of tools, and caring for offspring. They might conduct additional research to find out how these and other adaptations aid survival. Then, facilitate a discussion about the role of DNA, natural selection, and time in the evolution of adaptations.

#### Compare and Contrast

After students have read the article, lead a discussion about how behaviors varied between wild and captive dolphins. Encourage students to illustrate the variations with a series of Venn diagrams. For example, place "food getting" in the overlapping center of a simple diagram. The Wild circle might say "hunts" while the Captive circle might say "waits for frozen fish."

#### Retraining Solutions

Give each student a copy of the **Science Activity Master**. Then guide students to think like engineers and identify the problems that had to be solved to effectively retrain Tom and Misha for return to the wild. Encourage students to work individually at first, and then share ideas in small group or whole-class discussion. Prompt them to offer other solutions to a given problem or improve on the one developed by Foster and his team.

### ELABORATE

#### Find Out More

Display the "Different Dolphins" poster. As you review the information, have students compare and contrast the various sizes, shapes, and other characteristics. Challenge them to suggest which characteristics are adaptations and which are learned behaviors.

#### Extend Your Thinking about Animals in Captivity

Have students extend their thinking about species raised in captivity versus those living in the wild. Students might conduct research to find examples of animal species that are nearly extinct in the wild, but are maintaining small numbers in zoos or other institutions.

**Debate Opportunity:** Such research might supply evidence for claims made during a debate on whether society benefits from keeping so-called intelligent mammals in captivity or not.

### EVALUATE

Assess comprehension of science concepts mentioned in the article using the **Science Quiz** alone or in combination with the following questions. Have students record their answers in their science notebooks or on the back of the Science Quiz.

**Why do dolphins blow bubbles?** (They blow bubbles to confuse their prey, which makes them easier to catch.)

#### What are some ways that dolphins solve problems?

(Responses might include how dolphins protect their beaks with a freshly-plucked sea sponge when digging up the sea floor for bottom-dwelling fish, figuring out how to get fish out of a plastic tube, or other examples.)

**What are some learned behaviors that show teamwork among individuals?** (Students might cite examples such as working in teams to herd fish into tightly-packed balls, or stir up curtains of mud to confuse their prey.)

Name \_\_\_\_\_

Date \_\_\_\_\_

## VOCABULARY ACTIVITY: Born to Be Wild

Record each vocabulary term from the article. Add your observations and brainstorming ideas to form a definition.

Term	Text and Photo Clues	My Definition	Our Observations	Our Definition

**LANGUAGE ARTS ACTIVITY: Born to Be Wild**

Use the your observations from pages 7–8 to complete the chart.

<b>1. Briefly summarize a claim that the author made that you thought was very strong.</b>						
<b>2. What information or reasons were given to support this claim?</b>						
<b>3. Briefly summarize a claim that the author made that you thought was weak.</b>						
<b>4. Explain what it was about the support, reasons, or examples given that did not persuade you to accept the author's claim?</b>						
<b>5. What additional support might the author have provided that would cause you to see the claim more favorably?</b>						
<b>6. Rate how well this author provides support/reasons/examples for the claims that are made:</b>						
<b>Weak</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>Strong</b>

Name \_\_\_\_\_

Date \_\_\_\_\_

## SCIENCE ACTIVITY: Born to Be Wild

List four problems associated with retraining Tom and Misha for the wild and how Jeff Foster or others solved them. How might you have improved the solution or solved the problem differently?

Problem	Solution

**SCIENCE QUIZ: Born to Be Wild**

Circle the correct answer for questions 1–5. Then write your response to Your Ideas.

1. Why would a bottlenose dolphin swim with a frond of brown seaweed over her tail?
  - A. As a lure when hunting food
  - B. To act as a bandage when hurt
  - C. So that her baby would follow her
  - D. To socialize with other dolphins
2. Which is NOT a hunting strategy used by dolphins?
  - A. Sending out bursts of sound that are too rapid for human ears to hear
  - B. Producing clouds of bubbles by slapping their tails
  - C. Being almost motionless while waiting for prey to come close
  - D. Herding a school of fish into a tight circle called a bait ball
3. Which is NOT a strategy dolphins use to maintain relationships with other dolphins?
  - A. Seeking contact with humans
  - B. Feeding sick dolphins
  - C. Signature whistles
  - D. Learning the names of other dolphins
4. One way everyday life for captive dolphins is different from those in the wild is
  - A. the longer time the captives spend above the water.
  - B. the greater variety of food the captives eat each day.
  - C. that the captives are much stronger due to training.
  - D. the ability of the captives to click and communicate.
5. Which wild behaviors do captive dolphins seem to forget?
  - A. How to echolocate
  - B. How to hunt for food
  - C. Being fearful of humans
  - D. All of these

**Your Ideas:** Recommend three resources that would be needed to support a captive dolphin that could not be retrained for the wild. Write why the resources would be important.

### Objective

- Students will determine the meaning of words and phrases as they are used in a text.
- Students will cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.
- Students will provide a summary of the text distinct from personal opinions or judgments.

### Resources

- Vocabulary Activity Master (page 14)
- Language Arts Activity Master (page 15)

### Summary

The article “Seeing Eye To Eye” identifies how the eyes of people and other animals turn light into sight. It describes the science behind binocular, monocular, color, and compound vision and explores visual adaptations of various organisms.

## BUILD VOCABULARY AND CONCEPTS

- **binocular vision**
- **focus**
- **reflect**
- **refract**
- **visible light**

As a class, discuss the difference between familiarity and knowledge. Have students discuss the strategies they use to gather information as they encounter terms with which they are not familiar that may be critical to the comprehension of a passage they are reading. Challenge students to acquire new vocabulary strategies as they work through this activity.

Display the vocabulary words. Then give each student a copy of the **Vocabulary Activity Master**. Instruct students to write each word in the first cell of the table. Have students rank their familiarity with each word by writing the number 1–5 after the words, with the number 5 meaning that they are very familiar with each word and could teach it to a student that had written a 1 beside it

Divide the class into four groups and have them each use the **Vocabulary Activity Master** to create a game that other groups will use to explore the vocabulary words. Allow class time to play the games and evaluate their game's success.

Display the Wordwise feature on page 17 of the **Projectable Magazine**. Have students write those definitions on their worksheets and then compare them with the definitions they wrote. Most likely, the two sets of definitions are very different. Encourage students to scan the article to find out why. Guide the class to recognize that words can take on very specific meanings in different contexts. Discuss how that concept applies to the vocabulary words in this article.

### READ

Remind students that the article explores how eyes turn light into images that make sense. Throughout the article, the writer gives examples, explains vision problems, explores how colors are perceived, and describes night vision. On each page of the article the author makes explicit statements but also allows the reader to make inferences based on their previous knowledge and experiences.

Display pages 12–13 of the **Projectable Magazine**. If needed, model how to identify explicit information and making inferences using the Out of Focus passage. **Say:** *When I read the headline “Out of Focus,” I think about how sometimes words are out of focus if I hold a book too close. That’s why I wear glasses. So it makes me think that the three paragraphs in this section will be about vision problems. As I begin to scan the text, I see the first sentence states explicitly that “not all eyes are perfect.” I then see the word eyeglasses, which, along with the explicit language, lends validity to my inference.*

Remind students that reading constantly involves making sense of what they are reading and making inferences is one way to do that. Also explain to students that identifying explicit information can help them validate their inferences.

### READ

#### (continued)

Give each student a copy of the **Language Arts Activity Master**. Have students read the article on their own. As they do, instruct them to identify explicit information (E) in the article or inferences (I) they make. They should label each as *E* or *I* and record support.

### TURN AND TALK

#### Text Evidence of Explicit Text

Have students turn and talk to compare their **Language Arts Activity Master** with a partner. Did students find the same examples of explicit language? Did they form inferences about the same material/information? Have students explain their reasoning to their partners. If partners used the same information to come to different understandings, encourage them to reread the text and review the information together. Students should discuss and examine the support they cited to come to a better understanding of how the author used explicit language to make points.

#### Inferences

With a different partner, have students turn and talk to compare their **Language Arts Activity Master**. Students can cite an inference and explain the reasoning behind it to their partners. If partners used the same information to validate a different inference, encourage them to discuss what they already knew or their thinking process that led them to different inferences.

### Summarize

**Say:** *One way to determine if you understand information is to try to summarize the main idea of what you have read. If you can't state a summary based on the main idea and details, you might need to read the article again.* Have students turn and talk to summarize the different ways eyes 'see'. Prompt discussion with questions such as: Is seeing believing? How do the parts of the eye work together to allow us to understand what has been perceived? How do optical illusions increase our understanding of vision? Guide students to ensure their summaries are factual and free from personal opinions or judgments.

### WRITE AND ASSESS

You may want students to write about what they learned to assess understanding. Encourage students to reflect upon what they read and how it affected their ideas about the role that visual information plays in survival.

- How would you explain the role that the properties of light play in vision?
- Why is the shape of the eyeball important in clear vision?
- Why are "wild eyes" observed by engineers and what do they do with their observations?
- What surprised you about what you read

### Objectives

- Students will explain how eyes are sense receptors that respond to electromagnetic (light) energy.
- Students will recognize how eyes sense light and transmit the message to the brain.
- Students will explore variations in sensory perception.

### Resources

- Science Activity Master (page 16)
- Science Quiz Master (page 17)
- "Light Catchers" poster (Teacher's Edition)
- Seeing Eye To Eye **Interactive Whiteboard Lesson** (website; optional)

### Science Background

Is sight more than seeing? Everything that you look at, whether you attend to it or not, is sent to your brain. Our eyes allow us to interact and interpret our environment by processing the information contained in visible light.

Sight is all about light. As you read this, you are actually seeing light waves from the monitor. If reading a print version, you sense light waves reflecting off the page. The mechanisms of the eye focus the light waves that pass through the pupil on the retina at the back of the eye. It is made up of light sensitive cells that send images to the brain.

The term *light*, however, refers to more than just visible light that humans perceive. Wavelengths in the electromagnetic spectrum on either side of visible light—infrared and ultraviolet—stimulate sight in some animals. Humans and many other animals perceive infrared radiation as heat, but some vipers, boas, and pythons convert that stimulus into an image. Several kinds of animals, especially insects, see ultraviolet light. Some mammals, such as reindeer and rats do as well. While we may see some violet light emitted from a "black light," most of the radiation being emitted is invisible to humans.

### ENGAGE

#### Tap Prior Knowledge

Have volunteers call out single words or phrases that describe eyes and the sense of sight. They might include characteristics of eyes among different species and the range of visual acuity. Record the responses and have students differentiate between biological characteristics and those based on opinion. Then, as a class, develop an operational definition of what vision is.

### EXPLORE

#### Tap Prior Knowledge

Invite students to read the headline and examine the photo on pages 10–11 and the black heads, pictures, and graphics on the remaining pages. Ensure students have a general understanding of the words *binocular vision*, *focus*, *reflect*, *refract*, and *visible light*.

Challenge students to predict what the article is about specifically. Discuss with students whether or not they find the fact that "vision is the most used sense" true. Encourage students to elaborate on their answers with some explanation. Prompt students to think about whether their explanation is based on fact or opinion.

#### Set a Purpose and Read

Have students read the article in order to find out how eyes collect information with light that the brain processes to aid survival.

### EXPLAIN

#### Sense Receptors and Information Processing

Elicit from students their ideas about what "information processing" is. They might allude to computer processing or other means of combining and analyzing data. Guide them to understand that simply, information processing is the taking in of information (stimuli) and the response it invokes. Use the Eyes in Action and Trick of the Eye sections on pages 13 and 14 to lead a discussion about how the brain processes information and what happens if it is fooled.

### EXPLAIN

(continued)

#### Senses Transmit Signals

Ask a volunteer to read the description of a damselfly's eye under A Bug's Eye View on page 16. Then have students compare and contrast the differences between the damselfly's eyes and their eyes. They might suggest what uses the two different types of eyes are best suited for. Students could also speculate what it might be like if they had compound eyes. Drawing pictures of a response that having compound eyes would enable can solidify their thinking about the differences.

#### Exploring Transmitted Signals

Give each student a copy of the **Science Activity Master**. Allow students to work in small groups to design objective tasks that will show variation in the acuity of their senses. The tasks don't have to be elaborate. For the sense of smell students might determine the distance at which they can identify a chosen aroma, such as vinegar or citrus. Something similar to a printed Snellen vision eye chart will work for vision. Students might also be interested in exploring how sensitive their eyes are to motion. Taste could be examined using sweet (sugar) or bitter (lemon juice) solutions of varying diluteness.

### ELABORATE

#### Find Out More

Display the "Light Catchers" poster. As you review the information, have students compare and contrast the various adaptations in eyes shown by each species. Challenge them to identify how each eye structure aids survival *before* they read the caption.

#### Extend Your Thinking About Sight and Senses

Have students extend their thinking about senses by exploring how people who have lost one of their senses accommodate. For example, they might research whether tactile sensitivity is really more acute in people who have lost their sense of sight or if that acuity is due to practice in tactile activities, such as reading Braille.

### EVALUATE

Assess comprehension of science concepts mentioned in the article using the **Science Quiz** alone or in combination with the following questions. Have students record their answers in their science notebooks or on the back of the Science Quiz.

- **How would you explain the process your eye uses to see an object?** (Objects become visible when light reflects off of them. Eyes bend the light. Light hits the cornea, the clear covering on the front of the eyeball. The cornea refracts the light. Behind the cornea the iris has muscles attached to it that change its size. This allows the iris to control how much light goes through the pupil. Light then moves through the eye's lens, refracting more. Muscles attached to the lens change the lens' shape depending on the distance to the object. Changing the lens' shape refracts the light a little more or less, like fine-tuning. The retina receives the light from the object as reversed and upside down. The retina then transmits the nerve signals to the brain and the brain "sees" the object right side up.)
- **What is needed to see in the dim light of night?** (The eyes need to capture a lot of light and make the most of it. Each human eye has about 125 million rod-shaped cells that help to see when there is less light. Some nocturnal animals have larger eyes that allow them to collect more light.)
- **How are your eyes fooled by optical illusions?** (Certain patterns and colors cause the brain and muscles to respond in a way that we perceive as motion or change in color.)

Summarize main points from the article using the **Interactive Whiteboard Lesson** that accompanies this article. If you don't have a whiteboard, your students can use all of its functionality using a computer workstation that is connected to a classroom projector. The whiteboard lesson allows them to learn fun facts about the human eye while extending their knowledge of optical illusions, color vision, and vision adaptations.

Name \_\_\_\_\_

Date \_\_\_\_\_

## VOCABULARY ACTIVITY: Seeing Eye to Eye

In 10 minutes, design a game using the vocabulary. Take turns playing it

<b>Words and Definitions:</b>	<b>Identify how you will evaluate the success of your game:</b>
	<b>Briefly explain the strategy you will use to teach the vocabulary words:</b>
<b>Discuss the game you intend to create and identify the required rules:</b>	<b>Select a title for your game:</b>
	<b>Evaluate your game:</b>
	<b>Little success</b> <b>Very successful</b>
	1                      2                      3                      4                      5

Name \_\_\_\_\_

Date \_\_\_\_\_

## LANGUAGE ARTS ACTIVITY: Seeing Eye to Eye

Complete the chart to learn more about how explicit statements and inferences are supported in a text. Recall that:

- Explicit statements are clearly expressed and supported.
- Inferences should flow logically from the text.

Page #	Explicit Statement or Inference	Support

Name \_\_\_\_\_

Date \_\_\_\_\_

## SCIENCE ACTIVITY: Seeing Eye to Eye

Design activities that will allow your team to determine how receptive each of their senses are. Complete the chart to explore the range of sensitivity among the team.

Sense	Test	Participant		Measure of Sensitivity

## SCIENCE QUIZ: Seeing Eye to Eye

Circle the correct answer for questions 1–5. Then respond to Draw It.

- The colors of visible light are
  - the colors of light that all animals can see.
  - the colors of light that humans can see.
  - the colors of light that allow animals to see depth.
  - the colors of light that cause optical illusions.
- Light stimulates the cells of which structure in the eye?
  - cornea
  - pupil
  - retina
  - optic nerve
- Which is NOT an adaptation for seeing well in very little light?
  - Many more cones than rods
  - A mirror-like layer behind the retina
  - A retina layer that contains only rods
  - Extra large eyes compared to the size of the animal
- The many lenses of compound eyes allows an insect to see
  - very bright colors.
  - colors humans cannot see.
  - optical illusions.
  - very small movements.
- A person can see clearly only when the light focuses on the
  - cornea.
  - iris.
  - lens.
  - retina.

**Draw It:** Draw a diagram with labels that explains the path of light through the eye.

### Objective

- Students will determine the meaning of words and phrases as they are used in a text.
- Students will analyze in detail how a key individual, event, or idea is introduced, illustrated, and elaborated in a text (e.g., through examples or anecdotes).
- Students will cite the textual evidence that most strongly supports an analysis of what the text says explicitly as well as inferences drawn from the text.

### Resources

- Vocabulary Activity Master (page 22)
- Language Arts Activity Master (page 23)

### Summary

The article *Sinking Venice* focuses on Project MOSE, which is an engineering project to protect Venice from flooding. As background, the port of Venice is built on a series of islands and the city is under threat because the land is sinking at the same time the sea level is rising. Consequently the city is flooded several times a year. To reduce impact, an engineering design of 78 giant steel gates on hinges is being constructed across three inlets through which Adriatic tidewater surges. When raised before high tides, the gates will prevent the tides from flooding the city.

## BUILD VOCABULARY AND CONCEPTS

- **barrier island**
- **dredging**
- **lagoon**
- **tides**

Display the vocabulary words. Remind students that using context clues such as the sentences before and after an unknown word and photographs on the page can help them figure out what the unfamiliar word means.

Give each student a copy of the **Vocabulary Activity Master** and have each complete it independently.

Students will devise their own definitions for each term and scramble their position in the chart. Stress that drawings and background knowledge can be used when writing definitions.

Have students exchange papers and independently match each vocabulary word with its definition. Then student pairs should discuss their efforts and clarify with explanation. As a summary, teams of students can compare their definitions to ones given in the WordWise and discuss the attributes of a good definition.

## READ

Explain to students that the article introduces them to Project MOSE, which is a huge engineering plan that Venetians hope will solve a problem. Point out that analyzing in detail how the key event that causes the problem is introduced, illustrated, and elaborated on in the text can lead to increased comprehension of the article. Examples or anecdotes given in the text are often critical components of building comprehension.

Display page 21 of the **Projectable Magazine**. Use the text on page 21 to model how an event can help to understand informational text. Write: *Today, Venice's economy largely depends on the millions of tourists that flock there every year.* Turn off the display or cover up the text before discussing the meaning of this short sentence. If needed, overview Venice's geographical location (explained on page 19) and the city's cultural significance that drives tourism. Continue reading the passage to show how this initial sentence leads to the main problem, which is an ongoing event, presented in the article.

### READ

(continued)

Give each student a copy of the **Language Arts**

**Activity Master.** Explain to students that they can build comprehension skills by analyzing how the author presents key events or ideas. This is often done through examples or anecdotes.

Have students read the article on their own. As they do, instruct them to look for other examples or anecdotes that aid in their understanding of the text. If they find more, encourage them to record additional information on the back of their papers. Tell students to explain how each example or anecdote further supports the main idea of The Problem passage.

### TURN AND TALK

Have students turn and talk to compare the **Language Arts Activity Master** with a partner. Students should listen as each one presents a unique example or anecdote with a rationale and compare those ideas that are similar.

### Analyze Using Examples or Anecdotes

Have students turn and talk to discuss how the key event of regular flooding is introduced, illustrated, and elaborated on in the text through examples or anecdotes using their **Language Arts Activity Master.** If another student mentions something they overlooked, instruct students to make additions to their masters. Encourage them to discuss how analyzing these aspects can aid in their understanding of the problem and the solution presented in the text.

**Cite Textual Evidence** Display the pages 22–23 of the **Projectable Magazine.** Write the questions: Why is citing text evidence important? Why is evidence given in nonfiction text? **Say:** *Understanding the importance of supporting evidence in a text passage helps you be a better reader.* Challenge students to share and discuss examples of evidence found on pages 22–23 and how comprehension was aided by each example.

### WRITE AND ASSESS

You may want students to write about what they learned to assess understanding. Encourage students to reflect upon what they read and how it affected their ideas about the problems facing Venice and possible solutions.

- How can you explain the factors that contribute to Venice's problem?
- Why is the MOSE solution not readily accepted by everyone?

# Sinking Venice

## SCIENCE

### Objectives

- Students will analyze how Venice's location increases its potential for flooding.
- Students will make generalizations about the impact of global warming on human activities.
- Students will consider the benefits and drawbacks of solutions to the problem of Venice's regular flooding.

### Resources

- Science Activity Master (page 24)
- Science Quiz Master (page 25)

### Science Background

Sea-level rise is a key concern of all coastal areas in this modern era of global warming. National Geographic reports that sea levels worldwide have been rising at about 3.5 millimeters per year since the 1990s. Even these small increases can devastate coastal habitats. Encroaching seawater floods wetlands, causes increased erosion, and contaminates ground water. The problem is compounded when higher sea levels are augmented by high tides or storm surges.

If rising sea levels were the only problem Venice, Italy, faced, they might have successfully implemented the same solution used by the Netherlands for the last thousand years—dikes. But Venice is also sinking, as are other coastal areas such as New Orleans, Louisiana, and Hampton Roads, Virginia.

For years, engineers have been investigating ways to keep the inflow of seawater from damaging or destroying Venice. In 1966, Venice was devastated by what is called the Great Flood. It was responsible for massive loss of life and severely damaged property. The 1970s saw Venetians confronting the problem head on when a law was enacted that studied six different approaches to solving the problem. In the early 1980s feasibility studies were completed and in the middle of the next decade a design for mobile barriers at lagoon inlets was approved. Construction began in 2003 with an intended completion date of 2014. Recent estimates predict that work on Project MOSE may not be complete until 2018.

### ENGAGE

#### Tap Prior Knowledge

Ask a volunteer to locate Venice on a world map, or if possible, a larger one of Europe. Point out the surrounding geography of the area. Then find out what students know about Venice, lagoons, tides, or barrier islands. Elicit from students their ideas and write them on the board. Revisit the list frequently to identify and correct misconceptions and to acknowledge sound thinking.

### EXPLORE

#### Preview the Lesson

Invite students to read the headline and examine the photo on pages 18–19 and the heads and pictures on the remaining pages. Ensure students have a general understanding of the words *barrier island*, *dredging*, *lagoon*, and *tides*.

Challenge students to predict what the article is specifically about. Discuss with students whether or not they find it surprising or even true. Encourage students to elaborate on their answers with some explanation. Prompt students to think about whether their explanation is based on fact or opinion.

#### Set a Purpose and Read

Have students read the article in order to learn how people identified a specific problem and came up with a possible solution.

### EXPLAIN

#### Analyze Impact of Location

Use photos from the National Geographic Encyclopedic Entry for lagoon at <http://education.nationalgeographic.org/encyclopedia/lagoon/> to highlight how Venice's location makes it even more susceptible to flooding caused by rising sea levels than other coastal cities. You might begin with less populated examples such as Bora Bora before showing the Venice photos. Elicit from students their ideas about the soils that make up barrier islands, the challenges of building on them, and the reasons why those with more development might be sinking faster than others.

#### Generalize Impact of Global Warming

Venice would be at increased risk of flooding due to its sinking even without the impact of global warming. Elicit from volunteers the cause-and-effect relationships of global warming that add to Venice's woes—melting polar ice and expansion among water molecules. To extend these relationships to other areas of the world, encourage students to search out other examples of the rising sea levels impacting people, such as Arctic and Pacific island communities.

#### Evaluate Solutions

Give each student a copy of the **Science Activity Master**. Allow students to work in pairs or small groups to list the different solutions posed in the article and to devise a new one themselves. For each solution, they should list the benefits and drawbacks of the plan. Using their responses as a base, guide students to determine if the solutions presented in the passage or their new ones are short- or long-term solutions.

### ELABORATE

#### Find Out More

Use Sinking Venice as an impetus for students to find out more about the impact of global warming on human populations. Project National Geographic's "Global Warming Effects Map" at <http://environment.nationalgeographic.com/environment/global-warming/gw-impacts-interactive/>. Begin by choosing Industry and Society from the Select Climate Impact pull-down menu. The "reduced tourism" button highlights Venice. From there, explore more impacts with the class.

#### Extend Your Thinking About Venice

Project National Geographic's "Venice Quiz" at <http://travel.nationalgeographic.com/travel/city-guides/venice-quiz/> as an interactive way to help students learn more about Venice and its culture.

### EVALUATE

Assess comprehension of science concepts mentioned in the article using the **Science Quiz** alone or in combination with the following questions. Have students record their answers in their science notebooks or on the back of the Science Quiz.

- **What makes Project MOSE so ambitious? Is the intention of the project doable?** (It intends to save "everything" about Venice—its art, architecture, homes, and economy from destructive floods. Student opinions on the viability of the project will vary.)
- **What is atypical about the land on which Venice is located?** (the city sprawls over a group of connected islands in the Venetian Lagoon instead of being built on extensive dry land.)
- **How would you explain how people directly caused Venice to sink at an even faster rate than usual?** (When ground water was pumped from below the city in the 1950s and 1960s, the weight of the city pushed down to fill the space.)

**VOCABULARY ACTIVITY: Sinking Venice**

Write your own definition for each word. Scramble their position in the chart.  
Exchange papers with a partner. Draw lines to match the definitions to the correct word.

**Word****Definition****barrier island****dredging****lagoon****tides**

Name \_\_\_\_\_

Date \_\_\_\_\_

## LANGUAGE ARTS ACTIVITY: Sinking Venice

Analyze examples or anecdotes of individuals, events, or ideas and explain how they build comprehension.

<b>Example/Anecdote</b>	<b>My Analysis of Meaning</b>	<b>How It Aids Comprehension</b>

**SCIENCE ACTIVITY: Sinking Venice**

List possible solutions for Venice's flooding problem. Think of a new one.  
Write the benefits and drawbacks of each plan.

<b>Solution</b>	<b>Benefits</b>	<b>Drawbacks</b>

## SCIENCE QUIZ: Sinking Venice

Circle the correct answer for questions 1–5. Then respond to Use Math.

- What takes the place of roads in Venice, Italy?
  - Streets
  - Sidewalks
  - Elevated walkways
  - Canals
- Which factor does NOT contribute to Venice's flooding problem?
  - Tides
  - Settling building foundations
  - Global cooling
  - Rising sea levels
- What caused Venice's buildings to sink at an alarming rate in the 1950s and 1960s?
  - Seismic events
  - Pumping groundwater
  - Increased traffic on Venice's roads
  - Hydraulic infusion
- Circle the two events that combine to make tides a bigger threat to Venice?
  - The sinking city
  - Increasing average rainfall
  - Rising sea levels
  - Underwater earthquakes
- Which is NOT a possible solution to a Sinking Venice?
  - Project MOSE
  - Canal maintenance
  - Groundwater removal
  - Dredging

**Use Math:** Estimates for the average height of Venice above sea level equal 50 centimeters. Assume that the sea level is rising at a consistent rate of 3 millimeters per year. At the same time Venice is sinking at 5 millimeters each year. If all solutions to Venice's situation fail, what year will Venice no longer be above sea level? Use the table to organize your thinking.

Height of Venice above sea level (cm)	
Height of Venice above sea level (mm)	
Rate at which Venice is sinking (mm)	
Rate at which sea level is rising	
Rate at which sea level is gaining	
Height about sea level/rate at which sea level is gaining.	
Current Year	
Current Year + Time until Venice is under water	

## ANSWER KEY

### Born to Be Wild

#### Vocabulary Activity, page 6

Students should scan the article and record the boldface words—*behavior, captivity, echolocate, pod*. Text clues, photo clues, and what students think each word means will vary. Evaluate each response for logic and accuracy.

#### Language Arts Activity, page 7

The claims and support students cite will vary, however they should be logically connected.

#### Science Activity, page 8

Students might list problems such as the size of the original pen, the physical weakness of the dolphins, the need to remove human contact, and so on. Solutions should relate to the problem stated.

#### Science Quiz, page 9

Answers: 1. D 2. C 3. A 4. A 5. D

**Your Ideas:** Students ideas will vary but should flow logically from the article with valid justification.

### Seeing Eye To Eye

#### Vocabulary Activity, page 14

Games will vary but should all include the boldface terms—*binocular vision, focus, reflects, refracts, and visible light*. Students might include other terms. After playing their own game and one or two others, students should be able to gauge the relative success of the effectiveness of their own for learning new vocabulary terms.

#### Language Arts Activity, page 15

Students' responses will vary, but should be logical in their relationship to the examples chosen. Evaluate each for accuracy and sense.

#### Science Activity, page 16

Students' experimental designs will vary, but each should show some range in sensory perception and a scale by which to quantify it.

#### Science Quiz, page 17

Answers: 1. B 2. C 3. A 4. D 5. D

**Draw It:** Diagrams should show how light bends as it moves through various structures to focus on the retina.

### Sinking Venice

#### Vocabulary Activity, page 22

Students definitions should reflect the boldface words—*barrier island, dredging, lagoon, and tides*. Definitions will vary, but their responses should reflect those in the article.

#### Language Arts Activity, page 23

The examples and anecdotes students choose will vary as will their analyses and ideas about how they aid comprehension. Evaluate students' responses for logic and sense.

#### Science Activity, page 24

Students should include dredging the channel along with Project MOSE and a solution or two that reflects their ideas. The benefits and drawbacks students identify might vary, but should include those in the article that involve blocking the natural flow of tides and the impact on biodiversity.

#### Science Quiz, page 25

Answers: 1. D 2. C 3. B 4. A+C 5. C

#### Use Math:

Height of Venice above sea level (cm)	50
Height of Venice above sea level (mm)	500
Rate at which Venice is subsiding (mm)	5
Rate at which sea level is rising	3
Rate at which sea level is gaining	8
Height about sea level/rate at which sea level is gaining.	63.5
Current Year	2016
Current Year + Time until Venice is under water	2079