SEA MONSTERS
A PREHISTORIC ADVENTURE

Funded in part by the National Science Foundation
DEAR EDUCATOR,

The instructional resources in National Geographic’s *Sea Monsters: A Prehistoric Adventure Educator’s Guide* were developed to bring the prehistoric world of the Cretaceous and the adventure of paleontology to life for you and your students. Inside this *Educator’s Guide* you’ll find:

> An introduction with background information about the film and its content.
> Activities with step-by-step instructions for classroom use.

These resources and more are available at nationalgeographic.com/seamonsters/educators. We welcome your feedback.

Enjoy this prehistoric adventure!

*National Geographic Education and Children’s Programs*
nationalgeographic.com/education

NATIONAL EDUCATION STANDARDS

The lessons included in this *Educator’s Guide* address the following voluntary National Education Standards:

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Accompany a team of paleontologists as they work to solve an 82-million-year-old mystery...

The film *Sea Monsters: A Prehistoric Adventure* transports students 82 million years back in time to the Cretaceous period when an extraordinary diversity of marine life populated vast ocean waters. Over the millennia, changes in Earth’s climate and geography have left ancient seabeds dry, revealing fossil evidence of this extraordinary—yet little known—time. In *Sea Monsters: A Prehistoric Adventure*, the scientific process comes alive as discoveries from around the world are woven together to reconstruct the complex puzzle of this prehistoric world.

The lessons in this guide are designed to support the educational use of *Sea Monsters: A Prehistoric Adventure* through standards-based learning. Developed and reviewed with input from scientists, teachers, and museum educators, they are designed to engage students in an array of scientific and geographic concepts through inquiry-based activities.

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nationalgeographic.com/seamonsters/educators

Funded in part by the National Science Foundation

National Geographic’s *Sea Monsters: A Prehistoric Adventure* Educator’s Guide

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Directions:

1. **Explain.** Scientist Paul Sereno searches for, discovers, and studies fossil remains. Scientists who do this work are called paleontologists. While on a dig in sub-Saharan Africa, Sereno discovered the fossil remains of *Sarcosuchus imperator* (“flesh crocodile emperor”), one of the largest crocodilians to ever walk the Earth. This SuperCroc was 40 feet long (as long as a city bus) and weighed about ten tons.

   **Note:** Additional information about SuperCroc and Paul Sereno, a National Geographic Explorer-in-Residence, is available online.
   - nationalgeographic.com/explorers-program/eir/psereno.html
   - nationalgeographic.com/supercroc

2. **Distribute “Meet a Paleontologist” to each student.**

3. **Listen or read aloud.** Ask a pair of students to read the interview aloud, with each student playing the role of interviewer or interviewee.

   **Note:** This interview has been adapted and abridged for students. The original audio interview was broadcast on National Geographic World Talk (nationalgeographic.com/radio/worldtalk.html) and is available online.
   - nationalgeographic.com/explorers-program/eir/psereno.html
     (Running time: 19:13)

4. **Review and discuss.** Check student comprehension. Write new vocabulary words on the board and discuss with students. Have students answer the following questions on a separate piece of paper and then discuss as a class.

   - **Why does Paul Sereno think science is fun?**
     **Answer:** He believes that science is about discovery and creativity, and asking questions or finding answers that no one else has.

   - **Why does Paul Sereno think it is important to study dinosaurs?**
     **Answer:** Dinosaurs are a connection to the distant past, a time that we can only dream about or think about scientifically.

   - **Where did Paul Sereno find SuperCroc?**
     **Answer:** In Africa.

   - **What did SuperCroc look like?**
     **Answer:** Its skull was six feet long and its body was 40 feet long.

   - **Why do you think it is named SuperCroc?**
     **Answer:** This prehistoric crocodile was twice as long and many times heavier than modern crocodiles.

5. **Brainstorm.** Ask students to brainstorm additional questions they might have about paleontologists and their work. Write this list on the board and suggest that students look for answers to these questions as they watch *Sea Monsters: A Prehistoric Adventure*.

   **Note:** The film *Sea Monsters: A Prehistoric Adventure* primarily profiles prehistoric marine reptiles, which are not classified as dinosaurs but lived at the same time.

**View Sea Monsters: A Prehistoric Adventure.**
MEET A PALEONTOLOGIST

While on a fossil dig in Africa, paleontologist Paul Sereno uncovered the skeleton of a very old, very large crocodile. In this interview he talks about this important discovery.

Interviewer, Peter Laufer: This is National Geographic World Talk. I’m Peter Laufer, along with paleontologist Paul Sereno. Is there any kid, anywhere, who’s not fascinated by dinosaurs? Why is it so important that we learn where dinosaurs came from, when the first dinosaurs appeared, and why they died out?

Paleontologist, Paul Sereno: We’re curious about our history. We’re curious about deep time. Dinosaurs speak about a time that we can only dream about and think about scientifically.

Peter Laufer: Tell us about SuperCroc, who he was, and how you found him.

Paul Sereno: Well, [in Africa] we came upon an incredibly huge skull—six feet long. It was just astonishing that it was a crocodile with a skull that long. Then we found enough of the skeleton to get a good idea of what it looked like. You’re talking about an animal 40 feet long, twice as long as the largest living crocodiles today and many times as heavy.

Peter Laufer: You are finding things that have never been seen before. They are related to animals that live with us today.

Paul Sereno: That’s the great thrill of working in paleontology.

Peter Laufer: Despite the fact that you’re studying these [animals] who lived so long ago, there’s constantly new material. Isn’t that correct?

Paul Sereno: Yes. That’s my great understanding of science. In college, I started out as an artist. Science seemed like a pile of facts that I could never remember. As I got interested in paleontology I began to understand that it’s about discovery and creativity. It’s about thinking of a question or trying to answer a question that nobody else has before you.

That’s what I love. We’re always going to be finding out new things.

Peter Laufer: Paleontologist Paul Sereno, thanks so much for joining us today on National Geographic World Talk. I’m Peter Laufer.
Activity 2  Join a Dig

Students join a dig with paleontologist Mike Everhart to learn what happens when a scientist in the field suddenly discovers fossil remains.

“Join a Dig” (p. 5) or “Join a Dig” (audio; nationalgeographic.com/seamonsters/educators)

Directions:

1. Explain. In 2002, paleontologist Mike Everhart was prospecting, or looking, for fossils in Kansas when he came across a wonderful discovery. In this activity, students will read or listen to his firsthand account of this find and then answer questions.

Note: Additional information about Mike Everhart’s work is available online.
  oceansofkansas.com

2. Distribute “Join a Dig” to each student.

3. Listen to the story. Play the “Join a Dig” audio recording narrated by the scientist, or read the story aloud. Students can read along as they listen. The audio recording is available online.
  nationalgeographic.com/seamonsters/educators

4. Review learning. Write new vocabulary words on the board and discuss with students. Then use the following questions to lead a class discussion on the story. Have students answer the following questions on a separate piece of paper and then discuss as a class. Alternatively: Discuss the following questions with the whole class.

What actions did Everhart take to find and collect the fossil remains?

Possible answers:
- Observe
- Identify
- Photograph
- Locate
- Excavate (remove) dirt
- Sketch
- Protect
- Transport

What tools did Everhart use? Why were they helpful?

Possible answers:
- Map and GPS data to record the location of the fossil
- Camera and notebook to document the fossil
- Large pick, shovel, small knife, ice pick, and small brush to remove dirt and excavate the fossil
- Wet paper towels, burlap, plaster, plastic, and a plaster frame to protect the fossil
- A van to transport the fossil

ADAPTATIONS
This activity contains content-area reading and listening. Support students who have difficulty comprehending some of the text by providing scaffolding such as reinforcing vocabulary concepts, using words in context, predicting, summarizing and clarifying key points, and modeling comprehension strategies.
JOIN A DIG

In 2002, paleontologist Mike Everhart came across a wonderful discovery. Here is his story about what happened that day.

We were on a field trip to the Smoky Hill Chalk in Kansas. I decided to search the lower—and somewhat older—gray chalk flats. When I looked down, I noticed a funny looking, rust-orange lump. Then I saw six teeth. From the size of the teeth, I could tell I had found the remains of a large shark. A shark like this had been on my wish list for years.

I got my camera out to take pictures. Everyone—including me—was in awe. It was a huge shark, a *Cretoxyrhina mantelli*, which I had nicknamed the “Ginsu” shark. I got out my field map, plotted the location, and checked it against the GPS data.

Time to start the excavation. First, I used a large pick and shovel. Then I got down on my hands and knees to work closer to the skeleton. I had to work very carefully because I didn’t want to damage the fossil. I removed the chalk with a small knife and an ice pick that has a very fine point. Every so often, I cleared away the bits of chalk with a small brush.

After a few hours, we had exposed the front 16 feet of a 20-foot shark. I made drawings in my notebook to show where each piece was found.

Now that the remains were exposed, we had to protect them. We used wet paper towels to pad the skull. Then we made a protective jacket for the skull out of burlap dipped in plaster. We waited for the plaster to dry and then loaded the jacket into my van. Then we covered the rest of the shark with plastic.

After a complicated but successful recovery, a plaster frame holding the body of the shark arrived at the Sternberg Museum three weeks later.
Activity 3  “Fossils Rock!” Radio Program

Directions:

1. **Explain.** Students will create a story or conduct an interview for a fictional radio program called “Fossils Rock!” They can work in groups or individually, as appropriate.

2. **Distribute “Fossils Rock! Radio Program” to each student.** Review the directions with students.

3. **Student presentations.** After students have had time to prepare their story or interview, have them present their work to the class. Students can pretend they are recording an imaginary radio program called “Fossils Rock!”.

   **Option:** Student work can be recorded using a computer with a microphone, or an audio or video recorder.

**STUDENT ASSESSMENT**
Rate student work on a scale from one to five on each of the following categories: creativity, accurate use of vocabulary, accurate understanding of paleontology, organization of main ideas.

**BACKGROUND INFORMATION**
Paleontology is a science dealing with the life of past geological periods as known from fossil remains. Paleontologists look for, discover, excavate, and study fossils to learn about life on Earth during prehistoric times.

Students synthesize their learning to write a story or conduct an interview. They will orally present or record their work for a fictional radio program.

“Fossils Rock! Radio Program” (p. 7)
You have been asked to work on a radio program, “Fossils Rock!” Use your imagination to write a story or an interview for this program. Write about finding the fossil remains of a prehistoric animal.

**Step 1: Think about ideas.** What details can you include to make your story or interview interesting for listeners? For example:

- Where did you find the fossil?
- What did you notice first?
- What is the name of the prehistoric animal you found?
- What did you do to recover the fossil?
- What tools helped you?

**Step 2: Write your story or interview.** Use at least ten words from the Word Bank in your story or interview. If you do not know the meaning of a word, use a dictionary to look it up.

**Word Bank**

- burlap
- camera
- chalk
- discovery
- excavate (remove) dirt
- field map
- fossil
- GPS data
- ice pick
- identify
- jacket
- large pick
- locate
- location
- observation
- observe
- paleontologist
- paleontology
- photograph
- plaster
- plastic frame
- protect
- remains
- scientific
- shovel
- skeleton
- sketch
- small brush
- small knife
- transport
Activity 4  What’s in a Name?

Students learn how scientists name a living thing in one of three ways: by reference to the location where an organism was found; in honor of a person with some connection to the discovery; or by reference to a unique body part or behavior.

“Greek and Latin Word Parts” (optional; nationalgeographic.com/xpeditions/lessons/17/g35/greeklatin.pdf)

Directions:

1. Explain. Scientists use Greek and Latin words and scientific conventions to name plants and animals, including prehistoric marine reptiles. There are three approaches: to reference the location where an organism was found; in honor of a person with some connection to the discovery; or to reference a unique body part or behavior.

One way scientists name living things is by the location where the animal lived or was first discovered. The mosasaur, a “Meuse River lizard,” is named after a tributary of a river in the Netherlands, where the first known specimen was discovered. Ask students if they can guess where the Argentinosaurus was first discovered.

Answer: Argentina.

Group Activity. Brainstorm some names of imaginary prehistoric sea creatures if they were discovered in your local area. Write the names on the board.

2. Explain. Other dinosaurs are named after famous people or for the lucky person who found them. The Mosasaurus hoffmanni is named after C.K. Hoffman. Ask students who Nedcolbertia is named after.

Answer: Ned Colbert (Dr. Edwin “Ned” Colbert). Or Ricardoestesia?

Answer: Richard Estes.

3. Explain. The last approach is to name animals by their body part, behavioral adaptations, or by whole body descriptions. Example: Englishman Richard Owen coined the word Dinosauria from “dino,” (terrible) and “saur” (lizard). An Ichthyosaur is an “ichthy” (fish) + “saur” (lizard).

4. Group Activity. Write the following Greek and Latin word parts on the board. Ask students to invent names for imaginary prehistoric sea creatures using three word parts (prefix, root word, and suffix). List these names and descriptions of the animals on the board. Example: a “Megabiceratosaurus” (‘big two-horned lizard’). Additional Greek and Latin word parts are available online.

nationalgeographic.com/xpeditions/lessons/17/g35/greeklatin.pdf

Note: This activity has been simplified for young students. Scientists would not mix Greek and Latin word parts.

Greek and Latin Word Parts
bi–two
cephal(o)–head
cerat(o)–horn
ichthy–fish
mega–large
micro–small
odon or oden–tooth
ops–eye or face
ped or pes–foot
rex–king
rhino–nose
saur(us)–lizard
tri–three
tyran–tyrant
uni–one
vor(e)–eating

Students learn how scientists name a living thing in one of three ways: by reference to the location where an organism was found; in honor of a person with some connection to the discovery; or by reference to a unique body part or behavior.
Activity 5  How Do Animals Adapt?

Directions:

1. **Explain.** Introduce the term “adaptation” to the students. An adaptation is a behavior or body part modification (change) that helps an animal survive where it lives. Explain that adaptations can occur through modified behavior (example: working in groups, swimming in schools to avoid predators) or modified body parts (example: chemical defense, camouflage, different limb shapes).

   Ask students to brainstorm other examples. **Possible answers:** Modified body parts such as eyes (ability to see at night, ability to see far away, ability to see underwater), keen sense of smell, large teeth, many teeth, claws, body size; modified behaviors such as playing dead, food selection, migration.

2. **Discussion.** Tell students that, like modern day animals, prehistoric animals also adapted body parts and behaviors in order to survive. In *Sea Monsters: A Prehistoric Adventure*, they will encounter incredible sea creatures that lived 82 million years ago. Ask the class to look for adaptations—body parts or behaviors—that helped these creatures survive.

   **View Sea Monsters: A Prehistoric Adventure.**

3. **Continue discussion.** Describe some of the challenges that the prehistoric marine reptiles faced in the film. **Possible answers:** Protecting their young, defending themselves, finding food.

4. **Distribute “Animal Adaptations” to each student.** As a class, review the model of the giraffe. Next, have students participate in a guided classroom discussion or do library or online research to complete the rest of the handout.

   **Suggested Online Resources:**
   - National Geographic: *Sea Monsters—A Prehistoric Adventure*
     - nationalgeographic.com/seamonsters
   - National Geographic Magazine: Monsters of the Ancient Sea
     - nationalgeographic.com/ngm/0512/feature3/multimedia.html
   - National Geographic: Animals
     - nationalgeographic.com/animals/

5. **Discussion.** Ask students to discuss what they learned about adaptations in modern and prehistoric animals.
# ANIMAL ADAPTATIONS

Use Internet or library research to complete the chart below. Use the giraffe as a model.

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<tbody>
<tr>
<td><strong>MODERN ANIMAL</strong></td>
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<tr>
<td>Giraffe</td>
<td>Mammal</td>
<td>Grasslands of Africa</td>
<td>Leaves from shrubs and trees</td>
<td>Long legs, long neck, long tongue, good eyesight</td>
<td>Live in herds</td>
<td>Height and long tongue help it reach food; living in herds provides protection</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>PREHISTORIC ANIMALS</th>
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<tbody>
<tr>
<td>Tylosaurus</td>
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<td>Styxosaurus</td>
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<tr>
<td>Cretoxyrhina</td>
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</table>

Student name ______________________________
Activity 6  Design-a-Saurus

Students create a drawing of a real or imagined prehistoric sea creature and name the creature after a place of discovery, an honored person, or an adaptation.

Directions:

1. Review. Ask students to think of the different adaptations they have discussed or seen in the film. Review the three ways scientists name something that is living or was once alive—after a person, a place, or an adaptation. Tell students that paleontologists often draw animals that they study.

2. Start activity. Tell students they are going to create a profile of a real or imagined prehistoric marine reptile. To complete the assignment, students should:

   • Draw the real or imagined animal.
   • Label one or more adaptations, noting how it helped the animal survive in its environment.
   • Draw and label a map of where it was found and who first discovered it.
   • Name the prehistoric marine reptile. If it is an imagined animal, create a name after an adaptation, a place, or a person. If it is a real animal, explain the origins of its name.
   • Write one or more declarative sentence(s) about the animal.

3. Student Presentations. Have students share their work with the class. Students should introduce their animal by name, describe the animal (including its body part and behavioral adaptations) and how those adaptations helped it survive in its environment, and determine if the animal is named after a person, a place, or an adaptation.

STUDENT ASSESSMENT

Students who master this lesson should have completed the “Animal Adaptations” handout with correct information about the animals researched. They should also create a drawing of a marine reptile that has one or more adaptations. Their created animals should be named after an adaptation, a location, or a person. The focus of the drawings are the adaptations shown and the way the creature is named. Emphasize the functions of the adaptations, not how well the drawings are made. Declarative sentences should accompany their drawings that accurately describe the adaptations. Students should be able to apply what they learned about adaptations (body parts or behaviors as a way to successfully survive in their surroundings) to modern animals. They should be able to give examples of adaptations from animals of which they are familiar.
Activity 7  Habitat Needs

Directions:

1. **Review.** Write this definition of “habitat” on the board: “The place or environment where a plant or animal naturally or normally lives and grows.”

2. **Brainstorm.** Ask students to brainstorm four basic survival needs that all animals require from their habitat. Tip: Prompt students to think about things that are essential for survival. Four basic survival needs include:
   - Food
   - Shelter from weather and predators
   - Water
   - A place to raise young

3. **Model an example.** Model an example for students, e.g.
   - **Animal:** salt water crocodile
   - **Habitat:** coastal marshes, estuaries, and shallow marine waters
   - **Basic survival needs include:**
     - Food – carnivorous (eats meat), including fish, birds, reptiles, and mammals
     - Shelter from weather and predators – have camouflage and can submerge for long periods of time
     - Water – provided by diet and from freshwater sources
     - A place to raise young – female prepares and guards a nest until the young hatch and are released

4. **Brainstorm.** Ask the class to brainstorm other examples using animals they are familiar with (e.g. dog, cat, hamster, bird, horse). For each example, discuss the animal’s habitat and basic survival needs. Continue until students have grasped the concept. For an increased challenge, have students brainstorm the basic survival needs of animals from a variety of habitats (e.g., jungle, Arctic, desert, Alpine regions).
Activity 8  Cretaceous Seas Bingo

Students create a bingo card and play a bingo game by answering the questions they researched in Activity 2.

“Cretaceous Seas Bingo Pictures” (p. 14)
“Cretaceous Seas Bingo Card” (p. 15)

Directions:

1. Distribute the “Cretaceous Seas Bingo Pictures” and “Cretaceous Seas Bingo Card” to each student.
   One page is filled with 30 images of sea creatures, and the other is a blank card with 25 spaces. Tell students to cut out the animal picture squares and mix them up. Students should randomly select 25 animal pictures to glue or tape in each blank square. They will not use all of the pictures.

2. Distribute markers. Each student will need approximately 20 markers to use when they are playing the bingo game.

3. Explain game rules:
   • Students play the game individually with the bingo card they created and their completed “Cretaceous Seas Fact Sheet” (Activity 2).
   • You will call out clues from the “Cretaceous Seas Fact Sheet.” Players use their fact sheet to look up the correct answer. Then, they look on their bingo card for an image of the correct answer and place a marker in this space. They may place only one marker if they have more than one image of the animal.
   • Players compete to be the first to fill five spaces in a row, column, or diagonal.
   • You will continue calling out clues until a player wins and announces “Cretaceous Seas Bingo!”

4. Start the game by asking the first question.
   Keep track of clues (and answers) you have used. Continue asking questions until a student announces that they have won. Check their card to make sure they have the correct answers. If one of the answers is incorrect, you should continue the game. If it is a winning bingo card, the round is over, and students should clear their cards so that a new round can begin.

Note to Teacher

Although habitats like deserts and rain forests are very different, together they form a complex life-support system for every living thing on the planet. The first photographs of Earth from space allowed us to see our planet for the first time as it is, a small blue sphere moving through the blackness of space. People began to use the term “Spaceship Earth” to help explain the idea that we must all work together, like the crew of a spaceship, to take care of all the habitats that make our planet home.

Spaceship Earth: The Mother of All Habitats
nationalgeographic.com/geographyaction/habitats/intro.html
CRETACEOUS SEAS BINGO PICTURES

Use scissors to cut out the animal picture squares below. Mix them up and select 25.

DOLICHORHYNCHOPS
TYLOSARUS
CRETOXYRHINA
AMMONITE
XIPHACTINUS
TUSOTEUTHIS
HESPERORNIS
HENODUS
PROTOSTEGA
STYXOSAURUS
DOLICHORHYNCHOPS
TYLOSARUS
CRETOXYRHINA
AMMONITE
XIPHACTINUS
TUSOTEUTHIS
HESPERORNIS
HENODUS
PROTOSTEGA
STYXOSAURUS
DOLICHORHYNCHOPS
TYLOSARUS
CRETOXYRHINA
AMMONITE
XIPHACTINUS
TUSOTEUTHIS
HESPERORNIS
HENODUS
PROTOSTEGA
STYXOSAURUS
DOLICHORHYNCHOPS
TYLOSARUS
CRETOXYRHINA
AMMONITE
XIPHACTINUS
TUSOTEUTHIS
HESPERORNIS
HENODUS
PROTOSTEGA
STYXOSAURUS
**CRETACEOUS SEAS BINGO CARD**

Glue or tape an animal picture in each square of the grid below. Place them in random order so that your card is unique.

<table>
<thead>
<tr>
<th>CRETACEOUS</th>
<th>SEA</th>
<th>PREHISTORIC</th>
<th>CREATURE</th>
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Activity 1  Unpack the Evidence

Students practice scientific thinking to understand evidence and inference.

Directions:

1. Preparation. Prepare a backpack with books and other items you will show the class. Include items students can use to hypothesize about the person who owns the bag.

2. Group activity. Show students the backpack and ask them to use scientific thinking to learn more about this backpack. As you examine the backpack and its contents, guide students through the following steps.

3. Ask students, “What can you observe?” Prompt students to describe the backpack and the contents inside.
   Possible answers: size, color, style, descriptions of objects as they are shown.

4. Ask students, “To whom does it belong?” Ask students what they can infer about the person who owns the backpack, based on the information they have acquired. What behaviors can they infer about the owner, based on the contents and how they might be used?

5. Write “evidence” and “inference” on the board, and discuss these terms with students.

Evidence is data that can be measured, observed, examined, and analyzed to support a conclusion. Ask students to share what they know about the backpack and its contents that are based on evidence.
   Possible answers: descriptions of the bag and its contents.

Inference is an explanation derived by reasoning. Ask students to share information they acquired during the backpack activity that is based on inference, i.e. ideas they have that cannot be directly observed in the contents.
   Possible answers: Descriptions of the type of person who may own the bag and how they used the objects found inside.

6. Making a connection. Introduce students to the work paleontologists do. Paleontologists search for, uncover, and study fossil remains, which is evidence of prehistoric animals. As was done in the backpack activity, paleontologists draw inferences from the evidence they uncover. Example: A shark’s tooth embedded in a fossilized bone may lead a paleontologist to infer that a shark bit the animal.
Behind the Scene: Science Notes

**Directions:**

1. **Review.** Review the concepts of evidence and inference. Ask students to look for examples of these concepts as they watch the film, *Sea Monsters: A Prehistoric Adventure*.

   **View Sea Monsters: A Prehistoric Adventure.**

2. **Discuss**. Discuss the film with students. What elements did they think were based on evidence? What elements did they think were based on inference?

3. **Distribute “Behind the Scene: Science Notes.”** Explain that one of the scientific advisors on the film has shared his notes from a scene in the film. Ask students to read the notes on the handout.

4. **Create a chart.** On a separate piece of paper, have students make a chart with two columns. Students should label these columns “Evidence” and “Inference.” Across from each example of evidence, students should list the inferences based on it (sometimes there is more than one).

   **Note:** There are seven examples of evidence and ten examples of inference. See answer key at right.

5. **Review and discuss.** Discuss students’ answers. Ask them to share their reasoning. What physical evidence supports an answer of “evidence”?

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<table>
<thead>
<tr>
<th>Evidence</th>
<th>Inference</th>
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<td>1. Based on Sternberg find in 1918—a <em>Dolichorhynchops</em> (nicknamed “Dolly”) within the ribs of a <em>Tylosaurus</em> (we’ll call “Tylo”).</td>
<td>1. Since only the skeleton of the Tylo remains, we assume the region is where the stomach was, but can’t say for sure.</td>
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<td>2. Tylo lacked hands to hold prey.</td>
<td>2. Thus, it had to either bite and shake large chunks out of prey, or swallow prey whole.</td>
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<td>3. Like snakes, Tylo had two rows of teeth way back on the roof of the mouth.</td>
<td>3. Like snakes, we believe it used these teeth to help swallow prey.</td>
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<td>4. Dolly had a short, rigid body and long flippers.</td>
<td>4. Flippers may have worked like wings to help it “fly” under water—similar to a penguin.</td>
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<td>5. Tylo had a long body and tail.</td>
<td>5. It probably swam with an eel-like movement.</td>
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<td>6. One way a slow Tylo could have caught a fast Dolly was if Dolly was dead (and Tylo scavenged).</td>
<td>6. Thus we suppose it was a much slower swimmer than Dolly.</td>
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<td>7. Fossil skin impressions show Tylo had very small, overlapping, lizard-like scales.</td>
<td>7. Another way was if Tylo made a surprise attack.</td>
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<tr>
<td>8. Another way was if Tylo made a surprise attack.</td>
<td>8. We can see from Dolly skeletons that its blind spot was immediately behind and below its body.</td>
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<td>9. We can assume that could have been the direction of a surprise attack.</td>
<td>9. Since most large marine animals are drab and/or dark, we assume the same might have been true for Dolly and Tylo.</td>
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*National Geographic’s Sea Monsters: A Prehistoric Adventure Educator’s Guide © 2013 National Geographic Society*
**BEHIND THE SCENE: SCIENCE NOTES**

During the making of the film *Sea Monsters: A Prehistoric Adventure*, scientific advisors reviewed storyboards to ensure the film was science-based. Below is a storyboard with scripted voiceover (VO) and notes from Dr. Ken Carpenter, a paleontologist with the Denver Museum of Nature & Science.

**Step 1: Review the scientific notes.** Which are examples of evidence? Which are inferences based on the evidence?

**Step 2: On a separate piece of paper, make a chart with two columns labeled “Evidence” and “Inference.”** List examples of evidence from the notes. Across from each example of evidence, write the inferences based on it (sometimes there is more than one). Hint: there are seven examples of evidence and ten examples of inference.

<table>
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<tr>
<th>VO: They had found a monster’s last meal – entombed within its ribs.</th>
<th>Notes: Based on Sternberg find in 1915 – a Dolichorhynchops (nicknamed “Dolly”) within the ribs of a Tylosaurus (we’ll call “Tylo”). Since only the skeleton of the Tylo remains, we assume the region is where the stomach was, but can’t say for sure.</th>
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<tr>
<td>VO: The Tylosaurus can open its mouth wide enough to swallow prey whole, like a snake.</td>
<td>Notes: Tylo lacked hands to hold prey. Thus, it had to either bite and shake large chunks out of prey, or swallow prey whole. Like snakes, Tylo had two rows of teeth way back on the roof of the mouth. Like snakes, we believe it used these teeth to help swallow prey.</td>
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<tr>
<td>VO: Because Dollies are fast, a Tylosaurus’ best bet is to catch one by surprise.</td>
<td>Notes: Dolly had a short, rigid body and long flippers. Flippers may have worked like wings to help it “fly” under water—similar to a penguin. Tylo had a long body and tail. It probably swam with an eel-like movement. Thus we suppose it was a much slower swimmer than Dolly.</td>
</tr>
<tr>
<td>VO: The female escapes...but her brother doesn’t see the danger coming.</td>
<td>Notes: Because Tylo was a slower swimmer there were probably two ways it might have caught Dolly to eat it: either Dolly was dead (and Tylo scavenged) or Tylo made a surprise attack. We can see from Dolly skeletons that its blind spot was immediately behind and below its body. We can assume that could have been the direction of a surprise attack.</td>
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<tr>
<td>VO: The Sternbergs had discovered a life-and-death moment...a story locked in time of two ancient lives intersecting.</td>
<td>Notes: Fossil skin impressions show Tylo had very small, overlapping, lizard-like scales. Unfortunately, these impressions do not indicate skin color. We don’t know the true color of any marine reptiles. Since most large marine animals are drab and/or dark, we assume the same might have been true for Dolly and Tylo.</td>
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Activity 3  Mapping the Cretaceous

Students should view *Sea Monsters: A Prehistoric Adventure* prior to Activity 1.

Directions:

1. **Introduce.** Tell students that they will set the stage for their exhibits by completing a map handout to illustrate what the landscape of the United States looked like millions of years ago during the Cretaceous period.

   **Note:** Scientists have determined the area of the Western Interior Sea by analyzing the types of rocks and marine fossils found within the rock strata of North America. The study of the origin, composition, and development of rock strata is called stratigraphy.

2. **Distribute map handout.** Explain that students will use coordinates to plot and draw Cretaceous-era outlines of land and water areas on a map of the present-day United States. After they plot the outlines, they will color land and water and add labels.

3. **Discuss.** After students have completed the assignment, review their work, and discuss how the appearance of the United States was different during the Cretaceous period than it is today. Which states were under water?

4. **Collect student work so that it can be used in the Closing Activity.**

**ADAPTATION**

This activity can be done as a whole-group activity with teacher-led, guided instruction.
Student Handout

MAPPING THE CRETACEOUS

Directions:

1. Plot the points below.

What did the land of the United States look like during the late Cretaceous?

2. Join the points to outline the western and eastern landmasses.

3. Color these two landmasses green to represent land. Color remaining areas in blue to represent sea.

4. Label the “Western Interior Seaway” between the two landmasses.
Activity 4  Eco-Illustrations

Directions:

1. Staging the activity. Divide the class into eight groups. Assign each group one of the following terms:
   - Extinction
   - Biodiversity
   - Habitat
   - Climate change
   - Conservation
   - Sustainability
   - Evolution
   - Endangered species

2. Instructions. Explain that each group will research its term and create a brochure. Each brochure should include:
   - The word and its definition
   - An original symbol that illustrates the meaning of the word
   - A brief description of the symbol’s meaning
   - Research sources

   Note: Students may present their work as a Word document, PowerPoint slide presentation, a web page, or a short video clip.

3. Students’ presentations. Have each group share its brochure with the entire class. Tell students that they will use their brochures in a science forum in the Closing Activity.

Students should view Sea Monsters: A Prehistoric Adventure prior to Activity 2.

ADAPTATIONS

If students have difficulty with these terms, you may wish to spend additional time reinforcing the meanings of the words. One way you can do this is by having the students write sentences using the vocabulary words in context to demonstrate that they understand the definitions.

Dolichorhynchops

Xiphactinus
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Mission Programs: Terry D. Garcia, Executive Vice President; M. Ford Cochran, Director, Mission Programs Online

Education & Children’s Programs: Mary Lee Elden, Interim Director, Geography Education Outreach

Giant Screen Films: Lisa Truitt, President; Derek Threinen, Director of Film Marketing, Outreach and Corporate Relations; Erica Meehan, Manager of Film Production

Content Development: Amy Grossman, Patricia Norris, Producers; Maral Tashjian, Assistant Producer; Maureen Carroll, Ph.D., Rick Crosslin, Writers; Cassandra Franklin-Barbajosa, Alice Manning, Copy Editors; Chelsea Zillmer, Researcher; Mary Crooks, Intern

Design: Project Design Company—Daniel Banks, Art Director; Kerri Sarembock, Designer. Mike Carina, Illustrator

Production: Clifton M. Brown, III, Manufacturing and Quality Control; Emmy Scammahorn, Editor

Project Administration: Katherine Broendel, Education Outreach Coordinator; Melissa Goslin, Project Administrator

Professional Development: Kim Hulse, Manager; Jo Erikson, Outreach Coordinator

Scientific Consultants: Kenneth Carpenter, Ph.D., Curator of Lower Vertebrate Paleontology and Chief Preparator, Department of Earth Sciences, Denver Museum of Nature & Science; Michael J. Everhart, Adjunct Curator of Paleontology, Sternberg Museum of Natural History, Fort Hays State University, Kansas; Glenn W. Storrs, Ph.D., Assistant Vice President for Natural History & Science, Withrow Farny Curator of Vertebrate Paleontology, Cincinnati Museum Center

Educator Reviewers: James A. Shymansky, Ph.D., E. Desmond Lee Professor of Science Education, University of Missouri-St. Louis; Mark Bockenhauer, Ph.D., Professor of Geography, St. Norbert College, De Pere, Wisconsin; J. Lynett Gillette, Exhibit Content Developer, San Diego Natural History Museum; Judy Scotchmoor, Assistant Director, University of California Museum of Paleontology, Berkeley; Peter L. Burnett, Fourth Grade Teacher, Cedar Rapids Community Schools, Cedar Rapids, Iowa; Loisann C. Hoper, Sixth Grade Teacher, Cedar Rapids Community Schools, Cedar Rapids, Iowa; Jim Jones, Fifth Grade Teacher, Coachella Valley Unified School District, Thermal, California; Mark Stefanski, 9-12th Grade Science Teacher, Marin Academy, San Francisco, California


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