

Nature at Extremes

How do extreme natural places like Great Salt Lake support biodiversity?

Purpose

This four-part guide uses Utah's Great Salt Lake to explore how habitat conditions drive Earth's biodiversity. It covers salinity, the water cycle, the food web and adaptation and how they are all tied to ecosystem health. Students also learn about environmental challenges facing Great Salt Lake and how these issues relate to their own surroundings.

Students Will:

1. Explore extreme habitats like Great Salt Lake and their unique ecosystems
2. Learn the importance of salt in saltwater habitats
3. Discuss the water cycle and its impact on life
4. Discover species diversity in extreme environments and their connections in the food web
5. Investigate bird adaptations to extreme habitats
6. Understand challenges facing habitats like Great Salt Lake and their broader environmental impact

Next Generation
Science Standards +

Lessons

- 1 Salinity & the Water Cycle
- 2 The Food Web
- 3 Adaptation
- 4 Habitat Health & Challenges
- 5 Resources



Learning Guide

Nature at Extremes

Grades & Performance Expectation

Elementary
Grades 3-5

Disciplinary Core Ideas

ESS3.A Natural Resources

ESS3.C Human Impacts on Earth Systems

LS1.A Structure and Function

LS1.B Growth and Development of Organisms

LS1.C Organization for Matter and Energy Flow in Organisms

Crosscutting Concepts

- Planning and Carrying Out Investigations
- Patterns

- Cause and Effect
- Stability and Change

Science & Engineering Practices

- Asking Questions and Defining Problems

- Developing and Using Models

Activities in this lesson can help support achievement of these Performance Expectations

- K-LS1-1** Use observations to describe patterns of what plants and animals (including humans) need to survive.
- K-ESS3-1** Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live.
- K-ESS3-3** Communicate solutions that will reduce the impact of humans on the land, water, air and/or other living things in the local environment.
- 1-LS1-2** Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive.
- 5-ESS3-1** Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

Salinity & the Water Cycle



Background



Vocabulary



Questions



Activities

- 1 Create Condensation
- 2 Wear the Water Cycle
- 3 See How Salt Deposits Form

Background

Salt is everywhere—in your kitchen, deep underground and in the ocean. But did you know it's essential for survival? Both people and animals need salt, but it has to be in the right amount. Too much or too little can make us sick.

When salt dissolves in water, the concentration is called **salinity**. While some animals, like whales and sharks, thrive in **salt water**, only a few species can survive in extremely salty environments. Great Salt Lake, the largest saltwater lake in the Western Hemisphere, is a prime example. To understand its high salinity, we need to explore the water cycle.

Water exists in three phases: solid, liquid and gas. The **water cycle** describes how water moves between these phases. When liquid water heats up and turns into vapor (like a shrinking puddle in the sun), it's called **evaporation**. As the vapor cools and forms tiny droplets (like **condensation** on a cold glass), it leads to cloud formation. When these droplets combine and fall as rain, sleet or snow, it's known as **precipitation**.

Great Salt Lake's salinity is a result of this cycle. Most lakes contain **fresh water**, but Great Salt Lake is fed by three rivers carrying snowmelt from nearby mountains. Unlike other lakes, no water flows out of Great Salt Lake, making it a terminal lake. As water evaporates, especially during hot summer months, it leaves behind increasing concentrations of salt and minerals. This process has made Great Salt Lake 2 to 9 times saltier than the ocean—too salty for fish, but perfect for other unique creatures we'll explore in the next lesson.

Salinity & the Water Cycle

 Background

 Vocabulary

 Questions

 Activities

- 1 Create Condensation
- 2 Wear the Water Cycle
- 3 See How Salt Deposits Form

Vocabulary

Brine	A strong solution of water and salt
Condensation	The process through which water vapor cools, condenses and returns to its liquid form
Evaporation	The process through which water heats up and turns into a gas (water vapor)
Fresh water	Water with a low salt concentration
Precipitation	Water that falls from the atmosphere to the Earth's surface in the form of rain, sleet, snow or hail
Salt water	Water that contains a high concentration of salt
Salinity	The measure of dissolved salts in water
Water cycle	The movement and circulation of water and the different forms it takes on Earth



Salinity & the Water Cycle

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- 1 Create Condensation
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Questions

1 What kind of water do we have where we live: fresh water or salt water?

2 What are some ways you use fresh water every day?

3 Why can't you use salt water for these activities?

4 Where does our fresh water come from?

5 If it rains tomorrow, what part of the water cycle does that represent?

Salinity & the Water Cycle

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- 1 Create Condensation
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- 3 See How Salt Deposits Form

ACTIVITY 1

 DEMONSTRATION

Create Condensation

Before you begin, boil water and transfer it into a mason jar or heat-safe container with a cooled or frozen lid. Prepare the lid by cooling or freezing it before class. You'll need a microwave, electric kettle or other heating mechanism and heat-resistant gloves for handling the jar once the water is added.

- 1 Show the class a cup of water and discuss its current form. What could they do with it? Drink it? Water plants?
- 2 Heat the water to boiling and add it to the jar. Place a cold or frozen lid on the jar and let it sit.
- 3 After a few minutes, remove the lid and show the class the droplets formed underneath.
- 4 Discuss what happened. Explain how boiling water turns into vapor (evaporation), and when the vapor cools on the cold lid, it turns back into liquid (condensation).
- 5 Relate this demonstration to the water cycle, explaining how water vapor in the natural world condenses in clouds and returns to Earth as rain, sleet, snow or hail.



Materials

- Mason jar (or heat-safe container)
- Water
- Heat source: stove, electric kettle or microwave
- Metal lid

Downloads

Data Collection Sheet



Salinity & the Water Cycle

 Background

 Vocabulary

 Questions

 Activities

- 1 Create Condensation
- 2 Wear the Water Cycle**
- 3 See How Salt Deposits Form






ACTIVITY 2

 HANDS-ON LEARNING

Wear the Water Cycle

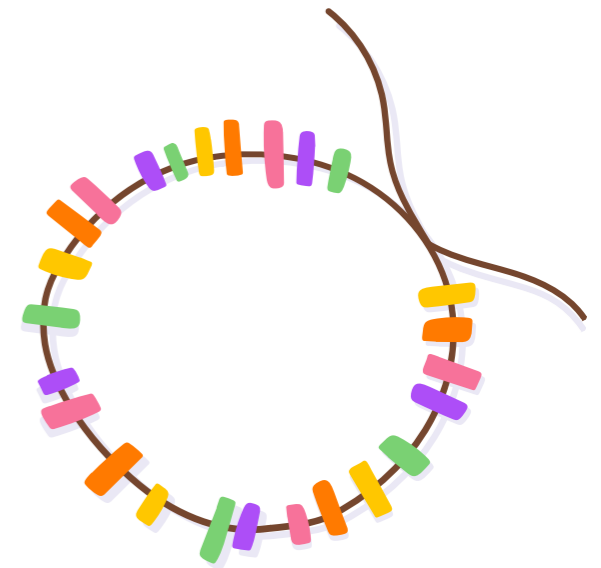
1 Give each student five different-colored cereal loops to represent the different elements of the water cycle.

For example:

-  yellow = sunlight
-  orange = evaporation
-  pink = condensation
-  purple = precipitation
-  green = large collection of water

2 Ask students to string the colored beads in the order of the water cycle: sunlight, evaporation, condensation and precipitation.

3 Then, have them put on their bracelets and talk about what each loop means. What kind of precipitation is their purple cereal loop? What body of water does their green cereal loop represent? When does evaporation happen the most?



Materials

- Colored loop cereal (5 colors for each bracelet)
- Yarn for bracelet
- Scissors

Salinity & the Water Cycle

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 Vocabulary

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 Activities

- 1 Create Condensation
- 2 Wear the Water Cycle
- 3 See How Salt Deposits Form**

ACTIVITY 3

 DEMONSTRATION

See How Salt Deposits Form

- 1** Pour different amounts of water into two bowls, then add a few drops of food coloring and start stirring. Add **lots** of salt into each bowl. The more salt you add, the more visual the effect will be.
- 2** Set the bowls in two different locations. For example, one bowl can be put in direct sunlight (or near a heater if it's wintertime), and the second can be set in a darker location.
- 3** As you check the bowls throughout the week, ask your students: "What's happening to the water? What's happening to the food coloring? How about the salt?"
- 4** Once the water evaporates completely, show them that the salt is left behind. (*Note: if the water doesn't evaporate on its own, use a microwave or other heat source to boil the water away.*)



Materials

- Water
- Salt
- Two bowls
- Food coloring

Downloads

Data Collection Sheet



The Food Web



Background



Vocabulary



Questions



Activity

Color the Food Web 

Background

Think about what you had for breakfast—scrambled eggs, cereal with fruit or toast and jelly. Do you know where it came from? While we buy food at the store, everything we eat is part of a larger system called the **food web**.

In a food web, energy is passed from one living thing to another when something small is eaten by something bigger. For example, a tiny pond fly might be eaten by a dragonfly, which is eaten by a frog, which is eaten by a snake. This is how energy moves up the food web. It often starts with plants, which use sunlight, water and carbon dioxide to make their own food through **photosynthesis**. At the top of the food chain are large animals like sharks, bears and lions, known as **apex predators**. In a healthy food web, there's a variety of plants and animals, known as **biodiversity**.

Great Salt Lake is a great example of how a healthy food web supports different life forms. As we learned, the lake is an extreme habitat, perfect for **microbialites**—algae and **bacteria** mats that look like coral reefs and thrive in salty, shallow water. Microbialites feed brine shrimp and brine flies, which, in turn, feed millions of migratory birds that stop at the lake on their way north.

Without microbialites at the bottom of the food web, **migratory** birds wouldn't have the food they need to complete their journey. This shows how plants and animals in the same area depend on each other for survival.

The Food Web

 Background

 Vocabulary

 Questions

 Activity

Color the Food Web 

Vocabulary

Apex predator An animal at the top of the food web with no natural predators of its own

Bacteria Microscopic life forms that consist of just one cell

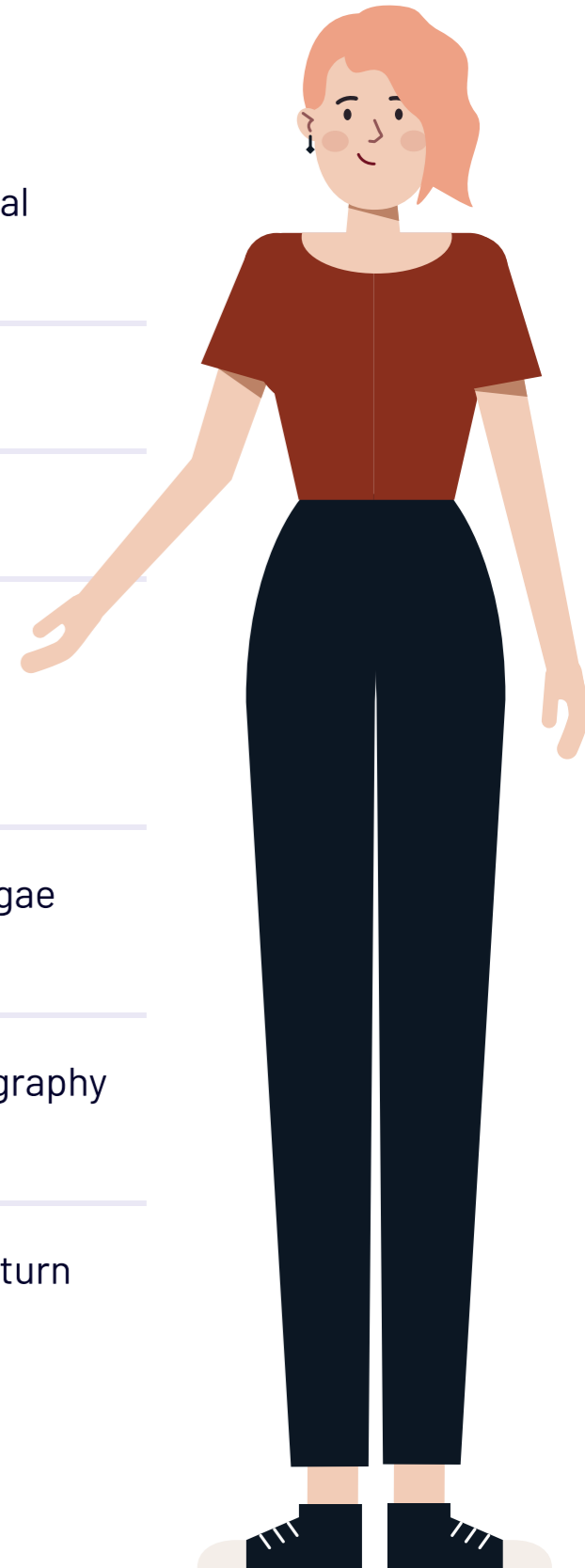
Biodiversity Variety of life that is found on Earth

Food web The interconnection of different species through the transfer of energy when one life form consumes another

Microbialites Reef-like structures that are formed by mats of algae and bacteria

Migration The seasonal movement of animals from one geography to another, typically for breeding or feeding

Photosynthesis The process through which plants use sunlight to turn water and carbon dioxide into food



The Food Web

 Background

 Vocabulary

 Questions

 Activity

Color the Food Web 

Questions

- 1 Think about what you ate for lunch today. Can you describe where it sits in the food web? What's below it? What's right on top?

- 2 Imagine the food web of Great Salt Lake. What happens if you remove the microbialites that are the base of the food web?

- 3 What are some other food webs you can describe?

The Food Web

 Background

 Vocabulary

 Questions

 Activity

Color the Food Web 

ACTIVITY 1



HANDS-ON LEARNING

Color the Food Web

1 Print a [Color the Food Web activity sheet](#) for each student and distribute. They can use this sheet to explore the food web by coloring, drawing and connecting the ways different animals depend on each other for survival.

2 Students will:

- Color a songbird BLUE
- Color a shorebird GRAY
- Draw a star around a brine shrimp
- Draw a square around a brine fly
- Color a nest BROWN and the eggs in it YELLOW— and circle in RED who might eat the eggs
- Find an APEX PREDATOR and color it ORANGE
- Find an animal that humans harvest and use as food for fish that we eat; color it PINK
- Find plants that help birds hide from predators and color them GREEN

3 Facilitate a class discussion to talk about how each item represents links in the food web.

Downloads

Color the Food Web
Activity Sheet



Adaptation



Background



Vocabulary



Questions



Activities

- 1 Make a Bird Feeder
- 2 Try Out Bird Beaks

Background

What happens in the springtime? The flowers are blooming, the bees are buzzing and you can hear the birds singing - lots of them. That's because in the spring, many birds migrate. While some birds stay in one place all year long, others travel south in the fall to warmer climates with more available food sources. Then, when spring comes, they travel north to find places to mate and raise their young. The movement of birds and other animals as the seasons change is called **migration**.

As they migrate, birds stop at places like Great Salt Lake to rest and refuel on abundant food sources. Their unique **physical traits** help them find food—**songbirds** catch insects mid-air, **shorebirds** dig in the sand or scoop prey from the water and **raptors** use talons to hunt. These traits are called **adaptations**.

Adaptation plays a key role in a healthy food web (which we learned about in lesson #2). If all the animals found within one area ate the same things, there wouldn't be enough food to go around. This would threaten the stability of the entire food web! But because animals have evolved over time to feed in different ways, on different things and in different parts of a habitat, they are able to survive and keep the food web in balance.

Adaptation

 Background

 Vocabulary

 Questions

 Activities

1 Make a Bird Feeder

2 Try Out Bird Beaks

Vocabulary

Adaptation

A physical characteristic that helps a plant or animal meet its basic needs

Migration

The seasonal movement of animals from one place to another, typically for breeding or feeding

Physical traits

Characteristics such height, weight, size, shape or coloring

Raptor

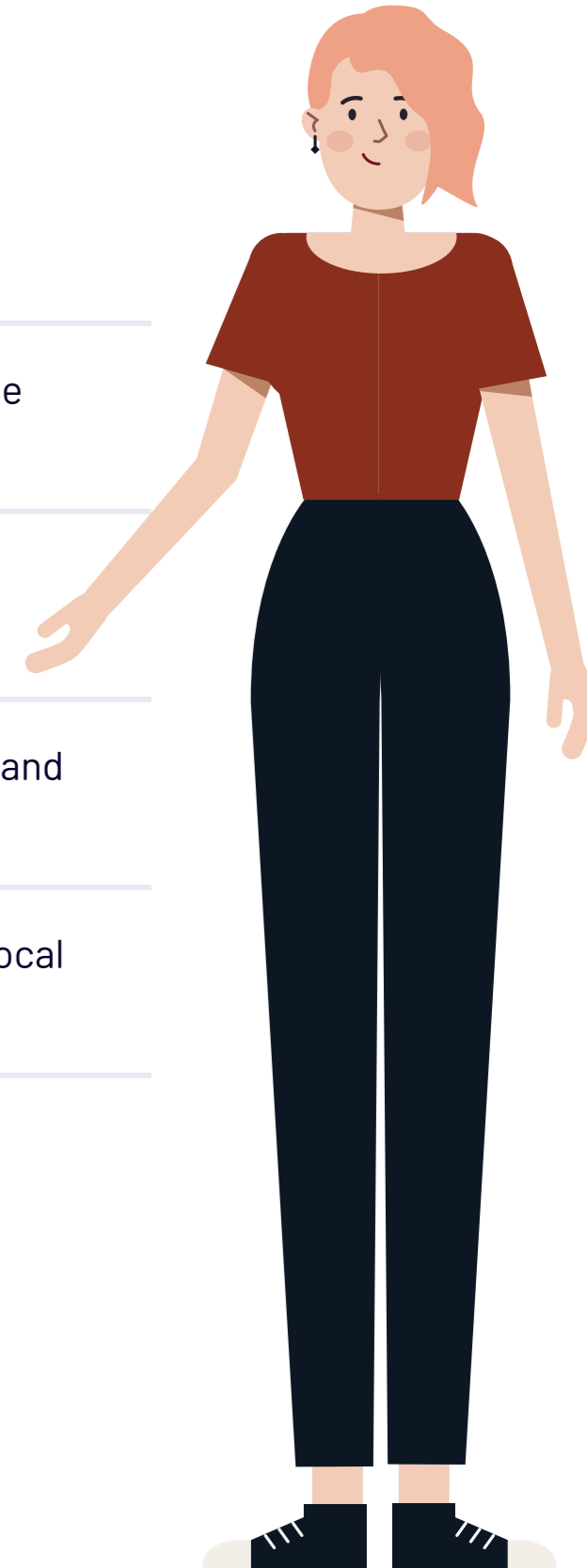
An apex predator that hunts small mammals, fish and other birds

Songbirds

Birds that perch on branches and have a unique vocal organ called a syrinx

Shorebirds

Birds that live along the edge of the water



Adaptation

 Background

 Vocabulary

 Questions

 Activities

1 Make a Bird Feeder

2 Try Out Bird Beaks

Questions

1 What are some features and behaviors birds have that other animals do not?

2 What makes one type of bird different from another?

3 What birds do you see in the springtime? How about in the winter?

4 What's your favorite bird and why?

Adaptation

 Background

 Vocabulary

 Questions

 Activities

1 Make a Bird Feeder

2 Try Out Bird Beaks

ACTIVITY 1



HANDS-ON LEARNING

Make a Bird Feeder

- 1 Punch holes around the edge of a sturdy paper plate or yogurt lid.
- 2 Tie and knot a string through each of the holes, then gather the strings and knot them at the top.
- 3 Sprinkle on birdseed.
- 4 Have students hang their bird feeders at school or home and note down weekly observations to report back to the class.
- 5 **Ask:** How might you redesign it to work better? What happens if you spread SunButter on the surface and sprinkle it with seeds? What other materials could you repurpose? Try a soda bottle, pine cone or a toilet tissue roll!



Materials

- Sturdy paper plate or yogurt lid
- Bird feed or an assortment of shelled seeds
- String or twine

Downloads

Data Collection Sheet



Adaptation

 Background

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 Questions

 Activities

1 Make a Bird Feeder

2 Try Out Bird Beaks

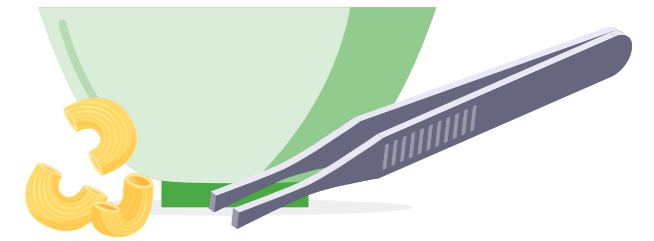
ACTIVITY 2

 HANDS-ON LEARNING

Try Out Bird Beaks

This activity has been adapted from our friends at [USGS](#).

- 1 Students will work in small groups of 2-4. Distribute one type of "beak" (utensil) to each student, instructing them to hold it in one hand and place the other hand behind their back.
- 2 Place a "stomach" (cup) in front of each student and place one type of food in each group's feeding area (plate). Then, instruct students that, at your signal, they must compete for as much of that food resource as they can gather with their "beaks." Remind them that their survival depends on their ability to gather food!
- 3 With a whistle or bell, signal each group 10-15 seconds to "feed." All food must go into their "stomach" (cups). After 15 seconds, give the signal to stop.
- 4 Repeat the procedure for each type of food available.
- 5 After the class rotates through all the types of food and beaks, ask them which "beaks" were best suited for which food. Have students share their responses with the class.



Materials

- Utensils (clothespin, toothpick, paper straw, spoon or tweezers/small scissors)
1 per group
- Plate for feeding area
1 per group
- Small cup for stomach
1 per student
- Whistle/bell
- Suggested food options:
Uncooked shell macaroni, Goldfish crackers, M&M® candies, gummy worms, chocolate sprinkles, sunflower seeds, raisins, mini-marshmallows, cereals

Downloads

Data Collection Sheet



Habitat Health & Challenges



Background



Vocabulary



Questions



Activity

Play Water Bingo 

Background

In the last few lessons, we've learned how extreme habitats like Great Salt Lake are home to unique creatures that have adapted to live in special conditions. But now, Great Salt Lake—and similar habitats—are in trouble. Over the past few years, the lake has shrunk by nearly half, making the water even saltier. This puts microbialites, brine shrimp, migratory birds and other animals at risk.

One cause is **climate change**. Our planet is surrounded by a blanket of heat-trapping gases that keep the **atmosphere** just the right temperature. However, human activities like driving, flying and running factories have thickened this blanket, trapping more heat. As the planet warms, it disrupts the water cycle and weather. In Utah, this has meant less snow in the mountains, which means less fresh water flowing into Great Salt Lake.

The bigger issue is that much of the snowmelt is being diverted before it reaches the lake. In Utah, fresh water is used for drinking, mining and **irrigating** crops. The more water used for these purposes, the less reaches the lake.

But we can help protect Great Salt Lake and other habitats. You and your family can reduce daily water use by taking shorter showers, collecting rainwater and turning off the faucet when brushing your teeth. Planting trees, vegetable gardens or **native plants** in your yard also helps by keeping water in the soil, benefiting your community, local lakes, birds and wildlife.

For a bigger impact, you can write to your local elected officials about your love for water and wildlife. They can help pass laws that protect nature in your area.

Habitat Health & Challenges

 Background

 Vocabulary

 Questions

 Activity

Play Water Bingo 

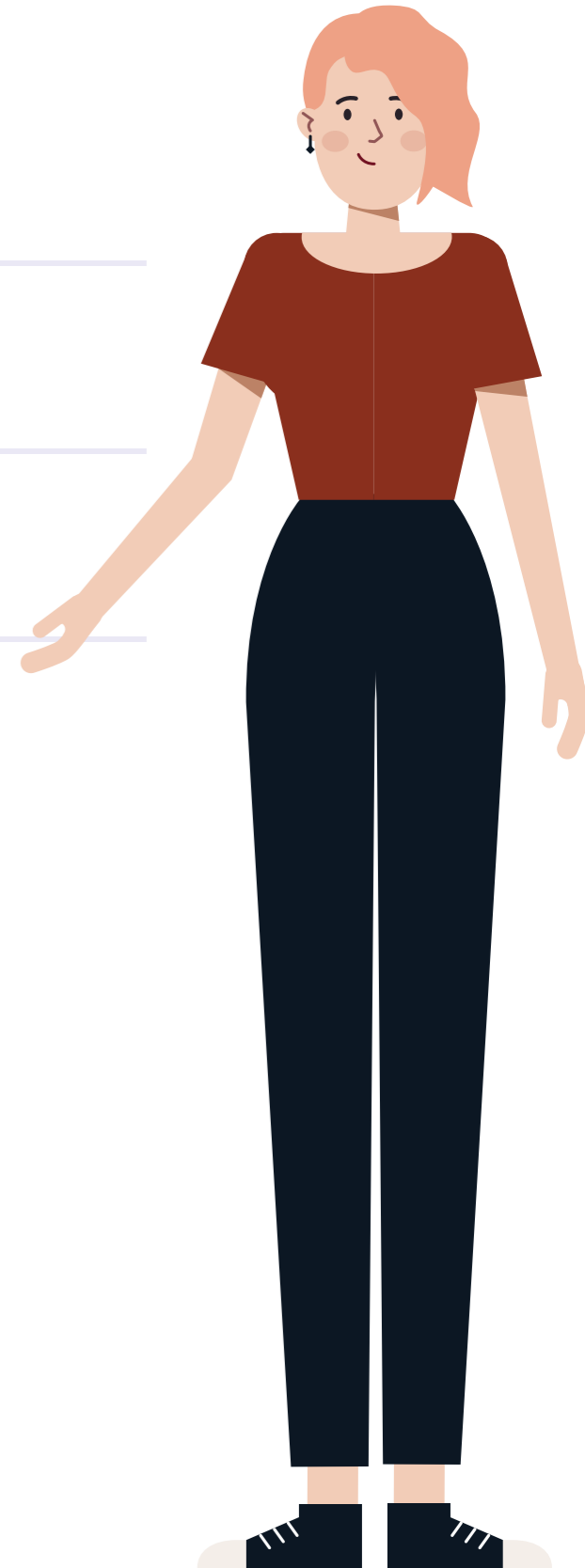
Vocabulary

Atmosphere A layer of gases that surrounds the Earth

Climate change Long-term shifts in temperatures and weather patterns that are resulting from human activity

Irrigation Supplying water to land or crops to ensure plants have enough to help them grow

Native plants The flowers, grasses and other plants that occur naturally in a specific place



Habitat Health & Challenges

 Background

 Vocabulary

 Questions

 Activity

Play Water Bingo 

Questions

1 What are the threats facing Great Salt Lake?

2 How do these threats impact nature where we live?

3 What changes do you notice in the natural world as a result of these threats?

4 What's one thing you can do to help protect nature?

Habitat Health & Challenges

 Background

 Vocabulary

 Questions

 Activity

Play Water Bingo 

ACTIVITY 1



HANDS-ON LEARNING

Play Water Bingo

Downloads

Water Bingo Card



- 1 Print a [Water Bingo sheet](#) for each student and distribute. Students will complete their sheet over the course of their day and bring it back the following day.
- 2 Facilitate a class discussion to talk about how each item represents water use. Want to know a secret? Everything on this bingo card uses water! For some activities, like teeth brushing, the way we use water is pretty obvious. Others, not so much. Here's a breakdown of how we use water in almost all of our daily activities:

Ride the bus: Water is used to drill and refine oil, which we need to run our cars, buses and other vehicles.

Eat fruit or veggies: Fruits and vegetables all need water to grow.

Have a packaged snack or candy: Processed foods—think candy, chips and ready-made meals—use more water than whole foods. That's because the process of preparing, packaging and shipping them is more involved, and uses water at different steps along the way.

Put on clean clothes: Water is used to make our clothes, from growing cotton or other raw materials, to bleaching and dying during the manufacturing process.

Read a book: Books start with trees, and like all plants, trees need water to drink. Trees are then turned into wood pulp (which becomes the pages of our favorite books) through a process that also requires a lot of water.

Turn on a light: Water helps produce the electricity we use every day. At some power plants, water is boiled to produce steam that generates electricity, while others draw water from lakes and rivers to use in their cooling systems.

Flush the toilet: You use more than a gallon of water every time you flush!

Brush your teeth: If you leave the water running while you brush your teeth, you could use up to four gallons!

Eat meat, cheese or eggs: Farm animals like cows need water to survive and also make milk, which eventually is turned into cheese.

Feed a pet: Water is needed to make food for our furry friends, too.

Wash your hands: Washing with soap and water removes dirt and germs.

Take a bath or shower: Taking a bath requires more water than taking a shower.

Water a plant: Like people and animals, plants need water to survive.

Plug in a device: As mentioned earlier, water is used to produce electricity.

Use a plastic fork or bottle: It takes 22 gallons of water to make one pound of plastic!

Throw away leftover food: About 21 percent of water used to grow food in the US is wasted when food is uneaten or discarded.

For more on hidden water use, visit watercalculator.org.



Nature Lab Sustainability Commitment

Each component of a Nature Lab collection is designed to embrace the concepts of recycling, upcycling and sustainability.

Additional Resources

[Visit nature.org/NatureLab](https://www.nature.org/NatureLab) for more educator resources.

[Sign up for our e-newsletters](#) to stay up-to-date on the latest teaching guides and videos.

[Follow @TNCNatureLab](#) on your favorite social channel to see how people and nature thrive together.



Virtual Field Trip: Great Salt Lake

Nature Lab virtual field trips transport young learners to different habitats, cityscapes and countrysides to learn about nature, the challenges it faces and how we can help protect it.



"Nature at Extremes" Kahoot!

In nature's most extreme places, wild and wonderful species thrive. This game-based play will help students discover how tiny creatures support larger animals within an ecosystem.



Backyard Birding

Meet 10 birds that are easy to spot from your window!

Data Collection

Name _____

 **QUESTION**

 **HYPOTHESIS**

 **OBSERVATIONS**

 **CONCLUSIONS**

Nature at Extremes

Great Salt Lake Food Web



For more educator resources, teaching guides and videos, [visit nature.org/NatureLab](https://www.nature.org/NatureLab).

The Nature
Conservancy 

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Nature at Extremes

How Do You Use Water?

Water shows up in our lives in some unexpected ways. Check off each activity you did today!



Ride on the bus



Eat fruits or veggies



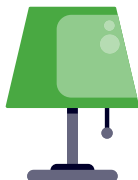
Have a packaged snack or candy



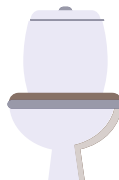
Put on clean clothes



Read a book



Turn on a light



Flush the toilet



Brush your teeth



Eat meat, cheese or eggs



Feed a pet



Wash your hands



Take a bath or shower



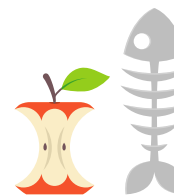
Water a plant



Plug in a device



Use a plastic fork or bottle

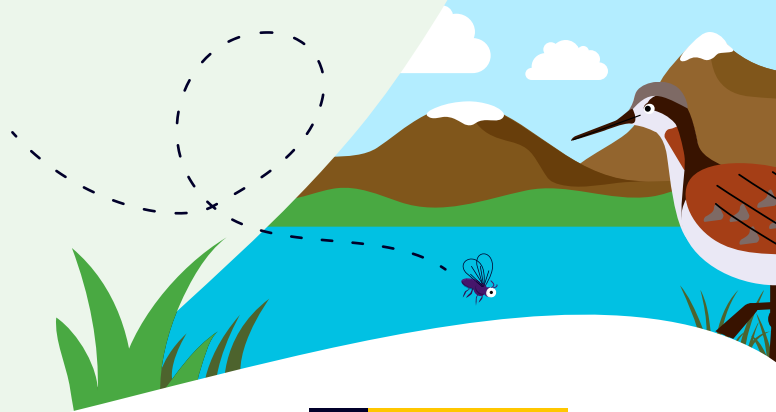


Throw away leftover food

Nature at Extremes

Great Salt Lake

Millions of birds depend on Great Salt Lake in Utah, which is the largest salt lake in the Western Hemisphere!



VOCABULARY

Terminal lake

n. lake with no outlet for water that enters

Microbialite

n. rock formation created by mud and sand hardening around mats of living bacteria and algae

Molting

v. annual shedding of old feathers or skin to make way for new growth

Wetlands

n. areas with water at or near the surface of the soil all or parts of the year

Why Does Courtney Float?

Imagine you have a bucket of tennis balls. Would you say that the bucket is full?

Yes, It's Full

No, It's Not Full

If you put a marble in the bucket, would it be more likely to stay on top or fall in between the tennis balls?

Stay On Top

Fall In Between

Now think: What would happen if you poured sand into the bucket with the tennis balls?

Would your marble be more or less likely to stay on top of the materials in the bucket?

More Likely

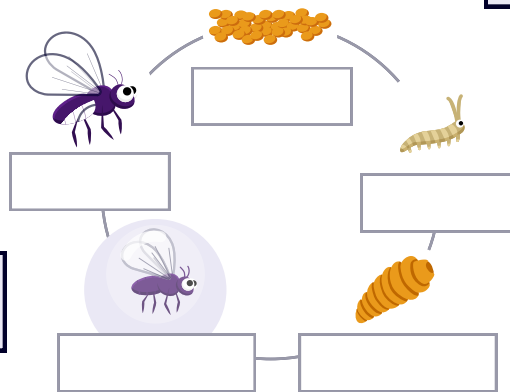
Less Likely

✔ That's why Courtney floats in Great Salt Lake! Salt fills in the spaces in water molecules, changing the density of the water. Density is the number of things—tennis balls, grains of sand, molecules of water or salt—contained in a certain area.

Brine Shrimp Life Cycle

The birds that live in and visit Great Salt Lake love to snack on brine shrimp! Can you put their life cycle in the correct order?

larva | fly inside air bubble | eggs | fly | pupal case



✔ Did you hear that? Brine shrimp are tough! Their eggs can survive almost anywhere—even in outer space!

What Can You Do to Help?

Draw a picture of one way you use water and write a sentence about how you can use less water.

