**BOOKS**


**WEB SITES**

Friends of the Red Knot (site started by kids to conserve red knots) — www.friendsoftheredknot.org

Horseshoe Crabs — www.chesapeakebay.net/info/horseshoe_crab.cfm

Horseshoe Crabs: A Living Fossil (Maryland Dept of Nat’l Resources) — www.dnr.state.md.us/education/horseshoecrab


“Horseshoe Crabs’ Decline Further Imperils Shorebirds” (article) — www.washingtonpost.com/wp-dyn/content/article/2005/06/09/AR2005060901894.html


Journey North — www.learner.org/jnorth

Life Cycle of the Horseshoe Crab — www.chesapeakebay.net/horseshoe_crab.html

Red Knot (Audubon Watchlist) — audubon2.org/watchlist/viewSpecies.jsp?id=273

Red Knots (Wildlife Conservation Society) — www.wcs.org/international/northamerica/knotsandcrab/181917

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Publisher: Robert A. Miller

Editor: David Reisman, Ed.D.

Design: Trina H. Sultan

Writer: Jordan Brown

Business Manager: Bob Adleman

Vice President and Director of Education: Ronald Thorpe

Consultant: Bob Berwick, Science Head, New Canaan Country School

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**FOR THE NATURE SERIES**

Executive Producer: Fred Kaufman

Series Producer: Bill Murphy

Series Editor: Janet Mess

Supervising Producer: Janice Young

Senior Producer: Laura Metzger

Executive in Charge: William Grant

**NATURE SCHEDULE**

February-May 2008

February 10

February 17

February 24

Crash: A Tale of Two Species

February 24

March 2

March 9

March 16

March 23

March 30

April 6

April 13

April 20

April 27

May 4

May 11

May 18

May 25

Arctic Bears

Raptor Force

Deep Jungle: New Frontiers

Deep Jungle: Monsters of the Forest

Deep Jungle: The Beast Within

Animals Behaving Worse

Cuba: Wild Island of the Caribbean

What Females Want and Males Will Do (part 1)

What Females Want and Males Will Do (part 2)

The Gorilla King

Penguins of the Antarctic

Superfish

Prince of the Alps

Rhinoceros

Killers in Eden

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**VIDEO ORDERING INFORMATION**

To purchase copies of *Crash: A Tale of Two Species* and other NATURE titles on DVD, go to www.questarhomevideo.com/nature.

**EYES ON YELLOWSTONE**

*Eyes on Yellowstone* is made possible by Canon. It assists with important scientific research and breaks new ground in conservation, endangered species protection and the application of cutting-edge science and technology that is essential to managing park wildlife and ecosystems. Canon technology is used for education to increase access to the wonder and magic of one of the most recognizable and popular parks in the world (www.windowsintowonderland.org) and raises awareness about the importance of environmental protection and conservation.

**RESOURCES**

NATURE is produced for PBS by Thirteen/WNET New York.
TOYOTA

WHY NOT?

Two words that are filled with possibilities.

They can turn a challenge into an opportunity.

An obstacle into an inspiration.

It’s a question we ask ourselves at Toyota every day.

Because we’re continuously looking for new ways to improve what we do.

By asking tough questions.

Can we make a car that has zero emissions?

Can we improve the economy of a community?

Can we enrich the lives of people around us?

Why not?

When it comes to the environment, we’re constantly working to reduce our impact.

Not just in our products and operations but also through our partnerships with organizations in the communities in which we live and work. The way we see the world, the more effort we put in, the less impact of human activity on the environment.

Driven by Canon's corporate philosophy “Kyunet” — which we define as “all people, regardless of race, religion, or culture, harmoniously living and working together into the future” — we understand the responsibility that we have to our society and to the environment.

Embracing this philosophy, Canon U.S.A. has chosen to protect future generations by helping to preserve nature’s most valuable resources through the support of a wide range of environmental and youth programs. We strongly believe in the importance of education for today's young people, and that teachers, like you, are an integral part of the process. Programs that we support such as NATURE reinforce our dedication to the environment, to environmental education and to a cleaner earth. Here's a sampling:

- Eyes on Yellowstone — www.windowintonowonderland.org
- Canon Envirothon — www.envirothon.org
- National Environmental Education Week and the National Environmental Education Foundation (NEEF) — www.neefusa.org

Canon is proud of its unwavering tradition of protecting and preserving our most precious of resources — the world we share. You can learn more about us and our programs by visiting www.usa.canon.com.

Regards,

Yoroku Adachi
President and CEO
Canon U.S.A., Inc.

Canon

Dear Teachers,

Since 1990, Canon U.S.A., Inc., has been a proud sponsor of NATURE and its accompanying Teacher’s Guide and poster. NATURE’S Crash: A Tale of Two Species tells the story of two very different animals — the horseshoe crab, a sea creature that has remained almost unchanged for 350 million years, and the red knot, a tiny migratory bird. The program explores how the red knot's existence depends on the horseshoe crab's survival. The lessons in this Teacher's Guide invite your students to learn more about "living fossils," migration, and the impact of human activity on the environment.

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This Teacher’s Guide accompanies the NATURE program, Crash: A Tale of Two Species. The program looks at the interconnection between two very different animals — the horseshoe crab and the red knot — and the threats to their survival.

Lessons in the guide use the programs as a starting point for discussions and activities that focus on adaptations that help these animals survive, the ways that human activity can endanger different species, and the varieties of wildlife in your own community. This guide includes teacher’s pages and student activity masters that can be used with the program. Please photocopy the pages and hand them out to students in class.

Using Nature Videos in the Classroom

You may wish to use questions on the teacher’s page to spark discussion about Crash: A Tale of Two Species. By posing these questions to students before they watch the video, you can help focus their viewing experience. You may stop the video periodically, so students can discuss the subject matter while it is fresh in their minds.

If you are going to use the program in school, please prescreen it to find the segments you’d like to use. The program is one hour. If time is limited, consider using clips that relate directly to the questions and activities that best meet your needs.

Teaching Nature with Standards

National Science Education Standards: Grades 5-8

- http://www.npre.org/readingroom/books/nt5-8htm.htm


Life Science: Content Standard C — Diversity and Adaptations of Organisms

History and Nature of Science: Content Standard G — Science as a Human Endeavor

National Council of Teachers of English Standards apply when using these materials:

Standard B: Students use a variety of technological and information resources (e.g., libraries, databases, computer networks, video) to gather and synthesize information and communicate knowledge. For more information on the Web, go to www.ncte.org/about/over/standards/110846.html

WEB RESOURCES

In addition to using the video and this guide, please ask your students to look at the NATURE Web site (pbs.org/nature). It may be helpful to copy and distribute other Web addresses we’ve included, or to have your students do Web searches on topics we’ve covered.

Copytaping Rights

You have the right to tape the program and play it for instructional purposes for one year after it is broadcast.

Broadcast Dates

Most PBS stations are broadcasting Crash: A Tale of Two Species on February 10, 2008. Broadcast times and dates vary in some areas. Please check your local TV listings to confirm when your PBS station will show the program.
CRASH: A TALE OF TWO SPECIES

OBJECTIVES

Students will:
- analyze some of the evolutionary adaptations that have allowed horseshoe crabs and other "living fossils" to survive for many millions of years.
- discuss how the fate of the red knot is connected to that of another animal, the horseshoe crab.
- observe, keep field notes on, and formulate questions about plants and animals in local areas.

PROGRAM HIGHLIGHTS

- Scientists collect data on the red knots that winter in Chile. They have discovered the disturbing news that the red knot population has dropped by 70% over the past two decades.
- Each year, thousands of horseshoe crabs spawn on the beaches along the Eastern Seaboard. Fishermen in South Carolina gather crabs for use in laboratories, where some of the crabs' blue, copper-based blood is removed for research. Later, the crabs are returned to the ocean.
- In Brazil, red knots prepare for the second and longest leg of their migration. For four days and nights, they fly over the open ocean using the moon, stars and the sun to navigate.
- Each spring, during the high tides of new and full moons, thousands of horseshoe crabs crawl onto the beach to spawn. After the females lay eggs deep in the sand, the males fertilize them. As the crabs return to the ocean, some of the eggs are unearthed. Later, red knots eat many of these exposed eggs as they bulk up their bodies for their big journey north. The eggs are their only source of nutrition before arriving in the Arctic.

BEFORE VIEWING THE PROGRAM

Show students color photographs of the following five animals (printed from the Internet, or from library books): shark, Komodo dragon, coelacanth, cockroach, and horseshoe crab. Ask students to hypothesize what all these animals have in common. Record their ideas on the board. After a brief discussion, explain that all five animals have been on our planet for many millions of years; so long that they are sometimes called "living fossils." Ask students to recall what a fossil is — evidence of a plant or animal that lived long, long ago. While many animal species, such as dinosaurs, became extinct millions of years ago, other animals have remarkable "survival power." Ask students to brainstorm why they think these five animals have survived for so long. (Possible responses might include these animals' ability to catch their prey, ways they protect themselves from predators, their remote habitats, and so on.)

Tell the class they will now learn more about one of these animals: the horseshoe crab. Show the class a picture of a horseshoe crab and ask them how they think it got its name. Tell students that — based on fossil evidence — scientists know that horseshoe crabs have been around for many millions of years; so long that they are sometimes called "living fossils." Ask students to recall what a fossil is — evidence of a plant or animal that lived long, long ago. While many animal species, such as dinosaurs, became extinct millions of years ago, other animals have remarkable "survival power." Ask students to brainstorm why they think these five animals have survived for so long. (Possible responses might include these animals' ability to catch their prey, ways they protect themselves from predators, their remote habitats, and so on.)

DISCUSSION QUESTIONS

1. What are some adaptations that have helped the horseshoe crab to survive for 350 million years? (Its hard shell deters most predators; copper-based blue blood clots if bacteria tries to enter its body; compound eyes on top of shell to see the cycles of the moon; each crab lays thousands of eggs.)
2. How does the red knot prepare for its long migration from South America to the Arctic? (In South America, red knots feed for days on end to bulk up their bodies; they molt and grow new feathers that enhance their flying abilities. Then, further north, in Delaware Bay, they eat as many as 18,000 horseshoe crab eggs a day on the beach.)
3. What are some of the reasons why the horseshoe crab population is declining? (Fishermen were overharvesting horseshoe crabs to use as bait.)
4. Do you think the red knot would survive if the horseshoe crab became extinct? Why or why not? (Answers will vary.)

There are lots of ways to help the horseshoe crab, like the Just flip 'em Program. For ideas, see www.horseshoecrab.com/act/flipem.html
WHAT TO DO
Here is a chart of five “living fossils” — animal species alive today that closely resemble their ancestors from many millions of years ago. As you watch the video, fill in the chart about the horseshoe crab. Then use the Internet and other library resources to fill in the rest of the chart.

After you watch the episode, answer the two questions about horseshoe crabs.

<table>
<thead>
<tr>
<th>Species</th>
<th>Species’ Age (based on fossils)</th>
<th>Habitat</th>
<th>Adaptations that have helped it survive</th>
<th>Threats to its future survival</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horseshoe Crab</td>
<td>(Limulus polyphemus)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frilled Shark</td>
<td>(Chlamydoselachus anguineus)</td>
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<tr>
<td>American Cockroach</td>
<td>(Periplaneta americana)</td>
<td></td>
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<tr>
<td>Komodo dragon</td>
<td>(Varanus komodoensis)</td>
<td></td>
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<tr>
<td>Coelacanth</td>
<td>(Latimeria chalumnae)</td>
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</tr>
</tbody>
</table>

What are some ways that human activities have caused the horseshoe crab population to decline?

How have humans taken action to prevent the horseshoe crab from being overharvested?

STUDENT ACTIVITY MASTER

CRASH: A TALE OF TWO SPECIES

ACTIVITY TIME: ABOUT 2 CLASS PERIODS

WHAT TO DO
The red knot is one of many species that migrate. Each spring, birds including whooping cranes, robins and orioles, as well as insects such as monarch butterflies, fly northward for thousands of miles.

1. Select one of the animals below, and visit its “Journey North” Web page.
   - Monarch Butterfly http://www.learner.org/north/monarch/AboutSpring.html
   - American Robin http://www.learner.org/north/robin/
   - Whooping Crane http://www.learner.org/north/crane/index.html
   - Barn Swallow http://www.learner.org/north/swallow/index.html

2. Click “Get Started” or, if not available, use other resources on the Web to learn more about this animal’s habitat, eating habits, and migration patterns.

3. Explore the links on the “Get Started” page or other Web sites about the animal you’ve chosen. On “Journey North,” you can read profiles of specific animals that have been tagged and are being tracked, “booklets” that describe the animal’s habits and how scientists study them, and daily migration updates from naturalists.

4. Use the Web site and other library resources to help you answer these questions about the animal you chose:
   - Where does the animal start its migration in the winter?
   - Where is the animal’s northern destination in the spring?
   - What kinds of food does the animal rely on to give it energy for the long journey?
   - What predators does the animal face along the way?
   - Is this animal endangered or threatened? If so, what actions are people taking to help out?

STUDENT ACTIVITY MASTER

NORTHWARD BOUND

ACTIVITY TIME: ABOUT 2-3 CLASS PERIODS

WHAT TO DO
The red knot is one of many species that migrate. Each spring, birds including whooping cranes, robins and orioles, as well as insects such as monarch butterflies, fly northward for thousands of miles.

1. Select one of the animals below, and visit its “Journey North” Web page.
   - Monarch Butterfly http://www.learner.org/north/monarch/AboutSpring.html
   - American Robin http://www.learner.org/north/robin/
   - Whooping Crane http://www.learner.org/north/crane/index.html
   - Barn Swallow http://www.learner.org/north/swallow/index.html

2. Click “Get Started” or, if not available, use other resources on the Web to learn more about this animal’s habitat, eating habits, and migration patterns.

3. Explore the links on the “Get Started” page or other Web sites about the animal you’ve chosen. On “Journey North,” you can read profiles of specific animals that have been tagged and are being tracked, “booklets” that describe the animal’s habits and how scientists study them, and daily migration updates from naturalists.

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   - Where does the animal start its migration in the winter?
   - Where is the animal’s northern destination in the spring?
   - What kinds of food does the animal rely on to give it energy for the long journey?
   - What predators does the animal face along the way?
   - Is this animal endangered or threatened? If so, what actions are people taking to help out?

INTO THE FIELD

ACTIVITY TIME: ABOUT 2 CLASS PERIODS

WHAT TO DO
It is one thing to read about, or watch a video about a species that you find fascinating. It is quite another to observe that species in the wild. Biologists and other naturalists spend many hours outdoors looking closely at animals that spark their curiosity.

In this activity, you and a classmate will create a field journal about an animal that lives in your area. You will sketch pictures of it, write down details such as the time of day you saw the animal, what the weather was like, if any other animals interacted with it (hopefully not eating it!), and more. THEN... you and your classmate will use your field journals to create a Nature Report to share with others. Perhaps your teacher can help you organize a special Nature Night at your school, at which everyone in your class can share and compare your findings.

Grab a small notebook and pencil (and maybe a magnifying glass if possible), and find a place near your school or home (such as a park, playground or yard) to make your observations.

Some Tips to Help You Observe and Record Your Data:
- Use your senses to describe sights, sounds, smells, and tactile experiences
- Log all the details about the date, time and weather conditions
- Keep track of questions that spark your curiosity (especially why, what and how)
- Estimate sizes of unfamiliar animals with those you do know “e.g. bigger than an ant”
- Use the Internet, field guides and other resources to learn more about the animals you’ve observed. Then, if possible, return to gather more information.

- The horseshoe crab has ten eyes and can see ultraviolet light.
- A quart of horseshoe crab blood is worth about $15,000.