science generation

THINKING ABOUT NATURAL SELECTION

SCIENCE ACTIVITIES

SUPPLEMENTARY ACTIVITIES FOR OTHER CONTENT AREAS

FOCUS WORDS

Overview
Unit 7.6

This unit introduces students to the concepts of natural selection and adaptation. The unit begins with a Reader's Theater in which a group of friends discuss whether or not the death of pigeons that aren't smart/fast enough to get out of the way of an oncoming car helps pigeons as a species through the process of evolution.

Students will also learn about the process of natural selection by reading the story of the peppered moth. This builds on the previous unit on heredity and traits. Adaptation is also introduced, and students will consider a science-fiction scenario where humans could evolve to adapt to strange extraterrestrial environments.

Finally, students will consider a fictional case in which a barrier across a river has an unintended impact on salmon reproduction, allowing only smaller salmon to spawn. Students will design a solution to the problem and write a persuasive letter that advocates for their design. They'll use what they've learned about natural selection in their letter.

A word chart with definitions and sample uses is on the last page of the unit.

Reader's Theater

Those Poor Pigeons!

Setting: It's early morning. Erica and Shawnte are sitting on the steps outside of school. Will walks up to them. Erica looks upset.

Will: What's wrong with Erica?

Shawnte: She's been quiet since I got here. Erica, what's up?

Erica: My dad ran over some birds by the park.

Shawnte and Will: What?!

Shawnte: That's messed up. What happened?

Erica: There were lots of pigeons on the road and my dad just drove right through them. I thought they'd get out of the way, but it felt like we ran over something. There were feathers under the car when I got out. It made me feel terrible.

Will: Good for your dad. Pigeons are nasty birds. There are too many of them anyway.

Shawnte: It doesn't matter how many there are. It's still wrong to kill them!

Erica: My dad said that if they weren't fast enough to get out of the way, they didn't deserve to **survive**. He said he was helping the pigeon population by killing the slow and dumb ones. Which I think is kind of sick.

Will: How does killing pigeons help them? I don't get it.

Erica: Well, he said if you kill all the slow and stupid pigeons, only the smart and fast ones **survive**. You're helping nature with natural **selection**.

Shawnte: It doesn't sound natural; it sounds pretty messed up to me.

*Shawnte, Will, and Erica keep talking. Erica pulls up an entry for natural **selection** on her phone, but it doesn't make much sense to her. She doubts Shawnte will get it either, but she decides to read it out loud anyway.*

Erica: I'm not sure, but I think this is the basic idea. Listen:

> Natural **selection** is the gradual, nonrandom process by which biological traits become either more or less common in a **population** as a function of differential **reproduction** of their bearers. It is a key mechanism of **evolution**.

Shawnte: Oh, that probably just means there's, like, a type of bird or fish and some are red and some are green. Say the red ones do better for some reason and the green ones bite the dust more often. Of course, you'd get more baby red ones going forward even if the color was just **random** before.

Erica: *(shocked that Shawnte understood)* Who ARE you? And what have you done with Shawnte?

Shawnte: *(ignoring the insult)* Maybe your dad thinks that since he killed the slow pigeons, the ones that are left will have babies that will be smarter or faster.

Will: Maybe after enough time we'll have pigeons with super powers! I saw this TV show a couple of weeks ago about how some pigeons have a GPS in their head. They can sense where they are and find their way home. That's like a super power.

Shawnte: Yeah, right. I'm looking that up. What were those pigeons called?

Will: Homing pigeons, I think.

Shawnte: Hang on...whoa! This says that pigeons can find their way home from a thousand miles away! Some people even have racing pigeons and **breed** their own pigeons.

Erica: Is pigeon **breeding** like dog **breeding**? My friend's mom **breeds** dogs. She finds dogs that have traits like soft fur and cute faces and has them make puppies.

Shawnte: Hey, it says here that Charles Darwin did sort of the same thing as your friend's mom. But he **bred** pigeons, not dogs.

Will: We learned about Darwin earlier. He was that **evolution** guy. So **breeding** is a kind of **evolution**?

Shawnte: That makes sense! By mating certain dogs together, you can get puppies with the traits you want. The dog population changes over the generations.

Erica: But I thought **evolution** was all about **survival** of the strongest. My friend's mom **breeds** dogs to be cute and fuzzy. Those dogs are pretty weak.

Will: **Evolution** is just living things changing over time. It doesn't say that they have to get stronger or faster. If that was true, everything would be super buff.

Teacher Directions, Session 1
pages 2-3

Reader's Theater

You may want to assign students parts so they can read the Reader's Theater aloud.

In this week's Reader's Theater, three friends are discussing whether or not running over pigeons that are too slow to get out of the road is helping to create a smarter, faster pigeon. They find information about natural selection on the Internet and struggle to understand the concept.

Review the focus words of the week. Use the word chart at the end of the unit to review definitions and sample sentences.

Reader's Theater

Identifying Perspectives

Shawnte: *(pointing to phone)* It says here that **breeding** animals is a kind of **evolution** called artificial **selection**. People select what **survives** and **reproduces**.

Erica: But humans don't go around **breeding** everything. How does **evolution** happen in nature?

Will: I guess things like weather and predators select who **survives** and **reproduces**. If you have **traits** that don't help you succeed in your environment, you don't stick around to make babies.

Erica: But isn't that **survival** of the strongest?

Will: No. You don't have to be strong to **survive**.

Shawnte: Yeah, you could be hard to see, or have a good sense of smell, or have protective poison or something. This website says that most plants and animals evolve through natural **selection**. Natural **selection** is when some groups of plants or animals are better **adapted** to their environment than others and so they **survive** and **reproduce**. Being a good fit for your environment is called "**fitness**."

Erica: Wait, I thought **fitness** meant being in good shape, like you've worked out a lot?

Shawnte: **Fitness** does mean that in P.E. class, but the meaning is a little different in science.

Will: Okay, so when your dad ran over pigeons with his car, was it artificial **selection** or natural **selection**?

Erica: Well, we didn't **breed** them, we just ran over the slow ones according to my dad. So it must be natural **selection**.

Shawnte: Yeah, but because your dad ran them over, humans did it. It must be artificial **selection**.

Erica: Either way, I still say it's messed up. I wish my dad taught me about **evolution** some other way.

With a partner, read and discuss the three questions below:

- Make a list of animals or plants that humans have **bred**. What traits do they have that make them valuable to humans?
- Erica thinks her father running over pigeons is an example of natural **selection**. Shawnte thinks it's an example of artificial **selection**. In what way does this example of **selection** seem natural, artificial, or both to you? Why?
- Do you think that Erica's father's argument that he was helping nature by killing some pigeons makes sense?

Refer back to the Reader's Theater to answer the following questions:

- List the evidence that caused Erica to conclude that her father ran over some pigeons.
  1. _____
  2. _____
  3. _____
- Dog **breeding** is not natural **selection** because:
  a) the effect is not permanent.
  b) humans are selecting who **reproduces**.
  c) certain traits are passed on to the next generation.
  d) nature plays a larger role than humans.
- Will and Shawnte pointed out that there are more traits than "being strong" that might help an animal or plant to **survive**. Restate one of their examples and then propose some more.

  _____
  _____
  _____
  _____

Reader's Theater, continued

When students have finished with the Reader's Theater, ask them to answer the six questions.

1. Sample response: *Humans have bred corn and soybeans to make them easier to grow and use in the production of other foods. Humans have also bred horses for various kinds of work and transportation. Some horse breeds are good for riding, while draft horses are bred big and strong to haul heavy loads.*
2. Sample response: *I agree with Erica that running over pigeons by accident is natural selection because it doesn't involve any human intention to breed smarter, faster pigeons. Or: I agree with Shawnte that this is artificial selection because cars are not part of the natural environment, so running over pigeons is a kind of human interference in evolution.*
3. Sample response: *I don't think it makes sense because I don't think that being able to avoid cars is necessarily the most important survival skill for pigeons. Or: I think it does make sense because traffic is a fact of life for urban pigeons, so they need to adapt to it.*
4. Sample response: *1) Erica and her father drove through the pigeons on the road. 2) It felt like they ran over something. 3) There were feathers under the car when she got out of the car.*
5. Answer: (b) humans are selecting who reproduces.
6. Sample Response: *Shawnte gave the example of an animal being hard to see; camouflage can help an animal hunt, or avoid hunters. Some animals, like skunks, use bad smells to defend themselves.*

Speaking Scientifically

Variation and Selection

Take a close look at your classmates. Does everyone look exactly the same? Though we're all part of the same **species**, our differences are pretty obvious. Some of us are tall and some are short. Some of us are skinny and others are heavier. Some of us have darker skin, while others of us have lighter complexions. Some of us are able to jump really high. Others are super flexible.

Animals and plants in a population have different characteristics, or traits. In the same environment, animals or plants with certain traits **survive** and **reproduce** better than other animals or plants. These traits are passed on to offspring, who then have an increased chance of **survival** in that same environment. The offspring, in turn, **rep oduce** and...you get the picture! This process, called *natural **selection***, is one very important way that a population changes over time.

The Amazing Story of the Peppered Moth

Before the 1800s, nearly all of the peppered moths in England were light-colored and very hard for birds to see against light-colored tree bark and lichen. Dark-colored pepper moths weren't common at all. The dark-colored moths that did exist were easy targets for birds to see and eat.

Throughout the 1800s, industry was on the rise. Steam-powered factories and commercial railroads burned coal to make energy. Burning coal produced dark soot that coated the tree bark and killed the lichen. The light-colored moths were now easier for birds to see against the darkened tree trunks, while the dark-colored moths were harder for birds to see. More dark-colored moths **survived** and were able to **rep oduce**, passing their genetic traits on to the next generation. Over time, the population of light-colored moths decreased. The population of dark-colored moths increased.

Teacher Directions, Session 2

pages 4-6

Speaking Scientifically

In this section, the story of the peppered moth in nineteenth century England illustrates the process of natural selection.

Read "Variation and Selection" and "The Amazing Story of the Peppered Moth" with your class. On the last page of this section, students will use what they know about natural selection to fill in missing information in both the text and the illustrations.

Teaching Tips:

Before reading, ask students to look at the first three illustrations of peppered moths (on this and the following page). Have them discuss with a partner what they see, prompting them to talk about the color of the moths on the trees and in the birds' mouths.

What pattern do they notice?

What ideas do they have for why this pattern occurs?

It may be helpful to review the information from 7.5, Traits and Heredity, before beginning "Speaking Scientifically."

Academic Language:

Students may want to practice sequence words and phrases as they discuss the illustrations.

- First, there are more ___
- Next, ____
- Then, ____
- In the end, ____

Vocabulary in Context:

Some students may not be familiar with the word "soot" in the paragraph next to the second illustration. Ask students how they can use the more familiar words surrounding "soot" to help them figure out the meaning of this unfamiliar word.

Speaking Scientifically

Variation and Selection

By the end of the 1800s, nearly all of the peppered moths in the industrialized areas of England were dark-colored.

In 1952, a thick blanket of dark pollution, mostly from the use of coal, covered the London area for five days. At the time, it was estimated that about 4,000 people died as a direct result of the terrible pollution. More recently, researchers believe that the number of people who died was closer to 12,000.

As a response to the Great London Smog of 1952, people became increasingly concerned about the quality of air. In 1956, the British Parliament passed the Clean Air Act, with a goal of reducing air pollution. Over time, the quality of air improved.

What happened next?

Using what you've already learned about natural **selection**, help tell the rest of the story of the peppered moths. Look at the drawings on the next page and then fill in the blanks in the accompanying text, using the words "light" and "dark." With a pencil, shade in the number of moths that you estimate should be dark. (Don't worry, there isn't an exact right number.) Don't forget the moth in the bird's mouth!

Speaking Scientifically, continued

Continue to read the passages with the class. The directions at the bottom of the page tell students to fill in the missing information on the next page. They need to write "dark" and "light" in the correct places in the text, and shade in a roughly appropriate number of moths in each illustration.

Background Information:

Many students may not know what the "British Parliament" or "Clean Air Act" mean. Encourage students to work in pairs to try to figure out the meanings. You may want to use the illustration of the London Fog of 1952 to show them what the British House of Parliament looks like (some students may have heard of Big Ben, the bell in the building's famous clock tower). Ask students what they think might happen in a big, famous building like this in a nation's capitol.

Speaking Scientifically

Variation and Selection

*Efforts to clean up the polluted air have just begun. The tree trunks are still _____-colored. There are more _____ moths than _____ moths. The birds have an easier time seeing (and eating!) the _____ moths. More _____ moths are able to live and **reproduce** and pass their traits on to the next generation.*

(Shade in some of the moths to help show the story.)

The air is getting cleaner! There is less dark soot on the tree trunks. Light-colored lichen is beginning to grow back. There is a mix of both _____ and _____ moths on the tree trunks.

(Shade in some of the moths to help show the story.)

*The air is much cleaner! The tree trunks are now light-colored and the light-colored lichen has grown back. The _____ moths are well-protected from birds since they're hard for the birds to see. The occasional _____ moth is usually snatched away and eaten by a bird. More _____ moths have been able to live and **reproduce**. There are mostly _____ moths on the tree trunks once again.*

(Shade in some of the moths to help show the story.)

Note: Frequently, **evolution** occurs at a very slow pace. Peppered moths are an example of natural **selection** working pretty quickly. One reason a change like this one can occur quickly in moths is that they **reproduce** more frequently than, say, humans or tortoises. The sooner a living thing can **reproduce**, the faster **evolution** can happen, although it isn't the only factor influencing the pace of **evolution**.

Speaking Scientifically, continued

Students can work in pairs or independently.

Efforts to clean up the polluted air have just begun. The tree trunks are still **dark** colored. There are more **dark**-colored moths than **light-colored** moths. The birds have an easier time seeing (and eating!) the light-colored moths. More **dark-colored** moths are able to live and reproduce and pass their traits on to the next generation.

(Most of the moths should be shaded in dark; the moth in the bird's beak should be left light-colored.)

The air is getting cleaner. There is less dark soot on the tree trunks. Light colored lichen is beginning to grow back. There is a mix of both **light** and **dark** moths on the tree trunks.

(There should be a roughly even number of light and dark moths; one bird should have a light moth and the other a dark moth to show the two colors' equal advantage in this intermediate environment.)

The air is much cleaner! The tree trunks are now light-colored and the light-colored lichen has grown back. The **light-colored** moths are well-protected from birds since they're hard for the birds to see. The occasional **dark-colored** moth is usually snatched away and eaten by a bird. More **light-colored** moths have been able to live and reproduce. There are mostly **light-colored** moths on the tree trunks once again.

(Most of the moths should be left light-colored; the moth in the bird's beak should be shaded in dark.)

Teaching Tips:

Gradual Release of Responsibility: Some classes or group of students may need additional instruction before completing this activity.

1. Fill in the first passage and illustration together as a class.
2. Ask students to complete the second passage and illustration with a partner.
3. Ask students to complete the third passage and illustration independently.

Suited for Survival

Adaptations

An **adaptation** is an inherited trait that makes it much more likely that an animal or plant will **survive** and **reproduce**, passing its genetic material on to the next generation.

A polar bear's coat is a great example of an **adaptation**. In winter, the polar bear's coat is pure white, which makes it blend in with the color of the snow and helps the polar bear hunt since it's harder for its victims to see it coming. Also, the polar bear has hollow hairs that trap warm air and keep the polar bear warm. Another **adaptation** that helps keep the polar bear warm is the black skin underneath its fur. Dark colors absorb heat. When the sun is shining, the black skin helps the polar bear stay warm.

A lion has long claws. Why do you think this **adaptation** is important?

Koalas have two thumbs on each of their front paws, so they're able to hold on tight to branches. They also have thick pads on their tails, which makes it comfortable for them to sit in trees all day. Why do you think these **adaptations** are important?

People sweat when we're in hot places or when we exercise hard. Sweating cools us off. Why do you think this **adaptation** is important?

What example of an **adaptation** can you think of?

Teacher Directions, Session 3

pages 7-8

Suited for Survival

Read the explanation of adaptations and the polar bear example.

Students consider what they know about lions, koala bears, and humans to consider why an adaptation is important. Some possible answers may include:

- *A lion's sharp claws can help grip the ground when running, or trees when climbing. Their claws are also useful weapons for killing prey, and useful tools for ripping through the coats of their prey to get to the meat.*
- *Koalas spend most of their time in trees, where they can eat leaves and avoid predators on the ground. Their paws are adapted for keeping a firm, safe grip on branches so they can climb well and not fall. The thick pad on their tail makes it easier to sit in trees all day.*
- *Humans need to be able to keep their body temperature in a healthy range. If they are in a very hot place, or heat up because they are doing hard physical work, cooling off by sweating helps them avoid reaching dangerously high temperatures.*

Other adaptations include:

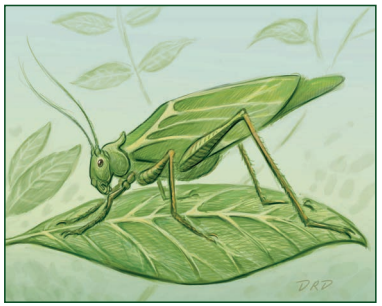
- *The camel's hump, which stores fat (not water!) that they can metabolize for energy when food is scarce. This efficient metabolism allows them to go months without drinking water.*
- *The hedgehog's spines, which protect them from predators.*
- *An alligator's eyes, ears, and nose: they are positioned to peak just above the waterline so they can locate their prey without being seen.*

Suited for Survival

Things Aren't Always What They Seem!

When is a leaf not a leaf?

When it's an insect! This **species** of katydid evolved over time to look like a leaf. Katydids are the same shade of green and the same shape as the leaves they live on. They even have lines on them that look like the veins on leaves.



With a partner, discuss:

- How do you think this **adaptation** helps the katydid?
- What explanation(s) can you offer for how this **adaptation** might have evolved?

Write your answers below:

Why doesn't this woodpecker have a headache?

The average woodpecker pecks a tree trunk at a rate of 20 pecks per second! Woodpeckers have evolved several **adaptations** that protect them from the hazards of all of this hard hammering. These include a small brain size, spongy sections of bone in their skulls, and a special beak design that softens the impact.

With a partner, discuss:

- How do you think these **adaptations** help the woodpecker?
- What explanation(s) can you offer for how these **adaptations** might have evolved?

Write your answers below:

Suited for Survival, continued

This activity asks students to elaborate on how they think an adaptation evolved. Answers will vary; encourage students to speculate but to be logical in their explanations.

Possible explanations:

Perhaps the katydid's ancestors looked like regular grasshoppers or something. However, in a process similar to the peppered moth case, there might have been some that looked more like leaves. These better-camouflaged ones would have been harder for predators to notice. As a result, the insects with leaf-like features survived in greater numbers to breed. As time went on, these traits were passed down and created what we now call the katydid.

The woodpecker's food source is bugs that live beneath the bark of trees. Maybe the woodpecker evolved from a bird that ate bugs that were more accessible. Those birds that were slightly better at picking away bark to find hidden insects would have had an advantage. Over many generations, some of the birds might have gradually become more specialized at hunting insects in wood. These specialists would have access to a food source that other birds couldn't compete for. But the specialists would also need to maintain their abilities: woodpeckers born without the right kind of beak or skull would tend to die (from starvation or injury) before breeding, taking their traits out of the population. Traits that favored hunting insects inside of wood would be the ones passed on to woodpecker offspring.

Science-Fiction Science

In a Solar System Far Away

Imagine that sometime in the not-too-distant future, the U.S. government decides to send out teams of explorers to live on two newly discovered planets in a nearby solar system. Both of these planets have environments that are similar to Earth's in two important ways: They have the same kind of gravity and breathable air. But each of the planets is also very different from Earth.

Planet X

An underground source of light means that it's never dark on Planet X. Instead, it's very bright all of the time. There's no water, just a liquid that's similar to extra sweet orange juice. A large population of plants are safe to eat, but the only edible creatures are fast-moving, high-jumping insects. A strong wind blows all of the time. Temperatures range from 15 to 20 degrees Celsius, similar to a comfortable fall day here on Earth.

Planet Y

Due to a black, fog-like layer that surrounds Planet Y, it's never light. There's a little glow in the air every once in a while, but otherwise it's pitch dark. Water is plentiful. In fact, water covers 80% of the planet. There are many different populations of underwater creatures that are good to eat, but there's very little edible plant-life. A high-pitched, whiny sound is constant. Temperatures are much warmer than on Earth, on average 50 degrees Celsius.

Teacher Directions, Session 4

pages 9-11

Science-Fiction Science

Students read about the environmental conditions of two fictional planets. Student groups consider hypothetical adaptations that would allow humans to thrive on one of these planets. In the future, the changed humans will return to earth and explain how adaptations and natural selection caused them to have a few new traits.

Read the explanation at the top of the page aloud to the class. Then, read the descriptions of Planet X and Planet Y.

Ask students to discuss the illustrations with a partner.

Idioms:

Many students may have heard the term "pitch black" when someone describes an environment where there is no light, like a cave or basement without windows. But many students may not know that *pitch* is a tar-like substance that is usually very black or dark in color. Pitch was used to seal seams in ships or houses.

Science-Fiction Science

In a Solar System Far Away

Fast forward to the even more distant future. You and your team are descendants of those original explorers. You've journeyed here to planet Earth to teach us about how natural **selection** has helped your **species** evolve over these many, many years.

(Your teacher will divide the class into groups and assign each group a birthplace of either Planet X or Planet Y.)

Working as a team, think of five things that you know about the environment on your planet and write them here:

1. _____

2. _____

3. _____

4. _____

5. _____

Next, read this list:

EYES	FEET	HANDS
NOSE	TEETH	HEART
FINGERS	LUNGS	VEINS
BLOOD	MOUTH	SKIN
HAIR	BONES	TOES

Now, keeping in mind the things you know about your environment and the list of body parts, talk as a group about what traits would help a person **survive** on your planet. Would it be useful to have longer fingers? A smaller nose? What kinds of **adaptations** would be useful? Feel free to get creative and come up with **adaptations** that we've never heard of! (Please focus on changes in the body, not on technological solutions.)

Science-Fiction Science, continued

Divide the class into small groups of no more than four students.

Assign Planet X or Planet Y to each group.

Each group reviews the environmental conditions of their assigned planet, making notes in the space provided.

Next, students look at the list of human features and consider what adaptations might have occurred in order to allow for the traveling humans to thrive in their new environments.

Students fill in the information in the space provided on the next page.

Science-Fiction Science

In a Solar System Far Away

Greetings Earthlings: How Our People Have Evolved over the Years

Fill in the blanks, using the following as an example:

On our planet, our people have evolved to have flaps over our ears in order to keep the strong wind from hurting our eardrums.

On our planet, our people have evolved to have _____

in order to _____.

On our planet, our people have evolved to have _____

in order to _____.

On our planet, our people have evolved to have _____

in order to _____.

On our planet, our people have evolved to have _____

in order to _____.

On our planet, our people have evolved to have _____

in order to _____.

Science-Fiction Science, continued

Teaching Tips:

Students may want to write their own sentences using other words and phrases that show cause and effect.

- *Due to the ____ , people have evolved to ____ .*
- *As a result of ____ , people evolved to ____ .*
- *consequently*
- *therefore*
- *hence*

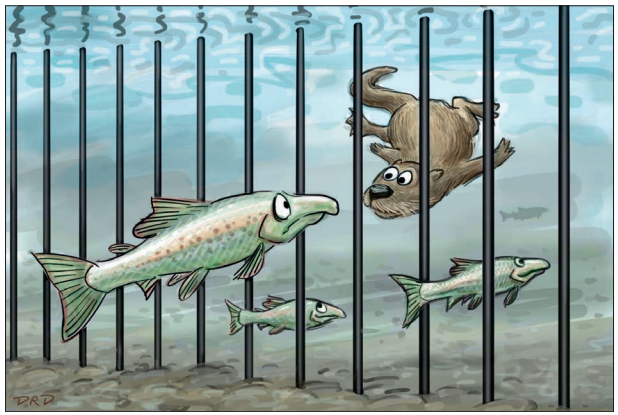
Fish Fence Crisis

You Otter Think of the Salmon

The Salmon River Otter Rescue Center has recently built an enclosure for orphaned and injured otters. The needy otters are kept and cared for until they are ready to be released into the wild. To give the otters the most natural habitat possible, the new enclosure stretches across a section of the Salmon River. At either end of this section of the river, a fence of steel bars runs across the river, with the bars set close enough to one another to keep the otters from escaping before they can **survive** on their own in the wild.

But there's a problem. In addition to being prime otter habitat, the Salmon River is also important for the **reproduction** of a large population of wild salmon. Each year, **breeding** salmon must swim from the ocean up the river to their spawning grounds, where they lay and fertilize eggs. When the eggs hatch, the baby salmon swim downstream to the ocean. Later, when they are mature enough to **breed**, they swim up the same river to **breed** in the same spawning grounds where they were born.

The Salmon River Otter Rescue Center and its otter enclosure are halfway between the ocean and the place where the salmon spawn. That means that the salmon have to swim through the new otter enclosure. The captive otters may eat a few of the salmon, but the salmon have always faced that same danger from free otters and other predators in other parts of the river. Hunting otters do not threaten the salmon population's overall **survival**. The bigger problem for the salmon is that the largest salmon are too big to fit between the bars that keep the otters in the enclosure. Salmon that can't fit between the bars can't reach the spawning grounds, and therefore can't produce offspring.



What do you think will happen to the salmon population over several generations if only the smaller salmon are able to **breed**?

Teacher Directions, Session 5

pages 12-14

Fish Fence Crisis

Students consider a fictional case of an enclosure for rescued otters and its unintended impact on salmon reproduction. Students design a solution to the problem and write a persuasive letter that advocates for their design. They use what they've learned about natural selection in their letter.

Read "You Otter Think of the Salmon" aloud to the class. Emphasize the words in bold and remind students that they should refer to the word chart at the back of the unit.

Ask students to write a response to the question at the bottom.

> *Sample Response:*
>
> *Because the larger salmon are blocked by the otter fence, they will not be able to breed. As a result, only the smaller salmon will be able to pass on their traits during reproduction. Overtime, the river will see a reduced number of larger salmon, and if there is not a solution that allows for these larger salmon to reproduce, they will eventually disappear from the river.*

Teaching Tips:

Some students may think that larger salmon are that way just because they are older than smaller salmon. Actually, salmon live to spawn only once, and then die. So all the salmon in a particular spawning group are about the same age. Just as there are taller and shorter people, salmon have genes that influence how large they will grow.

Session 5

survival • random • reproduction • selection • evolution • species • adaptation • fitness • breed

Fish Fence Crisis

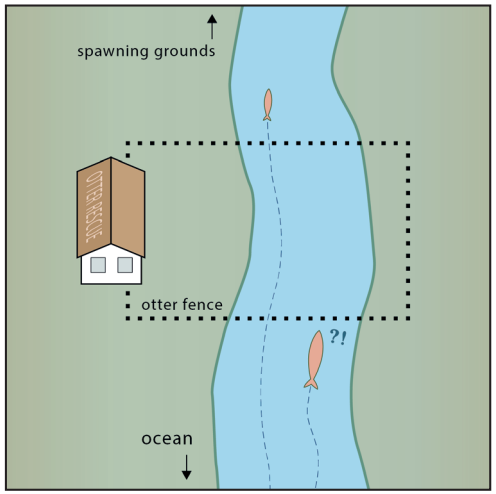
You Otter Think of the Salmon

Fishermen who depend on the salmon for their economic **survival** are concerned about how the Salmon River Otter Rescue Center's enclosure will affect the salmon population. They think that after several generations go by, the **surviving** salmon will all be small, because the fence will select the large-size trait out of the salmon population. The salmon **species** in that area may evolve into a smaller fish on average. Some of the fishermen want the otter enclosure removed.

Local environmentalists agree with the fishermen that the way the otter enclosure is built is likely to cause problems for the salmon (and for people and animals who depend on the salmon). But the environmentalists are also concerned about the otters. Human development near the river has taken away much of the otters' natural habitat, making it harder for otters to **survive** in the area. Therefore, the environmentalists support the work that the Salmon River Otter Rescue Center is doing for injured and orphaned otters, as a way of helping out a **species** threatened by habitat loss.

Help Solve the Problem

Below is a diagram showing the Salmon River Otter Rescue Center's accidental blockage of the larger fish in the salmon spawning run. In the space provided, sketch a remodeling suggestion that would allow the Salmon River Otter Rescue Center to give its otters access to the river without blocking the large salmon's access to the spawning grounds.



Fish Fence Crisis, continued

Read the additional information with the class. Be sure that students understand the controversy and the need for a solution to this problem.

Place students in pairs and ask them to design a solution to the problem. Then ask students to present their solution to another pair.

Possible design solutions include rebuilding the fence so that it encloses only one bank of the river (leaving the other side of the river open to all salmon); or else leaving the existing fence but digging a channel for the salmon that bypasses the fenced section of the river.

Ask students to each write a letter using their solution or the solution of the pair of students that they shared with.

All students should use their knowledge of natural selection (or artificial selection) in their letter.

Fish Fence Crisis

You Otter Think of the Salmon

Write a letter to the Salmon River Otter Rescue Center in which you (1) explain why their fences may pose a threat to the salmon population and the people and other predators who depend on the salmon, and (2) propose a way of remodeling their otter enclosure so that the otters can be cared for but the salmon can also be allowed to **breed** without the larger fish being selected out of the population.

I used _____ of the week's focus words in this writing assignment.

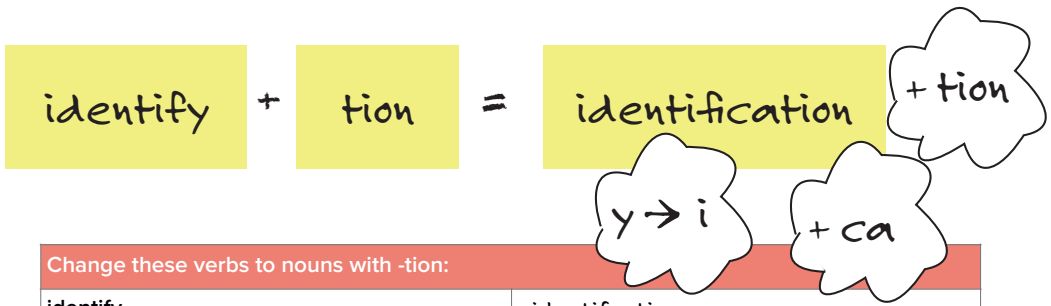
Nominalization

Building Nouns from Verbs

What is a verb? A verb is usually a word that shows the action in a sentence. Sometimes the action is silent or goes on in someone's head. For example: Can you *identify* the bird in the tree? *You* are the subject of the sentence. *You* are doing the identifying.

What is a noun? A noun is a word that is used to identify a person, place, thing, or idea. *Lion* is a noun. *Ocean* is a noun. This week's focus words include nouns that some people think are tricky, words like ***survival*** and ***adaptation***.

The suffix *-tion,* when added to a verb, means it is a noun related to the verb. Many verbs can be turned into nouns by adding *-tion*. In English, there are several patterns of changes to words when you add *-tion*. Check out the example below. Then work with the focus words that are listed. Next, try some new words. Use a spell checker or a dictionary to see if you converted the verb correctly.



Change these verbs to nouns with -tion:	
identify	identification
reproduce	
select	
evolve	
adapt	
quest	
amplify	

Now try it with different words...and backwards!	
justify	justification
	population
	variation
	generation
	action
	addition
	definition

Teacher Directions, Supplementary Activities

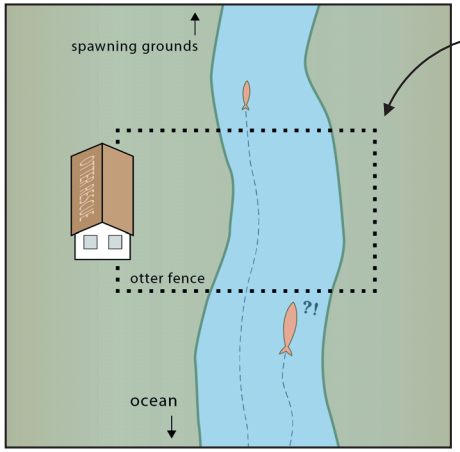
pages 15-17

ELA Activity

In their science class this week, students learned about how adaptations evolve over time in species through the process of natural selection.

This activity helps students to understand how a verb is changed into a noun by adding the suffix *-tion*.

Area of Irregular Shapes



Consider the rectangular shape here.

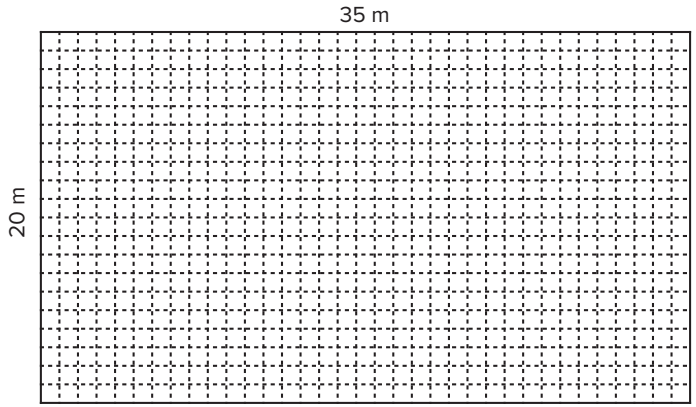
1. If the otter fence is 20 m by 35 m, what's the area within the fence?

2. Approximately what percentage of the area within the otter fence is water? What percent is land?

3. Can you estimate the area of the land within the otter fence? The area covered by water?

Below is a model of the area within the otter fence.

Shade squares to represent the portion of the area within the otter fence that is covered by water. Can doing this improve your estimates above? How?



Math Activity

In their science class this week, students learned about how adaptations evolve over time in species through the process of natural selection. In their final activity, students designed (or will design) a solution to a problem that involved an otter rescue center and its unintended impact on salmon reproduction.

This activity asks students to reexamine this otter rescue center.

Answers:

1. 700 square meters
2. answers will vary (60% land and 40% water)
3. answers will vary (420 square meters land, 280 square meters of water)

Don't Feed the Pigeons!

The text below is from a webpage made by the city government of San Francisco, California. It is meant to discourage people from feeding pigeons. Do you find the arguments presented on this webpage persuasive? What other questions does it raise? With a partner, please come up with 3–5 additional questions about this typical urban problem, using as many of this week's focus words as you can. Pose your most interesting question to the class for discussion.

City & County of San Francisco
Department of Public Works

Enter keyword GO

Home | About Us | Services A-Z | Projects | Community One-Stop | Contact Us

Services A-Z

TEXT FONT SIZE A- A+

Home » Services A-Z » more » Pigeons: Reasons why NOT to feed the pigeons

In This Section

- Graffiti
- Permits
- Potholes
- Street Sweeping
- Trees
- more
  - CULCOP Minutes and Agenda
  - Unwanted Handbills and Newspapers
  - News Rack Program
  - Mapping
  - Community Clean Team - Gigantic 3 Recycling Program
  - Pigeons: Reasons why NOT to feed the pigeons
  - Spruce Up by Sun Up
  - Don't Leave it on the Sidewalk!
  - Missing Sewer Vent Covers
  - CULCOP

Reasons why NOT to feed the pigeons

Please do not feed the pigeons. There are dozens of reasons why, but mainly: feeding pigeons harms our neighborhoods and also harms the birds.

Large population of pigeons is a health hazard.
Our huge feral pigeon population is a health hazard and creates many problems in the city. Pigeon droppings dirty public spaces, do costly damage to buildings, and can spread life-threatening diseases, especially to the elderly and immune-deficient. Their nesting materials block drains and harbor parasites like bird mites. Pigeon food makes a mess and attracts rats.

Feeding pigeons promotes overbreeding.
Pigeon feeding produces overbreeding. Pigeons normally breed two or three times a year, producing two eggs per brood. Overfed city pigeons can breed up to eight times a year.

Pigeons are harmed when fed.
When you feed pigeons, you are not doing them a favor. They lose their natural ability to scavenge and survive on their own. Pigeon over population leads to overcrowded, unsanitary conditions and produces sick and injured birds. A smaller flock is healthier and does less damage.

It is illegal.
It's against the law to feed pigeons on the streets or sidewalks of San Francisco (Sec. 486. M.P.C). Violators may be cited and fined.

You can help keep your neighborhood safe and clean and the pigeon population under control by not feeding pigeons. Keep edible garbage away from pigeons by discarding it in a securely covered garbage can. And don't feed pets outside.

You may report pigeon feeders to the San Francisco Police Department at 415-553-0123, or by calling 3-1-1.

Please join in on the efforts to keep San Francisco clean and beautiful by NOT feeding the pigeons.

City & County of San Francisco
Department of Public Works
View Site Map

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Social Studies Activity

In their science class this week, students learned about how adaptations evolve over time in species through the process of natural selection. The unit began with a group of friends discussing an accident earlier in the day where one character's father ran over a pigeon on the way to work. The friends discussed whether car-related deaths among pigeons might select for faster or smarter pigeons in the population, leading to evolutionary changes in the birds. They began a short discussion about the process of natural selection.

The web page from the San Francisco Department of Public Works explains why feeding pigeons is not good for the people in the city or the pigeons. Students discuss whether or not the arguments on this web site are persuasive and generate questions.

Encourage students to use the focus words on this page and remind them that there is a word chart at the back of the unit.

Allow time for students to pose their questions to the class for a short discussion. Encourage students to elaborate on their responses by using talk moves such as:

Can you say more about that?

Can you elaborate on that?

Can someone explain what _____ just said?

Focus Words survival • random • reproduction • selection • evolution • species • adaptation • fitness • breed

Examining the Focus Words Closely

SciGen Unit 7.6

→ **Scientific** or ✱ **Everyday Use**	Definition	Try using the word...
→ **survival** *noun*	the state of continuing to live due to being well adapted	*Why might darker moths have a greater **survival** rate during a period of heavy pollution?*
✱ **survive** *verb*	to continue to live after a difficult event	*It's amazing that people can **survive** terrible disasters like tornados. What is a survival story that you know of from the news?*
→ **random** *adjective*	without a particular order or method	*Janay reached into the raffle ticket box, drew out a ticket at **random**, and won. Was that fair? Explain.*
✱ **random** *adjective (informal)*	unexpected or unusual	*Susan said that Jason's comment in class was "**random**." Is that an insult? Explain.*
→ **reproduction** *noun*	the production of offspring	*How might wolves' **reproduction** rates be affected by an increase in the bison population?*
✱ **reproduce** *verb*	to copy something	***Reproducing** a CD is illegal. Why?*
→ **selection** *noun*	a process where certain organisms live more successfully	*Explain how **selection** might cause iguanas that live on rocks at the seashore to have longer claws.*
✱ **selection** *noun*	a range of things to pick from; the thing(s) that were chosen	*The **selection** at the farmers' market is better in summer than in winter. Why?*
→ **evolution** *noun*	the process by which living things slowly change from earlier forms	*Think of an animal with an unusual trait. How might **evolution** explain the development of this trait?*
→ **species** *noun*	a group of living things capable of breeding and exchanging genes	*Do you think there are more insect **species** or mammal **species**? How could you find out?*
→ **adaptation** *noun*	a change where a species becomes better fit for a certain environment	*Due to **adaptation**, sea otters have very dense fur to keep warm in cold ocean water. Can you think of an animal **adaptation** related to color?*
✱ **adapt** *verb*	to modify or adjust to new conditions	*My neighborhood library plans to **adapt** to the introduction of wireless technology by adding new routers. Do you know of a similar adaptation?*
→ **fitness** *noun*	compatibility for a certain environment	*What qualities demonstrate the **fitness** of fish for living under water?*
✱ **fitness** *noun*	the state of health or strength	*What are some ways to improve your **fitness**?*
→ **breed** *verb*	to mate for reproduction	*Do you think people are justified in **breeding** dogs even though many strays end up in shelters? Why or why not?*
✱ **breed** *noun*	a group within a species that shares certain characteristics	*The beagle is a **breed** of dog. Do you know a **breed** of cat?*

Teacher Directions, Focus Words

page 18

Examining the Focus Words Closely

The word chart here includes more scientific definitions that are reinforced throughout the unit. Each of these words has an arrow next to it. Additionally, there are other forms of the words or polysemous meanings that sometimes cause confusion for students. These words are marked with an asterisk.

Have students discuss the questions next to each word to help them make these distinctions. Make sure students answer the questions using the focus word.