Life Sciences Trek

Grades: 3 - 5

Time: a pre-visit session of 30-45 minutes and a post visit session of 20-30 minutes (*Note: Time for either session can be adapted. For instance the pre-visit session can consist of a 10 minute preview of the exhibits.)*

Rationale and Context:
This trek is organized around the NGSS crosscutting concepts structure and function and systems and system models. To help maximize their ECHO experience, students will be introduced to several ECHO exhibits before their classroom visit. They will make predictions about animal behavior, receive background information about certain species, and be introduced to concepts related to stewardship. At ECHO, students will find answers to questions and explore exhibits with purpose. After their visit, students will process their learning as a group and draw conclusions about structures, ecosystems, evolution (survival) and related crosscutting concepts. Teachers may choose to continue to explore these concepts using additional resources provided.

Teacher Background Information:
ECHO is home to numerous species of fish, reptiles and amphibians, making it an ideal place to study life sciences while also experiencing the joy of scientific discovery, wonder of nature, and care of Lake Champlain.

Learning/Behavioral Objective(s):

1. Students will engage with ECHO animal exhibits with a sense of respect and purpose.
2. Students will hypothesize about the physical structures of animals and animal behavior.
3. Students will develop a sense of stewardship for this region's native plants and animals and their environment.
4. Students will draw conclusions about life science concepts and connect their learning to the broader crosscutting concepts of structure and function and systems and system models.

Essential Questions:
How are systems models used to predict and understand real world situations?
What is the connection between structure and function?

Focusing Questions:
How do the structures of animals enable them to function?
How do animals interact with their environment and what are the effects of these interactions?
What happens to ecosystems when the environment changes?
Where do the differences amongst individuals of the same species come from?
How does the environment influence populations of animals?
How do scientists model the flow of matter and energy within ecosystems?

Vermont Standard(s): Next Generation Science Standards

Standard	**Description**
Crosscutting concept	Structure and Function Systems and System Models
3 LS3-1	Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.
3 LS3-2	Use evidence to support the explanation that traits can be influenced by the environment.
3 LS4-4	Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.
4 LS1-1	Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.
5 LS2-1	Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.(Specifically: organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants.)
Science and Engineering Practices	Developing and using models Constructing explanations and designing solutions Engaging in argument from evidence

Vocabulary: Students may gain an understanding of certain vocabulary words through active participation and explanation.

Behavior	Habitat
Camouflage	Predator
Coloration	Prey
Food web	Species
Function	Structure
Gills	Survive

LEARNING PLAN

Resources/Materials

1. Optional free admission for teacher walkthrough visit
    - contact ephillips@echovermont.org
2. Slide presentation of selected exhibits
3. Museum Map
4. ECHO Exhibit Preview sheet
5. ECHO Exhibit Exploration sheet
6. Links to extension activities

Before your ECHO trip:

Introduction

1. *When our class visits ECHO, you will have a chance to see many animals and habitats that have been created for them. Today we're going to preview a few of them and start thinking about some of the ideas you might explore when we are there.*
2. *At many of the exhibits, you'll be able to think about structure and function or systems and systems models*. If necessary, introduce or review these crosscutting concepts.
3. Hand out the ECHO Exhibit Preview sheet.

Exhibit Preview

1. Begin slideshow. Show slide of **mudpuppy**, then discuss:
    a. *This is a mudpuppy. What do you notice about it?* Take several responses. If no one comments on the feathery external gills, call students' attention to them.
    b. *Those "feathers" are actually gills. Why might mudpuppies have them?* Take several ideas. If no one suggests that it has something to do with breathing, ask:
        i. *Mudpuppies have lungs and can gulp air at the surface. Why do you think they also have gills?* Take several predictions.
        ii. *Mudpuppy gills grow bigger when there is less oxygen in the water where they live! Scientists can actually tell a lot about the quality of the water by looking at mudpuppy gills.*
    c. *What do you think mudpuppy gills would look like in clean water? In polluted water?*

d. Allow students time to record ideas on their worksheet. Share and discuss.
e. *When we go to ECHO, one of your jobs will be to notice interesting structures on the animals and think about what their function might be and how they might help them survive.*

2. Show slide of group of **red-eyed tree frogs**, then discuss:
    a. *What do you notice?* Take several responses. If no one mentions that there are several individuals of the same species, ask:
        i. *How many frogs are in this picture?*
        ii. *These are red-eyed tree frogs. They don't usually live in groups in the wild, but at ECHO they have several of them in the same habitat. Do they all look exactly the same? What differences can you see?*
        iii. Allow students time to record ideas on their worksheet. Share and discuss.
    b. *Why don't all of these frogs look exactly the same? Where do you think these differences come from?* If no one mentions it, bring up the idea that animals tend to look like their parents.
3. Show slide of baby **eastern spiny softshell turtles**, then discuss:
    a. *What do you notice in this picture?* Take several responses. If no one mentions how tiny these turtles are, call their attention to it.
        i. *How old do you think these turtles are?* 1-2 months
        ii. *What are some dangers that might face small turtles?* Predators, being disturbed by humans, being injured by fishing hooks
    b. *These turtles have a rough time surviving even before they hatch. Adult turtles have less places to lay their eggs because so much of the lake shoreline has been developed. People and animals may disturb the nesting sites. They have been listed as a threatened species in Vermont since 1987*.
    c. *What are some ways people could protect these turtles?*
    d. Allow students time to record ideas on their worksheet. Share and discuss.
4. Show slide of **wood turtle**, then discuss:
    a. *This is a wood turtle. What do you think it eats?* Allow students time to record ideas on their worksheet, then create a list together. Their main foods are plants/algae, tadpoles, insects, worms, and any dead animals they can find (carrion). Add missing items to the list and highlight their actual diet.
        i. *These turtles eat lots of kinds of foods, including plants and algae. Remember that plants and algae make their own food from the sun.*
        ii. *Do you think anything would eat a wood turtle?* Allow students time to record ideas on their worksheet, then create a similar list of predators. Actual predators (especially of young turtles) include mammals (raccoons, otters, cats, coyotes), large fish, birds, and snapping turtles. *A lot of animals eat wood turtles, too!*

b. Show the slide of the simple wood turtle food chain. *Scientists like to make drawings of what is eating what in different habitats. They might make a drawing like this to show that wood turtles eat plants, but are also eaten by snapping turtles. You may have heard them call it a food chain. Scientists also sometimes combine several food chains into a bigger picture, called a food web.*
c. *When you are at ECHO you'll have a chance to learn about lots of different animals and think about what they eat… and what eats them.*

Closure and Connections

1. *What are you most excited about seeing, doing or learning on our ECHO field trip?*
2. *During our visit, you will get to discover many other exhibits. Many relate to physical sciences and engineering, too.*

During your ECHO trip:

1. It may be helpful to have students identify which of the previewed exhibits they are most excited about. They can be split up into small chaperoned groups by their interest. We will help direct your groups to different areas of the museum to begin your ECHO explore time.
2. Give each student or partner group a copy of the ECHO Exhibit Exploration sheet to guide them as they interact with the exhibits.

After your ECHO trip:

1. *Now that everyone has explored the exhibits at ECHO, let's hear what you thought.* Allow a quick share where everyone can share one favorite exhibit/experience/etc.
2. *Let's discuss what you've learned about differences in animals of the same species.*
    a. *Which animals did you compare?* Take some responses. *Were all of them exactly the same? What differences did you notice?* You can consider having students form groups based on the animals they compared for this question and discuss/report.
    b. *Where did those differences come from?* Their parents.
3. *Now let's talk about issues that affect animals' survival.*
    a. *How many Eastern Spiny Softshell turtles were in the tank?* (Note: Some of them might have been baby map turtles.)
    b. *Do you think this is a good way to help the turtle population increase? Why or why not?* Encourage discussion that makes a claim about the merit of the solution to the problems caused by a changing environment.
4. *Were you able to fill in the missing animals in the Lake Champlain food web model?* Take some responses and discuss how they decided what would fit. Remind students that it's not important for them to know exactly what each animal eats. The important idea is that some animals eat plants for energy, other animals eat those

animals for energy, and still other animals do both. Scientists can show these relationships using a food web model.

5. *Let's discuss what you've learned about animal structures.*
    a. *What body parts did you notice about the American eel?* If no one mentions their long, skinny body, bring their attention to that structure.
    b. *Where was the eel most of the time?* Along bottom of tank, hiding in the rocks
    c. *How do you think having a long, skinny body helps them survive at the bottom amongst the rocks?* They can move through the rocks easily to hide from predators and catch prey.
    d. *What other animals have structures that help them survive?* Students may have filled out part or all of the chart on their worksheet. A sample is provided below. If possible, focus discussion on the link between animal structures and how they support survival, growth and reproduction.

Location	**Animal**	**Body Structure**	**Function of structure**
Main hallway	Vietnamese mossy frog	Colored, bumpy skin Large, bulging eyes	Camouflage Help them see predators
Main Hallway	red-eyed tree frog	Red eyes Sticky toe-pads	Startles predators if it opens its eyes suddenly - startle coloration Help them climb for safety and hunting
Resource Room	American toad	Large back legs Thick, bumpy skin	Good for jumping to escape predators Protection
Outside the Gift Shop	painted turtle	Hard shell Webbed feet	Protection Good for swimming
Second floor	mudpuppy	Feathery external gills Large mouth	Helps them breathe, even in oxygen-poor water Good for catching prey

6. *How can understanding structure and function or systems and systems models help us as scientists?*
    a. This may also be a logical place to make connections with the current science unit under study.

Why does the stinkpot turtle have a long neck? The Musk Turtle's long neck gives it a longer reach if it needs to defend itself with its mouth.

Why does the Surinam toad look like a dead leaf? By staying still and being colored and textured like a leaf, they are virtually invisible to predators that hunt visually.

Why does the Eastern Spiny Softshell Turtle have a soft shell instead of a hard one? The softer shell allows more oxygen to be absorbed through it. They absorb 70 percent of their oxygen through their skin, which includes their shell!

Extensions

Structure and Function

1. Watch a video that shows how desert beetles' bodies have adapted to help them collect water.
2. After watching this video, create your own animal with structures to help it function in a specific environment.

Variation

1. Watch this video about inherited traits (requires a free sign up, but you can watch the first two minutes for free). Then challenge students to pick two animals and imagine what their babies might look like (it's not important that they are animals that could actually have offspring, but that students think about the mix of different traits they could have based on what their parents look like).

Turtle Headstart

1. Visit ECHO's webpage dedicated to the Turtle Headstart program.
2. Learn more about Eastern Spiny Softshell Turtles at the Vermont Fish and Wildlife website.

Food Webs

1. Watch a video to learn more about food webs and habitats.
2. Watch this video about what happens to ecosystems when one species in a food web is taken away. Discuss how a food web of Lake Champlain might change if the Headstart program wasn't around to help out eastern spiny softshell turtles.