Science & Literacy Activity

GRADES 6-8

OVERVIEW

This activity, which is aligned to the Common Core State Standards (CCSS) for English Language Arts, introduces students to scientific knowledge and language related to interactions between organisms. Students will read content-rich texts, visit the Bernard Family Hall of North American Mammals, and use what they have learned to complete a CCSS-aligned writing task, creating an illustrated text about interactions between organisms.

Common Core State Standards:
WHST. 6-8.2, WHST.6-8.8, WHST.6-8.9, RST. 6-8 .1, RST.6-8.2, RST. 6-8.4, RST. 6-8 .10

New York State Science Core Curriculum:
LE 7.1c

Next Generation Science Standards:
PE MS-LS2-1
Interdependent Relationships in Ecosystems: Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors.

Materials in this activity include:

- Teacher instructions for:
  - Pre-visit student reading
  - Visit to the Bernard Family Hall of North American Mammals and Student Worksheet
  - Post-visit writing task
- Text for student reading: "How Bears Feed Salmon to the Forest"
- Student Worksheet for the Bernard Family Hall of North American Mammals visit
- Student Writing Guidelines
- Teacher rubric for writing assessment

SUPPORTS FOR DIVERSE LEARNERS: An Overview

This resource has been designed to engage all learners with the principles of Universal Design for Learning in mind. It presents multiple ways for your students to engage with scientific concepts through reading, observing, discussing, and writing. While certain tasks may challenge individual students, we suggest that all learners participate in each part of the experience. In the paragraphs labeled "Supports for Diverse Learners" that supplement this activity, we have provided suggestions for how to adapt each section for students with different skill-levels. If any students have an Individualized Education Program (IEP), consult it for additional accommodations or modifications.

1. BEFORE YOUR VISIT

This part of the activity engages students in reading a non-fiction text about the interactions between organisms. The reading will prepare students for their visit by introducing them to the topic and framing their investigation.

Student Reading

Have students read "How Bears Feed Salmon to the Forest." Ask them to write notes in the large right-hand margin. For example, they could underline key passages, paraphrase important information, or write down questions that they have. They may also use this space to draw a flow chart or diagram, tracing the interactions between the organisms described in this reading.

Ask:

- How do the bears, salmon, and forest interact in the ecosystem described in this reading?
  (The bears capture and eat the salmon. Bears leave parts of uneaten salmon in the forest, and also leave urine in the forest. Nutrients move from the salmon, to the bears, and eventually to the forest.)
- What does Dr. Reimchen mean when he says, "in ecosystems there is no surplus, everything is used"?
  (This means that all nutrients are recycled in an ecosystem. For example, all of the nutrients that are in salmon are passed to the bears and forest. New generations of salmon consume these same nutrients as they grow.)
- Dr. Reimchen specializes in predator-prey interactions. Describe one example of a predator-prey interaction.
  (In this reading, bears are predators and the salmon are prey. Predators are the organisms that eat other organisms, while prey are food organisms.)

Students can work in pairs, small groups, or as a class. During discussion, remind them to use evidence from the text to explain their thinking, and to use specific examples.

SUPPORTS FOR DIVERSE LEARNERS: Student Reading

- "Chunking" the reading can help keep them from becoming overwhelmed by the length of the text. Present them with only a few sentences or a single paragraph to read and discuss before moving on to the next "chunk."
- Provide "wait-time" for students after you ask a question. This will allow time for students to search for textual evidence or to more clearly formulate their thinking before they speak.

2. DURING YOUR VISIT

This part of the activity engages students in exploring the Bernard Family Hall of North American Mammals.

Museum Visit & Student Worksheet

Explain to students that they will be viewing several dioramas, using worksheets to gather all the necessary information about the interactions between organisms. Tell students that back in the classroom they will refer to these notes when completing the writing assignment.

SUPPORTS FOR DIVERSE LEARNERS: Museum Visit

- Review the Student Worksheet with students, clarifying what information they should collect during the visit.
- Have students explore the hall in pairs, with each student completing their own Student Worksheet.
- Encourage student pairs to ask you or their peers for help locating sources of information. Tell students they may not share answers with other pairs, but they may point each other to places in the hall where answers may be found.
- Study the first diorama (Alaska Brown Bear) as an entire class, and then "jigsaw" the remaining two dioramas so that only half of the class does each. Students can exchange information back in the classroom or teach each other about a diorama.

3. BACK IN THE CLASSROOM

This part of the activity engages students in an informational writing task that draws on the pre-visit reading and on observations made at the Museum.

Writing Task

Distribute the Student Writing Guidelines handout, which includes the following prompt for the writing task:

> Based on the article "How Bears Feed Salmon to the Forest," your visit to the Bernard Family Hall of North American Mammals, and your discussions, write an essay in which you:
>
> - explain how organisms interact with each other in an ecosystem
> - provide one example of an ecosystem with interactions between organisms
> - include an illustration that shows how organisms in this ecosystem interact

Support your discussion with evidence from your reading and the Bernard Family Hall of North American Mammals.

Go over the handout with students. Tell them that they will use it while writing, and afterwards, to evaluate and revise their essays.

Before they begin to write, have students use the prompt and guidelines to frame a discussion around the information that they gathered in the Bernard Family Hall of North American Mammals and compare their findings. They can work in pairs, small groups, or as a class. Referring to the writing prompt, have students underline or highlight all relevant passages and information from the reading, and their notes from the hall, that can be used in their response to the prompt. Instruct each student to take notes on useful information that their peers gathered as they compare findings. Students should write their essays individually.

SUPPORTS FOR DIVERSE LEARNERS: Writing Task

- Re-read the "Before Your Visit" assignment with students. Ask what they saw in the hall that helps them understand the interactions between organisms.
- Allow time for students to read their essay drafts to a peer and receive feedback based on the Student Writing Guidelines.

Student Reading

How Bears Feed Salmon to the Forest

Trees Get the Table Scraps from a Fish Dinner

By Robert S. Semeniuk

Wearing night-vision goggles, Thomas E. Reimchen maneuvers our inflatable boat around rocks, deadfalls, and barnacles as we pick our way in the dark up an estuary in Canada's Pacific Northwest. In our wake we leave brilliant bursts of bioluminescence, as schools of fleeing salmon agitate unicellular algae called dinoflagellates. Why the "dinos" emit light is open to interpretation. One explanation, Reimchen tells me, is that the light attracts fish that eat zooplankton such as copepods, which are predators of the dinoflagellates.

© National Park Service

Bears fish for salmon in a variety of ways. This brown bear attempts to "guide" the salmon into its mouth with its paw.

A biologist at the University of Victoria in British Columbia, Reimchen specializes in predator-prey interactions. We are here to observe black bears catching spawning salmon (the bears get most of their catch in the dark). The field study is part of an investigation born more than a decade ago at Bag Harbour in the Queen Charlotte Islands. One day in 1992, as Reimchen was sitting under giant Sitka spruce trees and looking at half-eaten salmon carcasses strewn about on the forest floor, he realized that the abundance of carcasses and the abundance of giant trees adjacent to the river was probably no coincidence. Ever since that moment, he has collected evidence that the autumn return of salmon from the Pacific Ocean to the streams of their birth is much more than just the annual migration of fish. The run of salmon constitutes a major flow of marine nutrients into estuaries and coastal watersheds.

Reimchen estimates that before the expansion of commercial fishing and industrial logging in the twentieth century, when salmon were more abundant throughout coastal streams, each of the 30,000 black bears living in the salmon watershed may have caught on average 500 fish a year. If half of each carcass was left uneaten on the forest floor (a reasonable estimate), he figures the nutrient transfer into the rainforest amounted to more than 25,000 tons a year, of which 3.4 percent was nitrogen.

And salmon carcasses are by no means the only way bears spread salmon-derived nitrogen to the terrestrial ecosystem. Other field biologists, such as Grant V. Hilderbrand, formerly of the Alaska Department of Fish and Game, and his colleagues, have documented two other major means: urine and feces. Hilderbrand, who studied brown bears in Alaska, maintains that urine is particularly important. Bears consume salmon in the later summer and fall to accumulate the fat reserves they will need to hibernate-and that females will need to birth and provide milk for their cubs. Although some of the nitrogen from the salmon goes into building muscle tissue and meeting other physiological demands, the bears' fat tissue is virtually nitrogen free. Consequently, much of the nitrogen in the salmon protein is excreted. " The bottom line," Hilderbrand says, "is that if the bears leave half of each carcass in the forest, the other, eaten half also is ultimately deposited in the forest as well."

Reimchen's boat carries us out of the salty estuary and up the Klekane River into the conifer rainforest of the coastal mainland of British Columbia. After the boat has been safely tied up at the bank, Reimchen leads me and two of his coworkers, Deanna D. Mathewson, also of the University of Victoria, and Daniel R. Klinka, a graduate student of Reimchen's, along a creek into the pitch-black woods. To avoid surprising any bears, Reimchen trudges steadily forward, uttering low guttural sounds. Then, at the edge of the creek we stop and wait quietly; I scan the forest on the opposite bank.

"There is a bear downstream walking towards us," someone whispers softly. The splash of the footsteps sounds closer than the animal appears through my night-vision goggles. The bear lurches forward, crashes through the water, but misses a fish. The bear moves upstream slowly, to within perhaps fifty feet of us, and takes another lurch. Again, no catch. On its fourth try, the bear succeeds. I hear the crunch of fish skull, and the bear disappears into the forest with a big chum salmon in its mouth.

As we come to the end of our nighttime observations, Reimchen speaks about how his work feeds into the formulation of conservation policies. "People act as if they harvest the surplus, and are the only harvesters. They think that all the dead fish in the stream are wasted." But the work of Reimchen and other investigators shows that not only do salmon replenish the forest; they also revitalize streams and estuaries with carbon, nitrogen, phosphorous, and other minerals. Among salmon themselves, the circle of life is particularly intimate: nearly half of the nutrients consumed by juvenile salmon comes from their dead parents. "In ecosystems there is no surplus," says Reimchen. "Everything is used."

Student Worksheet

Use this worksheet to record information about the interactions between organisms.

DIORAMA: Alaska Brown Bear

Observe the diorama, read the information on the panel to the left, and discuss what you see with classmates.

Sketch the diorama and record notes:

List the organisms in this diorama and explain how they are interacting:

Read the panel on the right called "Bears and Salmon."
How do the brown bears and salmon "help support the riverside ecosystems?"

How do you think a change in bear population will affect the fish population and the grass population? Explain:

Student Worksheet

Use this worksheet to record information about the interactions between organisms.

DIORAMA: Wapiti

Observe the diorama, read the information on the panel to the left, and discuss what you see with classmates.

Sketch the diorama and record notes:

List the organisms in this diorama and explain how they are interacting:

Read the panel on the right called "Wapiti and Aspen."
How do the wapiti and aspen interact?

How do wolves regulate the interaction between wapiti and aspen, and help maintain a healthy ecosystem?

What other organisms benefit from a healthy ecosystem?

Student Worksheet

Use this worksheet to record information about the interactions between organisms.

DIORAMA: Canada Lynx and Snowshoe Hare

Observe the diorama, read the information on the panel to the left, and discuss what you see with classmates.

Sketch the diorama and record notes:

List the organisms in this diorama and explain how they are interacting:

Read the panel on the right called "Predator and Prey."
What does it mean that these two species have an "unusually tight predator-prey relationship?"

Sketch and describe the graph showing "population cycles."

What population falls first? Why do the populations recover over time?

ANSWER KEY

Student Worksheet

Use this worksheet to record information about the interactions between organisms.

DIORAMA: Alaska Brown Bear

Observe the diorama, read the information on the panel to the left, and discuss what you see with classmates.

Sketch the diorama and record notes:

List the organisms in this diorama and explain how they are interacting:

(This diorama has bears, fish, an otter, and grass. The bears and otter are eating the fish. The grass may also provide food for the bear.)

Read the panel on the right called "Bears and Salmon."
How do the brown bears and salmon "help support the riverside ecosystems?"

(Droppings and fish carcasses left behind by feeding bears help transfer nutrients to other parts of the ecosystem. These nutrients help the grasses grow.)

How do you think a change in bear population will affect the fish population and the grass population? Explain:

(Because bears are predators of salmon, if there are more bears, there will probably be fewer salmon over time because many are eaten. If there are fewer bears, more salmon will survive. Without many bears, the plants may suffer because bears help move nutrients from fish to the grass.)

ANSWER KEY

Student Worksheet

Use this worksheet to record information about the interactions between organisms.

DIORAMA: Wapiti

Observe the diorama, read the information on the panel to the left, and discuss what you see with classmates.

Sketch the diorama and record notes:

List the organisms in this diorama and explain how they are interacting:
(This diorama has wapiti, grass, trees, and a bird. The wapiti eat the plants. The bird uses the tree as a place to rest and may also eat plant material.)

Read the panel on the right called "Wapiti and Aspen."
How do the wapiti and aspen interact?
(The wapiti are herbivores and so they eat the young aspen trees for food, as well as many other plants.)

How do wolves regulate the interaction between wapiti and aspen, and help maintain a healthy ecosystem?
(Wolves regulate the wapiti population because they are predators that eat the wapiti. More wolves mean fewer wapiti, and that means there can be more aspen since fewer wapiti are eating them. Aspen and other plants are important to a healthy ecosystem because they provide food or shelter to many animal species and because their roots help prevent erosion.)

What other organisms benefit from a healthy ecosystem?
(Bison and beavers are herbivores too so they normally compete with wapiti for food. In a healthy ecosystem, wapiti won't eat all of the plant food. Songbirds live in aspen trees so they too benefit from having a good balance between the number of wolves and the number of wapiti. In a healthy ecosystem, there are plenty of trees for songbirds to use.)

ANSWER KEY

Student Worksheet

Use this worksheet to record information about the interactions between organisms.

DIORAMA: Canada Lynx and Snowshoe Hare

Observe the diorama, read the information on the panel to the left, and discuss what you see with classmates.

Sketch the diorama and record notes:

List the organisms in this diorama and explain how they are interacting:
(This diorama has a lynx, hare, and plants. The lynx eats the hares. The hares eat plants and also use plants for shelter.)

Read the panel on the right called "Predator and Prey."
What does it mean that these two species have an "unusually tight predator-prey relationship?"
(These two organisms have an almost exclusive predator-prey relationship. That means the lynx almost only eats hares, and the hares are almost only eaten by lynx. As a result, the population of one species will affect the population of the other.)

Sketch and describe the graph showing "population cycles."
(This graph shows the size of a lynx population and a hare population over many years. The populations rise and fall over and over again in a wave-like pattern.)

What population falls first? Why do the populations recover over time?
(The hare population falls first and then soon after, the lynx population falls rapidly. This is because the lynx eat most of the hares and then run short on food. With little food to eat, the lynx population either starves or leaves the area. With fewer predators, the hares make a dramatic recovery, allowing the lynx to also recover.)

Student Writing Guidelines

Based on the article "How Bears Feed Salmon to the Forest," your visit to the Bernard Family Hall of North American Mammals, and your discussions, write an essay in which you:

- explain how organisms interact with each other in an ecosystem
- provide one example of an ecosystem with interactions between organisms
- include an illustration that shows how organisms in this ecosystem interact

Support your discussion with evidence from your reading and the Bernard Family Hall of North American Mammals.

Use this checklist to ensure that you have included all of the required elements in your essay.

- ☐ I introduced interactions between organisms.
- ☐ I clearly named organisms and described how they interact with each other.
- ☐ I included a labeled illustration of an ecosystem showing interactions between organisms.
- ☐ I only included relevant information about the interactions between organisms.
- ☐ I used information from "How Bears Feed Salmon to the Forest" to explain ecosystem interactions in detail.
- ☐ I used information from the Bernard Family Hall of North American Mammals to explain ecosystem interactions in detail.
- ☐ I used academic, non-conversational tone and language.
- ☐ I included a conclusion at the end.
- ☐ I proofread my essay for grammar and spelling errors.

Assessment Rubric

	Scoring Elements	1 Below Expectations	2 Approaches Expectations	3 Meets Expectations	4 Exceeds Expectations
RESEARCH	**Reading**	Attempts to present information in response to the prompt, but lacks connections to the texts or relevance to the purpose of the prompt.	Presents information from the text relevant to the purpose of the prompt with minor lapses in accuracy or completeness.	Presents information from the text relevant to the prompt with accuracy and sufficient detail.	Accurately presents information relevant to all parts of the prompt with effective paraphrased details from the text.
	AMNH Exhibit	Attempts to present information in response to the prompt, but lacks connections to the Museum exhibit content or relevance to the purpose of the prompt.	Presents information from the Museum exhibit relevant to the purpose of the prompt with minor lapses in accuracy or completeness.	Presents information from the Museum exhibit relevant to the prompt with accuracy and sufficient detail.	Accurately presents information relevant to all parts of the prompt with effective paraphrased details from the Museum exhibit.
WRITING	**Focus**	Attempts to address the prompt, but lacks focus or is off-task.	Addresses the prompt appropriately, but with a weak or uneven focus.	Addresses the prompt appropriately and maintains a clear, steady focus.	Addresses all aspects of the prompt appropriately and maintains a strongly developed focus.
	Development	Attempts to provide details in response to the prompt, including retelling, but lacks sufficient development or relevancy.	Presents appropriate details to support the focus and controlling idea.	Presents appropriate and sufficient details to support the focus and controlling idea.	Presents thorough and detailed information to strongly support the focus and controlling idea.
	Conventions	Attempts to demonstrate standard English conventions, but lacks cohesion and control of grammar, usage, and mechanics.	Demonstrates an uneven command of standard English conventions and cohesion. Uses language and tone with some inaccurate, inappropriate, or uneven features.	Demonstrates a command of standard English conventions and cohesion, with few errors. Response includes language and tone appropriate to the purpose and specific requirements of the prompt.	Demonstrates and maintains a well-developed command of standard English conventions and cohesion, with few errors. Response includes language and tone consistently appropriate to the purpose and specific requirements of the prompt.
SCIENCE	**Content Understanding**	Attempts to include science content in explanations, but understanding of the topic is weak; content is irrelevant, inappropriate, or inaccurate.	Briefly notes science content relevant to the prompt; shows basic or uneven understanding of the topic; minor errors in explanation.	Accurately presents science content relevant to the prompt with sufficient explanations that demonstrate understanding of the topic.	Integrates relevant and accurate science content with thorough explanations that demonstrate in-depth understanding of the topic.