



## Pollination Adaptation: Connecting Habitat and Anatomy

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NPS PHOTOS

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# Introduction

## Theme

Zion has over 350 bee species because of diverse habitats and environmental factors.

## Focus

This activity focuses on understanding how varied habitats within a certain area influences species diversity within that area.

## Education Standards

### Utah SEEd 4th Grade

#### **Standard 3.2: Effects of Traits on Survival**

Standard 3.2.3: Construct an explanation that the environment can affect the traits of an organism. Examples could include that the growth of normally tall plants is stunted with insufficient water or that pets given too much food and little exercise may become overweight. (LS3.B)

### NGSS 3rd Grade

3-LS3-2. Use evidence to support the explanation that traits can be influenced by the environment

3-LS4-3. Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.

## Activities

### How to Get the Perfect Bee Body

Video: The video explores bee anatomy and how different bee body parts can vary based on how a bee gathers food, builds a nest, and defends itself.

Build-a-Bee: Using a description of a particular Zion habitat, students will design and draw their own bee species. After their artwork is complete, they will write a short report about their bee's adaptations and compare and contrast their bee to others' bees.

## Background

Zion National Park is famous for its towering sandstone cliffs and dramatic geography, which also make it very biologically diverse. At the lowest elevations (4000ft), we have desert that gets 10-15 inches of rain a year and frequently reaches over 105 F in the summer. At the highest elevations (7000ft), we have more water and bigger trees. A river runs through Zion, so there is riparian habitat as well. There are hundreds of flowering plants, ranging from the tall yucca to tiny ground flowers.

A habitat is a place where an organism makes it home. A habitat provides food, shelter, water, and space to make a home. For a bee, a habitat can be as small as a few flowers and the ground where they grow,

or it could be quite large and encompass many types of plants. Because Zion has many types of landscapes, including conifer forest, slot canyons, riparian areas, steep cliffs, and desert, there are many potential habitats for a bee. Individual species tend to be adapted for certain habitats, so Zion is home to over 300 bee species.

When we think of bees, we often picture honey bees that nest in large, communal hives. However, honey bees aren't native to the Americas and most native bees live very different lives than honey bees. Most native bees are solitary, meaning that all females reproduce individually and they don't work together on gathering pollen for their young. Native bees typically don't build big communal nests; instead, they often build a single nest cavity in which to lay their eggs. Common nest mediums include sand, mud, wood, and hollow plant stems. Depending on species, some bees may gather nectar and pollen from only one type of flowering plant (specialists), or they may gather nectar and pollen from a variety of flowering plants (generalists). Native bees often have specific adaptations to better survive in their particular habitat and lifestyle.

Bees are vital because they are pollinators, meaning that they fertilize flowers by bringing pollen from the anther of one flower to the stigma of another flower, which results in the flower producing seeds. Pollination is a happy accident—bees don't pollinate on purpose; it is a byproduct of gathering protein-rich pollen to feed to their young. Native bees are vital for pollinating many common crops, including blueberries, cranberries, tomatoes, and eggplant. Here in Zion, they are responsible for pollinating many unique plants that are endemic to Zion. Without bees and their pollination prowess, both our diet and our world would be much less diverse.

### Background (Continued)

As with all animals, bees need food, shelter, water, air, and love (or some way to reproduce). However, different animals obtain those basic needs in different ways.

For bees, most of their most notable adaptations have to do with what they eat and how they gather that food. Bees eat two primary foods, depending on their life stage. When they are young and in their larval form, they eat pollen in the form of bee bread because it is rich in protein. Bee bread is made by a mother bee gathering pollen, storing it in a special stomach called a crop, then mixing it with saliva and forming it into a ball. When bees are adults, they primarily eat nectar, a sugary substance produced by flowers.

Shelter varies widely, and can be a

defining feature for different bees.

Because most bees are solitary and don't build large communal nests, shelter can take a variety of forms. Some bees dig nests in wood (carpenter bees), some bees nest in hollow reeds and sticks, some bees dig nests in sand or soil (mining bees).

Water and air are easily obtained by bees. Bees don't have lungs. Instead they breathe through open ports on their body called "spiracles". Water they drink with their proboscis.

Love, or reproduction, is of course more complicated, and could be a lesson on its own. Suffice to say, female bees tend to be more interesting and do all the work of gathering pollen, digging a nest, and otherwise ensuring survival for baby bees. Female bees are also the only bees with a stinger—a modified ovipositor (the egg-laying organ).



Fairy bee on the left and carpenter bee on the right. Look how tiny the fairy bee is compared to the carpenter bee! Certain species of fairy bees are smaller than a grain of rice, while carpenter bees are some of the biggest bees in North America.

# How to get the Perfect Bee Body

## Introduction & Video

### Duration

~15 minutes

### Location

Inside

### Key Vocabulary

Bee, Exoskeleton, Antennae, Mandibles, Abdomen, Thorax, Simple eyes, Compound eyes, Proboscis

### Objectives

Students will be able to identify key bee body parts and their role in bee survival.

### Method

By watching an educational video about bee body parts, what they are and how they function, students will fill out a worksheet accurately identifying bee anatomy.

### Materials

- Anatomy worksheet (one per student)

## Material (Continued)

- Pen or pencil
- How to get the Perfect Bee Body video ([LINK](#))
- Projector

### Background:

Please refer to the background information in the introduction for more information about bees, their importance, and how Zion's biodiversity influences bee biodiversity.

### Suggested Procedure:

1. Introduce the concept of adaptations to specific habitats and explain that this lesson will focus on bees and how their bodies adapt to different habitats.
2. Watch the How to get the Perfect Bee Body video
3. Fill out and review bee anatomy worksheet
4. (Optional) Look at bee images in resources section, see if students can identify body parts and talk about what kind of habitat those bees might have.

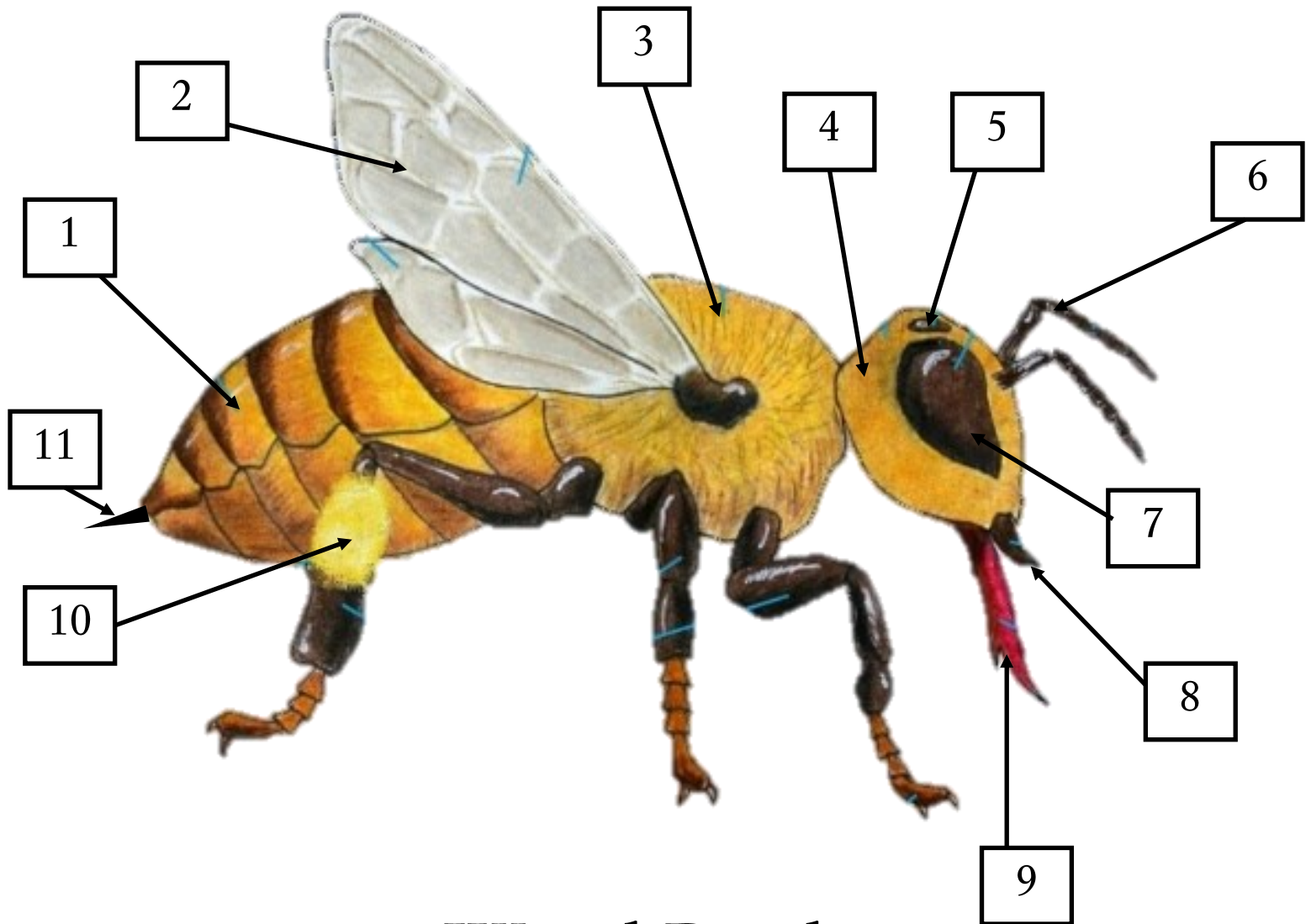


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# Discovering the Perfect Bee Body

**Directions:** Match the number on the bee body parts to the word below



## Word Bank

\_\_\_Mandible

\_\_\_Compound  
eye

\_\_\_Proboscis

\_\_\_Antennae

\_\_\_Stinger

\_\_\_Thorax

\_\_\_Wings

\_\_\_Simple eye

\_\_\_Pollen basket

\_\_\_Abdomen

\_\_\_Head



# Build-a Bee

## Duration

20-30 minutes

## Location

Inside and/or Outside

## Key Vocabulary

Bee, Pollinator, Adaptation, Trait, Habitat, Desert, Plateau, Riparian

## Objectives

Students will design their own bee, basing its traits around how their assigned habitat would influence the bee's ability to survive, and will be able to explain how their bee is adapted to its habitat.

## Method

Using what they know about how environment influences adaptations and what they learned from the “How to get a Perfect Bee Body” video, students will design their own bee and write a brief report analyzing how their bee is adapted for a particular habitat.

## Materials

- Build-a-Bee worksheet (one per student)
- Assigned Habitat
- Colored pencils, crayons, or markers

## Background

Please refer to the background information in the introduction and in the “How to get a Perfect Bee Body” video for information about bee adaptations and the importance of bees.

As mentioned previously, Zion has a wide variety of ecosystems which means it has an even greater diversity of habitats. For small animals like bees, a habitat can be quite tiny. The habitat types for this lesson are as follows:



## Background (Cont.)

### The Desert

Lowest areas of the park—classic desert with less than 15 inches of rain per year and high heat in the summer. Sandy soil that is easy to dig into. Common wildflowers include desert marigold, gooseberry-leaved globemallow, and black-brush

### Pinyon-juniper woodland

Hot and dry. Lots of pinyon pine and Utah juniper. Sandy and rocky. Very diverse plant life, including cliff-rose, pricklypear cactus, yucca and Utah serviceberry.

### Sagebrush

Found at various elevations. Characterized by big sagebrush, a large, fragrant shrub. Also includes sand verbena, lupine, fragrant sumac, Zion milkvetch, and desert paintbrush.

### The High Plateau

The highest elevation in the park, and gets more rain—about 20 inches of rain/year. Big trees include ponderosa pine, douglas-fir, and some quaking aspen. Flowers include mountain snowberry, mountain mahogany, bluebells, Oregon grape, lupine, and more!

### Wetlands

Found at any elevation, wetlands are found by the rivers or near springs. The ground nearby is either rocky or sandy. Common flowers include columbine, shooting star, and cardinal monkeyflower

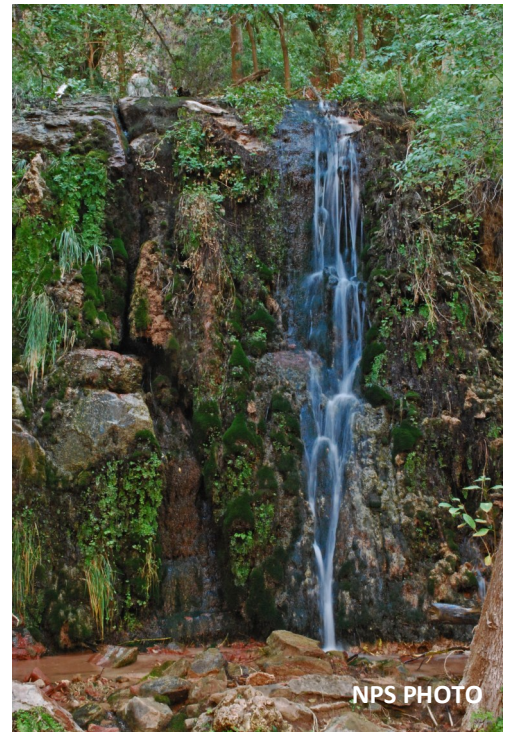
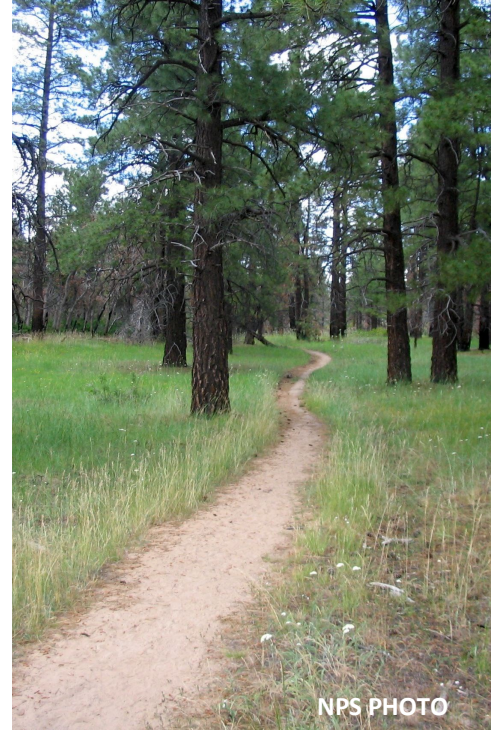
Remember, any element of these broader habitat types could be an entire home for a bee!

## Suggested Procedure:

1. Watch “How to Get the Perfect Bee Body” and fill out worksheet about bee body parts.
2. Review habitats and some of the habitats found in Zion.
3. Look at the Bees of Zion images together. Talk about which bee body parts are big or small and how that might help them survive in their habitat.
4. Hand out worksheets and colored pencils/markers. Assign students a habitat (alternative, have students pick habitat type from a hat)
5. Explain that they will be designing a bee that has adaptations to help it survive in that habitat. Remind them to have at least one adaptation to help them find food, eat food, make a nest, provide for their babies. There is a table of sample bee adaptations, but remind your students to be as creative as they want while still ensuring that their bee has all the necessary bee body parts.
6. After designing their bee, students will write a brief report about how their bee’s adaptations will help it survive in that environment. Students will also compare and contrast their bees, either in small groups or as a whole class—do the bees all look the same? What are some differences?

### Possible Extensions

1. Have students go outside. How many types of habitat can be found near their home or near their school? How might this influence bee diversity?
2. Imagine that the habitat changes. What would happen to their bee? Would its adaptations be as useful?





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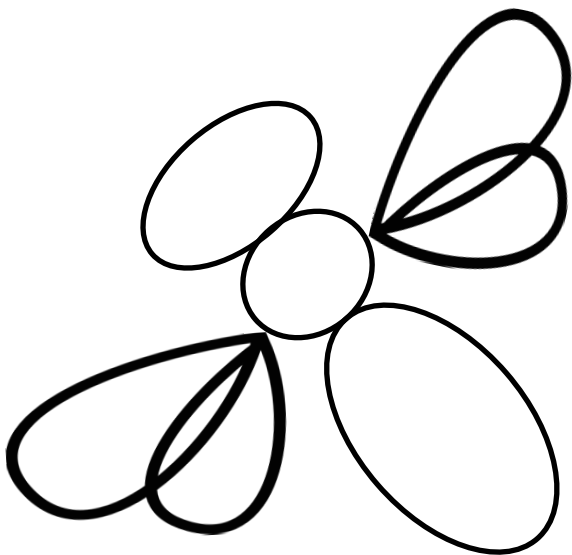
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# Build-A-Bee Worksheet

Bee Name: \_\_\_\_\_

Habitat: \_\_\_\_\_

Directions: Using what you learned about bee body parts and what you know about habitats, draw a bee that is adapted to collect food, make a nest, and protect itself. Bee as creative as you want! Along the way, fill out the section below about your bee's adaptations.



Bee example. Feel free to add your adaptations to this bee. If you feel extra creative, draw your own!

Adaptation to drink nectar: \_\_\_\_\_

Adaptation to find food: \_\_\_\_\_

Adaptation to make a nest: \_\_\_\_\_

Other special adaptations: \_\_\_\_\_

\_\_\_\_\_

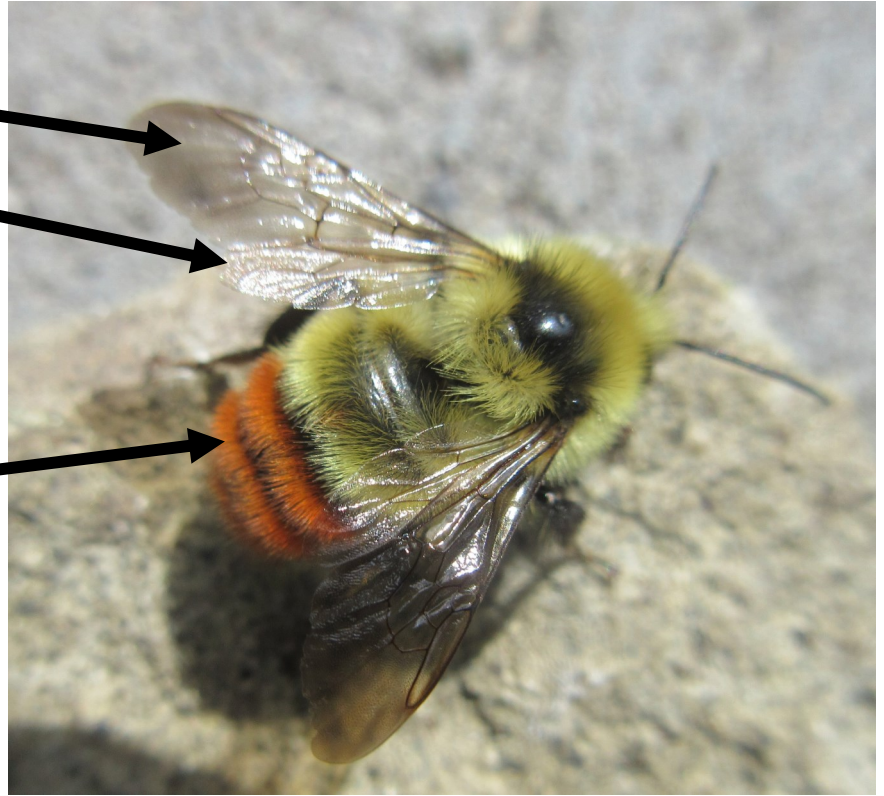
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# Reference Bees

These are real-life bees found in and around Zion National Park—notice the diversity in their size, coloring, and other body parts!

Front wing and back wing! You can see how they almost look like one wing when they're locked together

Fuzzy body—perfect for getting covered in pollen!

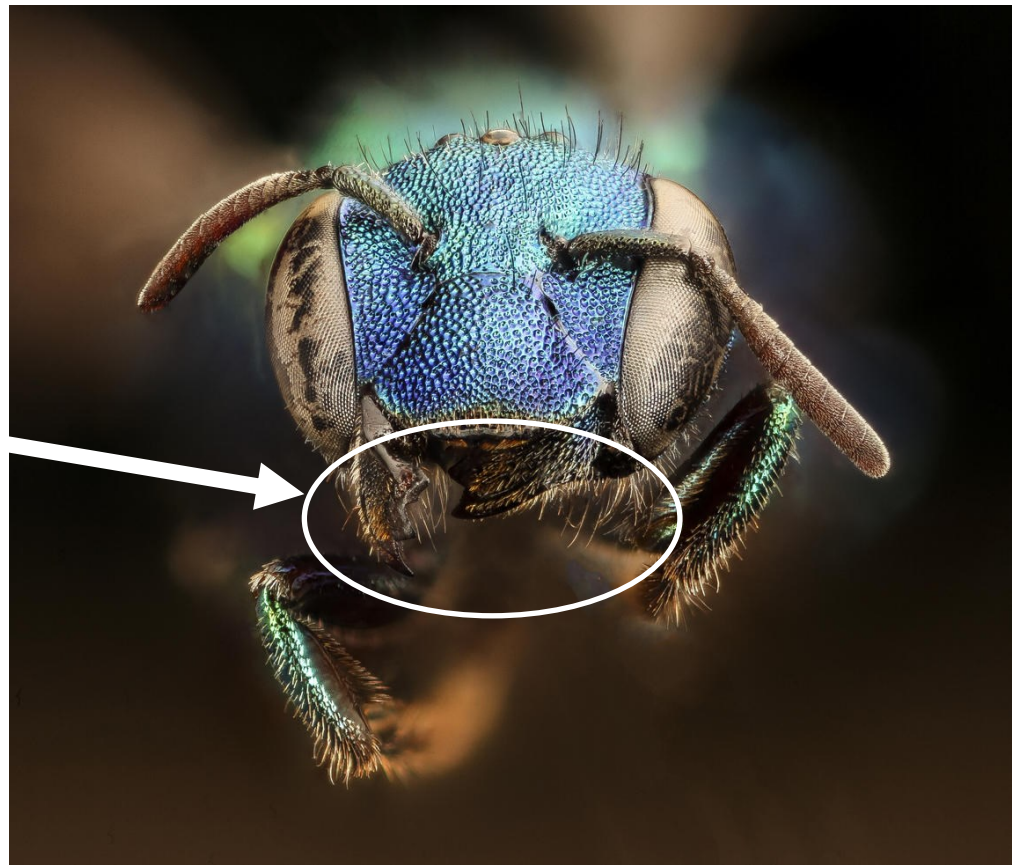


Bumblebee! It has very full pollen baskets. All that yellow stuff is pollen that is sticking to this bumblebee's pollen baskets.





Mining bee. It makes its nest by digging in the sand. See how its mandibles are smaller than a carpenter bee's mandibles?



Mining bee. It likes to fly in the early morning and late evening, when there isn't much sunlight. See how big its simple eyes are? This way it can still find its way around when there isn't much light!







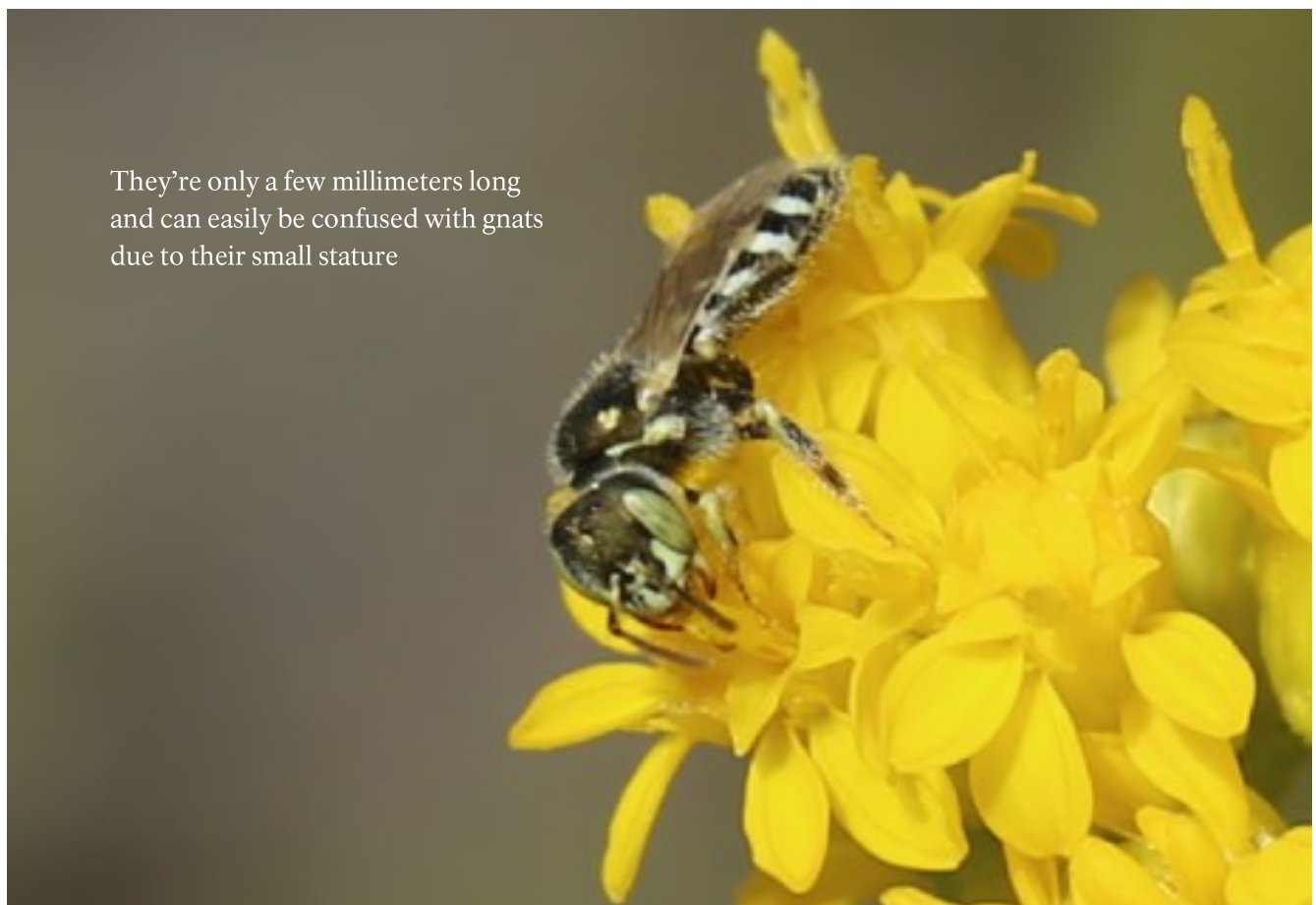
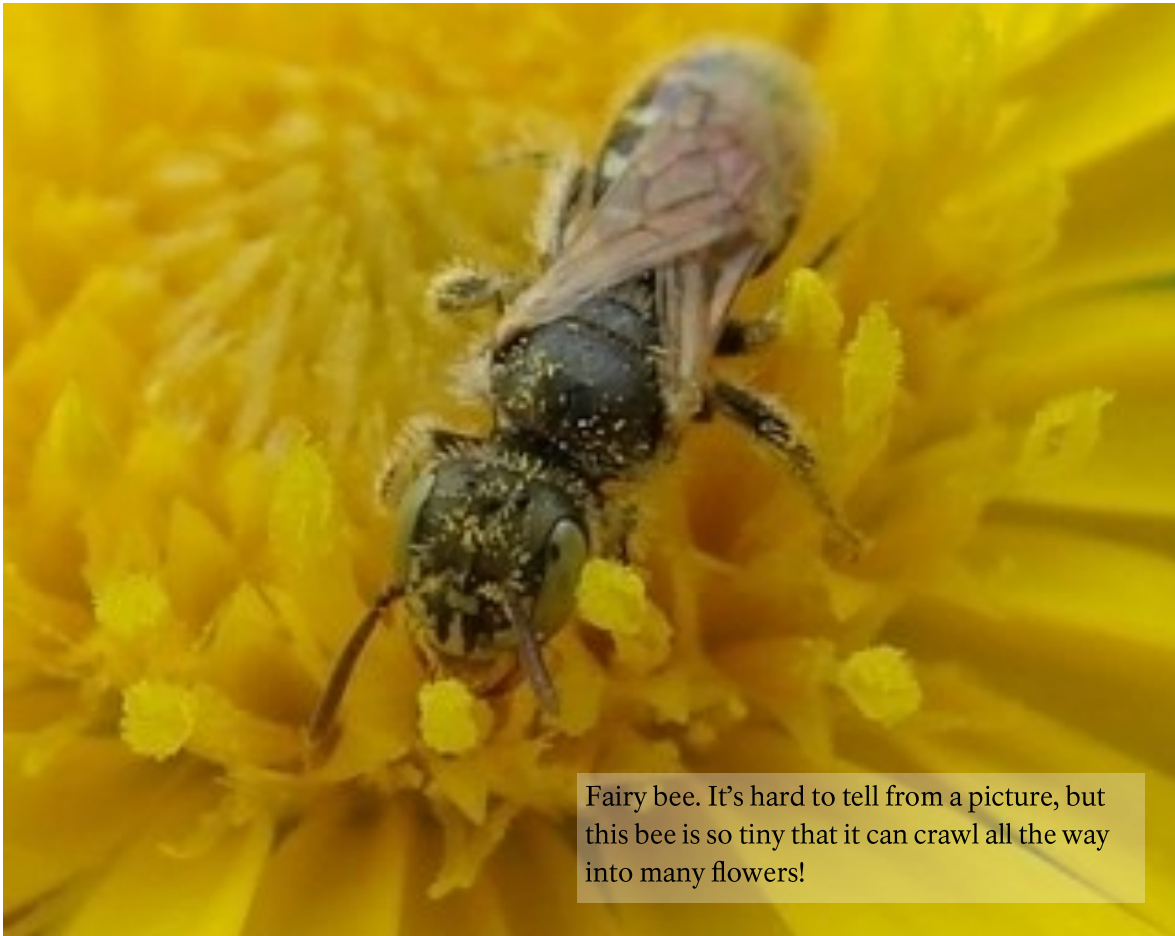
Carpenter bee. Wow! Look at those big mandibles, perfect for chewing a nest into wood.

Simple eyes on the carpenter bee. Notice how they are much smaller than the simple eyes on the mining bee? The carpenter bee flies in the daytime!



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## Resources & References

The following are websites used as sources for the background information sections of the lesson plan.

These web pages are also good resources for addition information:

<https://www.nps.gov/subjects/pollinators/index.htm>

<https://www.xerces.org/>

The following are books used as sources for the background sections of the lesson plan. They are also good resources for additional information

The Bees in Your Backyard by Joseph S. Wilson and Olivia Messinger Carril. 2016.

The Bee: A Natural History by Noah Wilson-Rich. 2014.