Overview

In the FOSS Animals 2 by 2 unit students are provided with experiences with a number of animals that look and act quite unlike the barnyard model that heighten their awareness of the structure and behavior of animals. They experience four pairs of similar organisms: Fish (Goldfish and Guppies), Snails (Land Snails and Aquatic Snails), Worms (Little Redworms and Big Night crawlers) and Isopods (Pill Bugs and Sow Bugs). They are challenged to compare the similarities and differences of each pair. Through these observations, children learn that all of these organisms are animals, what animals need to survive and the relationship between their needs and where they live. The performance expectations in kindergarten help students formulate answers to questions such as: “Where do animals live and why do they live there?” Students are also expected to develop understanding of what plants and animals (including humans) need to survive and the relationship between their needs and where they live.

The crosscutting concepts of patterns; cause and effect; systems and system models; interdependence of science, engineering, and technology; and influence of engineering, technology, and science on society and the natural world are called out as organizing concepts for these disciplinary core ideas. In the kindergarten performance expectations, students are expected to demonstrate grade-appropriate proficiency in asking questions, developing and using models, planning and carrying out investigations, analyzing and interpreting data, designing solutions, engaging in argument from evidence, and obtaining, evaluating, and communicating information. Students are expected to use these practices to demonstrate understanding of the core ideas.

Planning for Engagement with Big Science Ideas

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<tr>
<th>Puzzling Phenomenon or Anchoring Event</th>
<th>Essential Question</th>
<th>Related/sub-questions:</th>
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<tr>
<td>How do living things live, grow, respond to their environment?</td>
<td>Related sub-questions:</td>
<td>What are the parts of these animals?</td>
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<td>What do these animals do?</td>
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<td>How are these animals similar to - and different from - each other?</td>
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**Big Ideas:**
- Animals have identifiable structures and basic needs.
- Animals' behavior is influenced by conditions in their environment.
- Students can observe and record and compare behaviors and structures.

**Gapless Explanation of Duck Video (adult level):**

We chose this duck video because we thought kindergarten children could recognize ducks, and by analyzing what they know and think about ducks, extend their thinking and experiences to the other living organisms in the Unit.

The opening screen shows a male and female Mallard Duck, and follows the male as it swims away. We hope that the children will recognize them as ducks. The male and female look different, so some children may think they are different types of ducks.

Soon a third bird swims into view. This is a mud hen – not a duck. The key point here is that not all birds are ducks.

Mallards can be found in almost any wetland habitats, including permanent wetlands such as marshes, bogs, riverine floodplains, beaver ponds, lakes, reservoirs, ponds, city parks, farms, and estuaries. The scene then switches to ducks standing on the shore. The ducks' feet are easy to see – they are webbed – to help them swim better. (A mud hen walks in, and, though it is quick, the feet are very different - no webbing!)

At the one minute mark, a pair of mallards are shown dunking their heads under water. Mallards are generalist foragers and will eat a wide variety of food. They don't dive, but dabble to feed, tipping forward in the water to eat seeds and aquatic vegetation. They also roam around on the shore and pick at vegetation and prey on the ground. Not all behavior is about eating.

At ~1:30 there is a short bit with two ducks resting. They are standing in very shallow water – one is standing on one leg. Ducks spend many hours a day loafing, sleeping, and performing basic maintenance and comfort movements like preening and stretching. The birds select loafing and roosting sites based on the

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<td><strong>LS1.A: Structure and function</strong></td>
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<td>All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water, and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow. (from Grade 3)</td>
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<tr>
<td><strong>LS1.C: Organization for Matter and Energy Flow in Organisms</strong></td>
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<td>All animals need food in order to live and grow. They obtain their food from plants or from other animals. Plants need water and light to live and grow.</td>
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<td>As found in K-LS1-3</td>
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<td><strong>ESS2.E: Biogeology</strong></td>
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<td>Plants and animals can change their environment (as found in K-ESS2-2)</td>
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<td><strong>ESS3.A: Natural Resources</strong></td>
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<td>Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do. (as found in K-ESS3-1)</td>
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temperature, humidity, wind speed, and sky conditions. On warm, sunny days, for example, ducks and geese will loaf in open areas where they can warm themselves in the sun. At night, waterfowl often roost in more sheltered habitats where the birds can conserve body heat and save energy.

Key things that are visible in the video:
- Ducks have a variety of behaviors – not just eating
- Ducks interact with each other in a variety of ways, and interact with other species in a variety of ways
- Ducks are found around water – where they get their food
- Ducks have webbed feet – adapted to help them be better swimmers

GAPLESS EXPLANATION of Duck Video (student level):
Ducks live near water, where they get their food.
Ducks are good swimmers and have webbed feet that make them good swimmers.
Not all birds are ducks.
Not all ducks look the same.
Ducks do more than swim – they also rest and preen (clean their feathers)

Ducks do more than swim.
Not all ducks look the same.
Ducks do more than swim – they also rest and preen (clean their feathers)

The year in kindergarten might be the first time many children are introduced to animals other than the familiar neighborhood animals that humans have invited into their homes as pets. The typical kindergartner’s concept of animal is narrow, embracing for the most part a selection of mammals. When asked to recall the names of a few animals, kindergartners will provide lists that read like farm and zoo inventories. Cats, dogs, bears, and birds, in a category of its own. The conceptual organization used by kindergartners does not yet recognize the superordinate set called animals that includes all the members in the kingdom of animals. Animals probably emerged on the scene about 700 million years ago in forms similar to present-day sponges and jellyfish. An organism in the animal kingdom is multicellular and must eat to survive. Unlike members of the plant kingdom, animals cannot make their own food by photosynthesis (or a related process), so they must eat other organisms to get the energy needed to sustain life. Kingdom Animalia has more members than any of the other kingdoms (Monera, Protista, Plantae, and Fungi).

By some estimates 10 million different kinds of animals are living today, but many experts agree that the actual number could be many times greater. Bet

Younger children tend to believe: All animals have the same structures and behaviors. People are not animals. Birds, fish, insects, worms are not animals. All animals can move from place to place. Insects can’t live in water. Animals are four footed, or furry. Animals are wild, pets, or farm animals. Animals are large. Animals live on land. Fish do not need air. Fish sleep with their eyes closed.

There are many wonderful children’s fiction books that portray animals and plants with human characteristics—plants that can walk and talk, and animals that talk and wear human clothes. These fanciful stories, whether serious or humorous, capture the imagination of children. But it is important to help young students distinguish fact from fantasy. After reading a fictional story that gives plants or animals attributes they do not really have, take the time to ask students what was real and what was imaginary in the story. Have students compare their own firsthand experiences with plants and animals to those in the story.

Ducks have webbed feet adapted to help them be better swimmers.
Ducks interact with each other in a variety of ways, and interact with other species in a variety of ways.
Ducks are found around water where they get their food.
Ducks have a variety of behaviors not just eating.

As Stated in Standards | Adapted for K–2
--- | ---
Asking questions (science) / Defining problems (engineering) | Wondering (science) / Deciding the ‘rules’ (engineering)
Developing and using models | Drawing diagrams and building models to represent how things work.
Planning and carrying out investigations | Doing “exploriments”
Analyzing and interpreting data | Comparing and looking for patterns
Using mathematical and computational thinking | Counting and measuring
Constructing explanations (science) / designing solutions (engineering) | Describing what happened (science) / Tinkering (engineering)
Engaging in argument from evidence | “I think ____ because I see or know ____.”
Obtaining, evaluating, and communicating information | Writing, drawing, or talking (acting out) about what we know, read, and understand about new discoveries (things) (ELA connections)

Age Appropriate Science and Engineering Practices
This unit begins by having students observe a video of a pair of ducks swimming and diving. The students must consider what the ducks are doing. Students are asked to make careful observations and consider what they know about observations of other birds in their past. Students are asked to make a claim for what the ducks are doing. Science and Engineering Practice: Engaging in Argument from Evidence: students make claims and use presented data to construct an explanation for the question: What are these ducks doing?

Before-during-after drawings are particularly helpful for students to show what they think is happening. It requires students to show much more of their thinking. Many of the most compelling classroom conversations about a phenomenon have been about what happens before it starts, or after it stops. It helps if you ask students to "draw what you would see if you had microscope eyes." It sounds simple, but works well. Consider showing how to make a "call out" or "magnifier" circle. Hints:

- Ask students to draw/explain what can be seen and what can't be seen.
- Ask students what things are the ducks doing? Why are they doing it?
- After students have drawn an initial model, have a conversation with them about how the class should represent certain ideas, so that everyone understands each other's drawings.
- If students are working in groups, as an equity move, have each student within a group use a different color marker or tell students you want to see everyone's writing somewhere on the model.

Specific ideas to look for in these drawings include:

- Body parts have different functions. (Beaks, feet, eyes, etc.)
- Moving around. (Swimming & walking)
- Getting Food. (Feeding)
- Similarities & Differences (Male & Female Ducks, different species.)

These Model Templates have been created as one possible tool to help students expose their thoughts about the phenomenon.
### Supporting Ongoing Changes in Student Thinking

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<th>Big Idea</th>
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<td>What do we figure out?</td>
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<td><strong>Investigation 1: Goldfish and Guppies</strong></td>
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<tr>
<td>Students observe goldfish living in a simple aquarium. They look for and name different parts of the fish, such as fins, tail, mouth, and gills. They look to see if all the fish are alike, or if there are differences such as color and size. They draw a picture and dictate a sentence to record what they see.</td>
<td></td>
<td>What are the parts of a goldfish?</td>
<td>Start thinking about similarities and differences. In the video there are both male and female Mallard ducks (Males have Green heads, females are mostly brown.) There are also a couple of other types of birds near the beginning. Looking at details will lead to understanding that there are many varieties of animals.</td>
<td>Students can glue their Fish Outline drawings in their science notebooks and add labels or dictate a sentence.</td>
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<tr>
<td>Students learn how to care for goldfish, giving them food and fresh water, and adding plants to the aquarium. With each addition, students describe the fish behavior they observe.</td>
<td></td>
<td>What do goldfish need to live?</td>
<td>What are the ducks doing? What are the ducks' needs? We see them feeding, sleeping and grooming at various parts of the video.</td>
<td>Have students illustrate their ideas in their science notebook. Let them tape a little fish food on their drawing of the aquarium.</td>
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<tr>
<td>Students add a tunnel to the aquarium to observe how the fish respond. They make their own paper aquariums to model the fish behavior they have observed.</td>
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<td>What do goldfish do?</td>
<td>Ducks have a variety of behaviors.</td>
<td>A cutout fish taped to the end of a string and attached to the page can be used to show what fish do. Students can illustrate the aquarium and make additions from the word bank.</td>
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<tr>
<td>Students compare the structures and behaviors of guppies to those of goldfish, and identify the guppies by gender.</td>
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<td>How are guppies and goldfish different? How are they the same?</td>
<td>Ducks are different in many ways from the other birds shown briefly at the beginning. They vary from other birds in many ways, as well.</td>
<td>Students can use the content chart for a guide or illustrate their own answers to the focus question.</td>
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**Science & Engineering Practices:** Asking questions, Developing and using models, Planning and carrying out investigations, Analyzing and interpreting data, Constructing explanations, Obtaining, evaluating, and communicating information. **Crosscutting Concepts:** Patterns, Cause and effect, Systems and system models, Structure and function.
### Key Activity: What Students Do

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<td><strong>Investigation 2: Land and Water Snails</strong></td>
<td>Students observe the structures and behaviors of two kinds of water snails. Students work with a variety of seashells, discussing similarities and differences in their size, shape, color, and texture. Students must match shell pairs, make designs, and create patterns.</td>
<td><strong>Science &amp; Engineering Practices:</strong> Asking questions, Planning and carrying out investigations, Analyzing and interpreting data, Constructing explanations, Engaging in argument from evidence, Obtaining, evaluating, and communicating information. <strong>Crosscutting Concepts:</strong> Patterns, Cause and effect, Systems and system models, Structure and function</td>
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#### 2.1 Land Snails

- **Students get to know one species of land snail.** They handle the snails, observe their features, and see how they interact with objects.
- **Snails are animals and have basic needs—water, air, food, and space with shelter.**
- **What are the parts of a land snail?**
- **The ducks have many parts that help them meet their needs. Consider the feet—webbed feet are great for swimming.**
- **Students can glue their Land Snail Outline drawings in their science notebooks, then add labels or dictate a sentence.**

#### 2.2 Snail Races

- **Students observe one aspect of snail behavior, how land snails move.** The investigation concludes with a snail race for the lettuce.
- **Snails have senses.**
- **What do land snails do?**
- **Ducks have senses. We know they see as we see them interact with others. Consider other senses...**
- **Have students illustrate their ideas. They can tape a bit of snail food (lettuce) in their science notebook to show what snails eat. A small drawing of a snail can be cut out and glued to a length of yarn, then attached to the page, to illustrate their words.**

#### 2.3 Observing Water Snails

- **Students are introduced to aquatic snails. They investigate their physical characteristics and behavior, and compare land and aquatic snails for similarities and differences.**
- **Different kinds of snails have some structures and behaviors that are the same and some that are different.**
- **How are land snails and aquatic snails the same? How are they different?** (as above)
- **Students can draw the two snails to illustrate differences. Those who are beginning to write can copy words from the class chart made during wrap-up.**

#### 2.4 Shells

- **Students observe seashells. Using their experience with living snails, they look for shells that they think might have belonged to relatives of the water snail they observed. They organize the shells into pairs or groups and give rationales for their decisions.**
- **Shells differ in size, shape, pattern, and texture.**
- **How can shells be grouped?**
- **Not all birds look the same.**
- **Draw two circles on students’ notebook pages. Inside, have students draw shells from the two groups they made. Encourage students to use the word bank to label their circles.**
### Key Activity
**What Students Do**

### Key Learning/ NGSS Connections
**What do we figure out?**

### Big Idea
**Focus Questions**

### Connection to Puzzling Phenomenon

### Formative Assessment Task

**Investigation 3: Big and Little Worms:** Students dig for redworms, rinse them off, and look at their structures. They study their behavior. They construct worm jars and provide for the needs of the composting worms. Students observe how the worms change the plant material into soil. They compare the redworms to night crawlers, which are much larger.


Crosscutting Concepts: Patterns, Cause and effect, Systems and system models, Structure and function.

#### 3.1 The Structure of Redworms

<table>
<thead>
<tr>
<th>Students dig through a terrarium to discover that there are redworms living in the soil. They look for some of the structures they have seen on other animals they have studied so far. They rinse the worms in water to remove the soil and to get a better view.</th>
<th>Worms have identifiable structures. Worms are animals and have basic needs.</th>
<th>What are the parts of a redworm?</th>
<th>(as before)</th>
<th>Students can glue their Worm Outline drawings into their science notebooks and add labels or dictate a sentence.</th>
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</table>

#### 3.2 Redworm Behavior

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<tr>
<th>Students focus on the movement and behavior of redworms. They notice how the worm’s body contracts and stretches to move forward. They observe the worm to see if it can move in other directions. They try blocking the worm’s path to see what it does.</th>
<th>Worm behavior is influenced by conditions in the environment.</th>
<th>What do redworms need to live?</th>
<th>(as before)</th>
<th>Have students illustrate their ideas. They can draw a picture of a drop of water in their science notebook to show what worms do when near water. A small drawing of a worm can be cut out and glued to a length of yarn, then attached to the page, to illustrate their words.</th>
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</table>

#### 3.3 Comparing Redworms to Night Crawlers

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<tr>
<th>Students discover a new kind of worm in their terrarium—night crawlers. The new worms are much longer and fatter than the redworms. Students observe the two kinds of worms and compare the structures and behaviors of the two animals.</th>
<th>Different kinds of worms have similar structures and behaviors; they also have differences (size, color).</th>
<th>How are redworms and night crawlers different? How are they the same?</th>
<th>(as before)</th>
<th>After the investigation, have a class discussion using the following frame to collect students thinking: Redworms and nightcrawlers both __________. After the investigation, have a class discussion using the following frame to collect students thinking: Redworms and nightcrawlers both __________. Use the following sentence stem to model writing a sentence using the information collected. Remove the model sentence. Then have students use a blank sentence stem to complete their own sentences in their science notebooks. (Sentence stems can be printed off and glued into notebook or written in by students.)</th>
</tr>
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</table>
**Investigation 4: Pill Bugs and Sow Bugs:** Students observe structures of two kinds of isopods. They learn to identify which are pill bugs and which are sow bugs. They hold isopod races. Students make a terrarium in which all the land animals live together.

**Science & Engineering Practices:** Asking questions, Planning and carrying out investigations, Analyzing and interpreting data, Constructing explanations, Obtaining, evaluating, and communicating information.

**Crosscutting Concepts:** Patterns, Cause and effect, Systems and system models, Structure and function.

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### 4.1 Isopod Observation

Students begin by investigating two kinds of isopods (sow bugs and pill bugs). They draw upon knowledge and experience gained from the previous activities to investigate the structures and behaviors of isopods.

- **Isopods are animals and have basic needs—water, air, food, and space with shelter. There is great diversity among isopods.**
- **What are Isopods?**
- **(as before)**
- **(as before)**
- **Students can draw their observations into their science notebooks and add labels or dictate a sentence.**

### 4.2 Identifying Isopods

Students compare the isopods and sort them into two groups, based on the different structures and behaviors they observe.

- **Different kinds of isopods have some structures and behaviors that are the same and some that are different.**
- **How are pill bugs and sow bugs different? How are they the same?**
- **(as before)**
- **(as before)**
- **Have a class discussion using the following frame to collect students thinking:**

  Use the following sentence stem to model writing a sentence using the information collected.

  **Pill bugs are different than sow bugs because pill bugs __________________.**

  Remove the model sentence. Then have students use a blank sentence stem to complete their own sentences in their science notebooks.

### 4.3 Isopod Races (Optional)

Students conduct isopod races as a way to focus observation on isopod movement.

- **Isopod behavior is influenced by conditions in the environment.**
- **How do isopods move?**
- **(as before)**
- **(as before)**
- **Students can write predictions in their science notebooks using this stem:**

  **I think ________ will be faster than ________ Because ________.**

### 4.4 Animals Living Together

Students build a class terrarium to observe how several animals live together. They put the isopods and a few snails into the earthworm terrarium, then add objects from the natural environment to create an appropriate habitat for the animals.

- **Plants and animals (including humans) depend on the land, water, and air to live and grow. All animals need food in order to live and grow. They obtain their food from plants or from other animals. Plants need water and light to live and grow.**
- **What do animals need to live?**
- **(as before)**
- **(as before)**
- **Have a class discussion involving students referring to their notebooks to contribute what they think should be in an aquarium for fish and water snails, while the teacher models drawing and labeling the aquarium. Students then draw what they think a terrarium should contain to sustain isopods and worms. They should label their diagram, using as many words as possible from the word wall.**

Life Science – Kindergarten – “Animals 2x2”
Pressing for evidence-based explanations

Why do we use these particular practices?
This final set of practices will help students construct a final, evidence-based explanatory model for an anchoring event. The goals of this practice are:

1. Engage all students in authentic disciplinary discourse around using evidence to support explanations.
2. Hold students accountable for using multiple sources of information to construct final explanatory models for the anchoring event (this accountability of course must be supported by scaffolding and guidance from you).
3. Support students in using evidence to support different aspects of their explanatory models.

Summary Table Discussion
Create a summary table as a sense-making exercise to consider how living things live, grow and respond to their environment.

- Create summary table.

Use student ideas to complete the table