

Unit II Lesson 2 Chains of Diversity

OBJECTIVES

Students will...

1. Describe relationships between birds, their food and habitats in terms of diversity.
2. Demonstrate understanding about biodiversity, or biological diversity in terms of species diversity and habitat diversity.
3. Prepare for their Aviary field trip using their Avian Explorer Handbooks.

DURATION

45–60 minutes

MATERIALS

1. An Avian Explorer Handbook for each student
2. A pencil for each student
3. From the Appendix:
 - Great Salt Lake Eco-Web Instructions
 - Great Salt Lake Eco-Web Information Pages, one for each student pair
 - Great Salt Lake Eco-Web Cutout Page, one for each student
4. Wall display of completed Bird Species Cards & additional blank Bird Species Cards for additions (See Unit II Lesson 1 Appendix)
5. Dry erase board and markers

ADVANCE CLASSROOM PREPARATIONS

1. Bird Food Diversity
 - a. Create space on the board to create a Bird Food List.
2. Bird List Challenge Activity
 - b. Create space on the board to write the class list of bird species.
 - c. Prepare a place to post Bird Species Cards in the classroom after the lesson.

AVIAN EXPLORER HANDBOOK

PAGES TO BE USED IN THIS LESSON

1. Student Journal Pages
 - Page 3, Before Takeoff...
 - Page 4, The Daily Flyer
 - Pages 9–10, Great Salt Lake Eco-Web
2. Student Reference Guide Pages
 - Pages 7–8, Glossary

APPENDIX

Adult Supervision Guide & Request for Adult Chaperones Form
Great Salt Lake Eco-Web Instructions
Great Salt Lake Eco-Web Information Pages
Great Salt Lake Eco-Web Cutout Page
Great Salt Lake Ecology Web Answer Sheet

VOCABULARY

WORDS & PHRASES USED IN THIS LESSON

A glossary of vocabulary relevant to the entire AVES Project is included in the Student Reference Guide section of the Avian Explorer Handbook. The list below shows the words that appear in this lesson. Any words defined in this lesson are shown in **bold**, both below and in the lesson text.

GRADES 4 AND 5

adaptation
amphibian
aviary

biodiversity
bird
extinction

habitat
prey
species

survive

Instructional Sequence

ENGAGE CLASSROOM BIRD SPECIES LIST

1. Direct the students' attention to the classroom display of Bird Species Cards, which they created during Lesson 1 of Unit II. Remind the students that this display helps to illustrate the variety and abundance of birds all around us.
2. Invite the students to suggest additions to this display during the following weeks as they learn about new bird species.
3. Distribute Avian Explorer Handbooks, one to each student.

REVIEW GETTING SPECIFIC

1. To establish a context for this lesson, ask the students to recall some of their learning highlights from Lesson 1.
2. Remind the students that each of the birds named on their classroom display is a different species. Ask one or more students to help define "species."
3. Direct the students to the species definition provided in the Glossary of the Student Reference Guide of the Avian Explorer Handbook on pages 7–8. Ask a student to read the definition.
4. Next, ask others to help identify the most important elements within that definition:
 - a. It is a group of living things;
 - b. These living things look and act the same as one another;
 - c. They are able to become parents by producing young of their own kind.
 - d. **Species** is a word that always has an "s" at the end. It can refer to one group (singular) or more than one group (plural). For example, the American robin is one species; American robin, moose, cutthroat trout and human are four species. It is estimated that there up to 30 million or more unique species on Earth today, from the tiniest bacterium to the colossal blue whale.

EXPLORE WHAT'S ON THE MENU?

1. Remind the students that in Lesson 1 they discovered that there have been 443 species of birds identified as residents or regular visitors to Utah, and scientists have identified approximately 10,000 bird species worldwide.
2. Review some vocabulary from Lesson 1 in this unit.
 - a. Ask the students to recall the word that describes there being different kinds or types of something.

The word is *diversity*.
 - b. Ask the students to recall the two-word phrase that describes the number and variety of plants and animals that are found in an ecosystem.

This phrase is *biological diversity*. Biological diversity can be shortened into one word, "**biodiversity**."

3. Remind the students that one major reason there can be a large diversity of birds is that there is also great diversity of things for birds to *eat*.

Challenge the students to each name a different kind of bird food, and construct a Bird Food List on the board.

4. To help build this list, encourage the students to recall *specific* birds and the things they eat. It might be helpful to have them refer to their Bird Species Cards display for ideas.

EXPLAIN BIRD FOOD DIVERSITY

1. Review and revise the students' Bird Food List as appropriate. Here are some examples:

Algae	Insects
Birds (of other species)	Leaves
Brine shrimp	Lichen
Buds and bark from trees & shrubs	Lizards
Caterpillars & other larvae	Moss
Chili peppers	Nectar from flowers
Clams and mussels	Nuts
Dead animals	Sap
Eggs of reptiles and other birds	Small rodents
Fish	Spiders
Flower seeds	Ticks
Fruits	Turtles
Frogs & other amphibians	Worms

2. Emphasize that nearly every item on the list itself represents many hundreds or even thousands of species of plants, fish, reptiles, amphibians or other living things.

EXPLORE WHY SO MANY DIFFERENT BIRD FOODS?

1. Ask the students to suggest why this list can be so big—why do different birds eat so many different things? Why don't all birds just eat the same thing? What would happen if all the different species of birds had only a few kinds of food to eat?
 - Different birds eat different things because they are adapted to eat those different foods. This is made possible because each bird species has its own set of adaptations, as learned in Unit I, that helps it survive in its particular habitat.
 - If all species were limited to eating just one or even a few of the same foods, those particular food items would probably run out. That would result in far fewer birds as well as fewer bird species.
2. Now we know why it is necessary for birds to have plenty of different things to eat. However, there still remains one unanswered question:

Why are there so many of these different things for birds to eat? How can there be such a great diversity of fish, insects, reptiles, plants and other living things?

EXPLAIN THE IMPORTANCE OF BIODIVERSITY

1. Explain that the answer to the question of why there are so many kinds of living things for birds to eat is actually the same as the answer to the question about why there are so many birds themselves.
 2. Why are there so many birds? Four things are mainly responsible for our planet having such a rich variety of birds. List these factors on the board:
 - a. Many different places for birds to live (habitats)
 - b. Many different places for birds to find shelter (roost, rest, nest, escape danger, stay cool or stay warm)
 - c. Many different things for birds to eat
 - d. Many ways birds look and act (their adaptations)
 3. Why are there so many things for birds to eat? Point out how for each of the four listed factors above, the word “birds” can be substituted with any other group of living things. Demonstrate this with some examples from the Bird Food List.
 4. To put it another way, we have high biological diversity, or biodiversity—of birds, as well as plants, mammals, fish, reptiles, amphibians and insects—because of the diversity of food, shelter and space that is available. Fewer foods or fewer places to live = lower biodiversity.
 5. Finally, point out that biodiversity prevents any one species from relying too much on any other species. If a great horned owl, for example, only had a single species of rodent to eat, fewer numbers of that rodent would survive, thus resulting in fewer great horned owls. However, great horned owls eat over a dozen species of mice, voles, shrews, rabbits, weasels, gopher and other small mammals. This is to ensure that neither the owl nor any of its prey species will be pushed toward **extinction**, the act or process of coming to an end or dying out.
- Similar examples of diversity exist for nearly every species of animal or plant we can name.
6. To bring this point home, ask the students to consider what would happen if there was only one type of food that they ate, everyone in their neighborhood ate or everyone in the entire state of Utah ever ate.

The food would become very scarce, expensive, and probably wouldn't last long.

ELABORATE AVIAN EXPLORER HANDBOOK PAGES

1. Turn the students' attention back to their Avian Explorer Handbooks. Remind the students of the many ways they all helped demonstrate how different plants and animals were connected in the forest and desert webs that they created in Lesson 1.
2. Now to help them appreciate biodiversity even more, direct the students to complete Great Salt Lake Eco-Web on pages 9–10 in the Student Journal Section of their Avian Explorer Handbooks. (See Appendix for Instructions, Information Pages, Cutout Page and Answer Sheet.)

**TOUR
PREPARATIONS**

3. Direct the students to complete page 4 in the Student Journal section of their Avian Explorer Handbooks, titled The Daily Flyer. This is an assessment page reviewing vocabulary and relationships pertaining to biodiversity, why it is important and what factors may help or hurt biodiversity. Have students recall the Biodiversity Impacts Activity they completed in Lesson 1.

THE UPCOMING VISIT TO TRACY AVIARY

[This section could be completed before or after the Elaborate section, above, depending on scheduling preferences.]

1. If necessary, distribute Avian Explorer Handbooks to the students.
2. Direct student attention to page 3 of the Student Journal section of the Avian Explorer Handbook, titled Before Takeoff...
 - a. Discuss what each student will need to bring with them for their Aviary field trip.
 - b. Review the directions and then provide time for the students to complete the checklist on the top half of the page.


Remind everyone that by checking off the items on the list, each student is agreeing to be responsible for bringing those items.

(An exception might be the Avian Explorer Handbook itself, since it is a good idea to bring all of the handbooks for redistribution at the Aviary on the day of the tour.)
 - c. Introduce the second section on the page, Birder’s Code of Conduct, by reminding them that each student plays a role in making the tour successful and fun.
 - d. Direct the students to check off each item on the “Egg”cellent Behavior and “Bad Egg” Behavior lists as you discuss them. As before, remind everyone that by checking off the items on the list, each student is agreeing to honor this code of conduct.

EXTENSIONS FOREST AND DESERT ECOLOGY EXTENSIONS

1. To help students solidify the connections in the desert and forest habitats, have the class as a group or as individuals label the web connections on their Desert and Forest Web Activity Sheets (See Lesson 1 Appendix). Invite students to write on the lines between the boxes of their web *how* those elements are connected. Refer to the visual example of Great Salt Lake Eco-Web on pages 9–10 of the Student Journal Section of the Avian Explorer Handbook.

For example, on the Forest Web Activity Sheet, students may write the word “eats” on the line between ruffed grouse and sweetroot and “lives in” on the line between flying squirrel and aspen.
2. To expand students’ knowledge of plants, animals and elements, invite students to research one Desert or Forest Web Card species (See Lesson 1 Appendix). Students can then present their research as a written report or as a presentation to the class.

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3. Invite students to practice their classification, graphing and language arts skills by reading the Desert and Forest Web Cards and creating graphs that show how many animals in each habitat are herbivorous, carnivorous or omnivorous. How many other ways could students group and graph the parts of each habitat?

When this lesson has been completed, please go to the AVES link on the Tracy Aviary website (www.tracyaviary.org) to complete the appropriate teacher feedback report from Unit II.

Appendix

Adult Supervision Guide & Request for Adult Chaperones Form

Great Salt Lake Eco-Web Instructions

Great Salt Lake Eco-Web Information Pages

Great Salt Lake Eco-Web Cutout Page

Great Salt Lake Eco-Web Answer Sheet



Tracy Aviary Field Trip Adult Supervision Guide

Why am I being asked to participate?

Past experience has repeatedly shown that the more teachers and adults participate in field trip activities—modeling interest, enthusiasm and listening skills—the more attentive students remain and the more successful our efforts are likely to be. To ensure that our students receive a safe, positive and meaningful experience from the upcoming field trip, you are being asked to serve three important roles: 1) Participant, 2) Supervisor and 3) Co-facilitator.

What am I expected to do?

1. **BE A THOUGHTFUL PARTICIPANT.** We think that you, too, will find our activities stimulating and informative. As an adult participant, we ask that you become personally involved in all field trip activities, both for your own enjoyment as well as to help retain student interest and motivation. You need to be cautious, however, not to reveal answers or take over tasks intended for the young people. Our activities have been designed for student discovery to do much of the teaching. The best contribution you can make here is curiosity and appreciation, *not* teaching.
2. **BE AN ATTENTIVE SUPERVISOR.** It is the duty of the school to provide primary leadership and teaching during the field trip. However, the unfamiliar outdoor setting, with its wide open space and all its distractions, creates a greater challenge to student focus and concentration. This is where you come in. We ask that you assist in *full-group gatherings* by placing yourself among the students, remaining fully attentive to the discussion or activity taking place and monitoring the behavior of students near you. An effective yet silent technique for “reeling in” temporarily distracted students is to simply step behind them for a moment, place your hand on a shoulder and point to the proper focus of attention.

For *small-group activities*, you may be assigned to a student group. Be sure that the group has the materials they need and understands their task. Remind them that all members of the team are to take part and share in the investigation. Field trip activities such as these require the development and use of cooperative skills, sometimes more than in the classroom. Students unable to remain on-task should be reported to their classroom teacher for possible discipline or reassignment.

3. **BE A CO-FACILITATOR.** With large field trip groups, it becomes challenging for students to receive the attention they need and deserve without your thoughtful assistance. During each tour stop, keep an eye out for students who might benefit from your guidance. Help students remain focused on the task at hand, and guide them in participation without actually taking over the process or revealing answers that they are meant to discover on their own.

How do I prepare for this?

You should dress so that you may be able to join the students in all of their activities. This will likely include being in the sun and shade. Bring a lunch, a liquid refreshment (water is best in the heat), protection from the sun, and a healthy enthusiasm... and you're ready!



Tracy Aviary Field Trip Request for Adult Chaperones

Dear Parent or Guardian,

This season our class will have the opportunity to visit the Tracy Aviary bird sanctuary. It will be fun, exciting and very educational. We are looking for two parents to accompany our class. If you are available we would appreciate it if you would join us.

Our class will be visiting the Tracy Aviary on the following day: _____

Thank you for your support.

_____ Yes, I am willing to be considered as one of two adults to accompany my child's class on the field trip.

Child's name

Parent/Guardian Name

Phone Number

Students participating in the Tracy Aviary AVES Project are eligible to receive **Free Admission** during the coming year for two adults and three children, including themselves.

----- ✂ Cut and Save this Valuable Coupon! -----

Tracy Aviary Family Guest Pass

Student's Name _____ Teacher _____

AVES Students: Now that you are expert ornithologists, use your knowledge to lead your family on a tour of the Tracy Aviary. We hope to see you soon.

This pass allows up to two adults and three children **free admission** to Tracy Aviary.
Expires Dec. 31, 2010. Not valid for Special Events.

GREAT SALT LAKE ECO-WEB INSTRUCTIONS

Purpose

To introduce or reinforce student understanding of the lives and interrelationships of Great Salt Lake ecosystem using an activity that combines reading, collaboration and cutout materials.

Summary

Student pairs create a Great Salt Lake Eco-Web by reading information about different life forms, agreeing on the appropriate relationships between them, and then gluing cutouts of the different organisms onto their Great Salt Lake Eco-Web in their Avian Explorer Handbooks.

Procedure

1. Organize students in working pairs. Provide each pair with scissors and glue.
2. Have the students open their Avian Explorer Handbooks pages 9–10 in the Student Journal section of their Avian Explorer Handbooks.
3. Explain the procedure:
 - a. Each pair is to work together to determine the correct way to complete the Eco-Web, as suggested by the labeled arrows on the worksheet.
 - b. To help complete the activity, students should read the Information Pages. These describe the organisms and their relationships at Great Salt Lake.
 - c. After reading the Information Pages, the students each cut out their own sets of Great Salt Lake life forms from the Cutout Page.
 - d. Students should work together to lay the cutouts on their Eco-Web pages of their handbook first without glue.
 - e. Once they agree on the appropriate sequence, the pair may glue the cutouts into The Great Salt Lake Eco-Web.
4. When the students are finished, review the activity by building a classroom version of the Eco-Web on an overhead transparency or as a bulletin board display. Ask for different volunteers to suggest the correct organism for each step, beginning with the box directly beneath the sun in the Eco-Web.

Review

1. Ask a student to clarify the purpose of the sun in the Eco-Web.
2. Briefly discuss each of the life forms in the web, beginning with algae. Ask students to suggest some information they recall about each organism.

Follow-up

Provide students with a blank sheet of paper and have them tape it along the bottom of the Great Salt Lake Eco-Web in their handbooks, which will later fold over onto their Eco-Web. On this sheet they should list their three favorite pieces of information about each of the pictured life forms.

Green Groceries

A single alga is usually too tiny to see with the naked eye, but we can often see green colonies of them floating in Great Salt Lake. **Algae** are not plants and they're not animals, but almost everything alive in Great Salt Lake depends on them. Of the thousands of different species of algae on Earth, only a few can live in the saltier parts of our lake. Like plants, algae change energy from the sun into food. Both brine shrimp and brine flies depend on green algae for their survival.



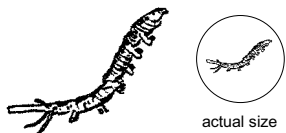
Flying Food

Some people make the mistake of thinking all insects are either boring or annoying. That's silly, because without **Brine Flies**, the millions of birds that make Great Salt Lake famous would not be here. Brine flies are perfectly adapted to living where other flies could not survive. When it's time to go underwater to lay eggs or feed on algae, the flies go "scuba diving" with a thin layer of air held by tiny hairs around their bodies. Although an adult brine fly only lives three or four days, there are up to 5,000,000,000 (that's five trillion!) of them at the lake each summer. Good thing, too, because, most birds prefer dining on flies.



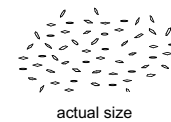
Swimming Caterpillars

Just like butterflies, brine flies hatch from eggs to go through three life stages: larva, pupa and adult. But for the flies, those first two stages take place entirely underwater. The **Fly Larvae** feed on the lake's algae for a few weeks. Then they clamp onto an underwater rock or plant and begin their pupa stage. Their skin slowly hardens into a brown pupal case, like a cocoon. Soon the adult fly crawls out, floats to the surface and flies away. Many birds feed on fly larvae. And because both the larvae and adult flies eat so much algae and other materials, they have become the lake's "cleanup crew." Without them, our Great Salt Lake would not survive.



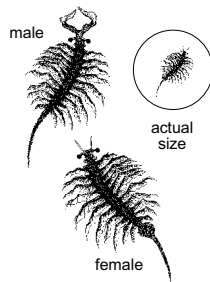
A Lake for a Nest

Most adult brine flies die during winter, but many larvae survive underwater, waiting for spring. Then, when the water in Great Salt Lake warms up, the larvae go into a metamorphosis to change into adult flies. In late spring and summer, the females crawl underwater inside of a small air bubble to lay close to 100 **Brine Fly Eggs** in the algae or along cracks in rocks. Like a scuba tank, the bubble allows them to stay underwater for up to fifteen minutes. It forms because their bodies have many tiny hairs and a waxy coating that keeps water from touching their bodies. Brine fly eggs are very small, shown actual size, above. But the larvae and adult flies that those eggs become are what help make Salt Lake so Great!



Tiny Wonders

They may be spineless, but these animals are the “backbone” of Great Salt Lake. **Brine Shrimp** hatch from tiny eggs in early spring, growing to an adult size of about 1/4 inch in two or three weeks. During the summer, females give birth to live young. But by fall, most of the algae the shrimp eat are gone, so the females begin laying eggs. By winter, most brine shrimp have died, leaving only eggs floating on the water until spring, when the cycle begins all over again. Millions of birds depend on brine shrimp for food. Each year, about 300,000,000,000,000 shrimp are born in Great Salt Lake, helping to build a food web of worldwide importance.



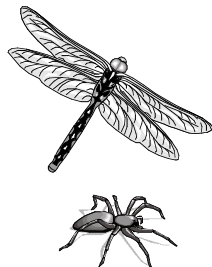
Bank Deposits

Before they all die in the fall, brine shrimp lay thousands of billions of tiny brown **Brine Shrimp Eggs**. These eggs float on the lake until spring, when the shrimp life cycle begins again. Some eggs are washed up on shore. Their special unbreakable shell allows them to dry out for twenty years or more, then still hatch into brine shrimp when they are washed back into the lake! This also means the eggs can be dried and sold in cans, which is exactly what some businesses do. All over the world, the larger kind of shrimp that people eat are fed brine shrimp hatched from eggs taken from Great Salt Lake. So, like a savings account, these eggs help in the future survival of brine shrimp, hungry birds and businesses.



Shoreline Shoppers

The food web that begins within the waters of Great Salt Lake reaches out onto the surrounding land. **Dragonflies** and **Spiders** are just two of the hundreds of animals that feed on brine flies. Other brine fly feeders include snakes, lizards, salamanders, turtles, ants, bees, wasps, birds and fish. Some of these predators then become food to even more hungry animals. The next time you have the urge to swat a bothersome bug, you better check first to be sure it's not a brine fly. They won't bite you, but there sure are a lot of critters out there that would like a bite of them!



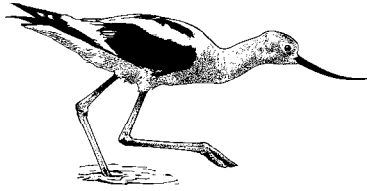
An Unusual Predator

Long legs that resemble oars on a boat are what give this swimming insect the name, **Water Boatman**. Their long hind legs and scoop-shaped front legs allow them to dart quickly through the water at Great Salt Lake, looking for brine fly larvae and brine shrimp to eat. They have to surface for air once in a while, but they also have a special gill that helps them breath underwater, almost like a fish. One thing about the lake that limits where these animals can hunt is water salinity. Parts of the lake where the salinity reaches 10% or more are just fine for brine flies and shrimp, but a bit too salty for the water boatman.



Fancy Dancer

This
orange,
black and
white bird



is the **American Avocet**. 250,000 migrate back to Great Salt Lake each year. You can watch them sweep their long curved bills from side to side, actually feeling through the water and mud for brine shrimp or brine fly larvae. They are so skillful with their bills that they can even snatch brine flies from the air. During their mating season, avocets put on a lively display, lowering their heads and bills just above the water, or stretching their necks to point straight up to the sky, then marching together across the shoreline with bills crossed.

Feathered Shark

Here is a bird
so specialized
for swimming
and diving that



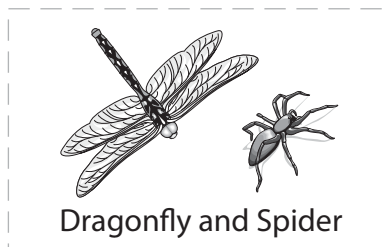
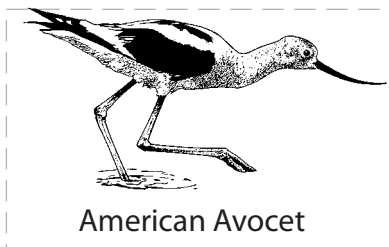
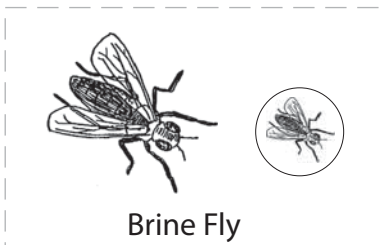
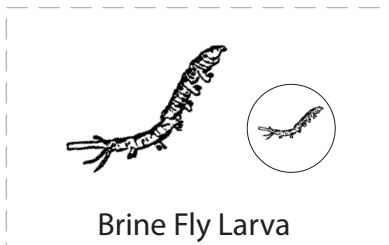
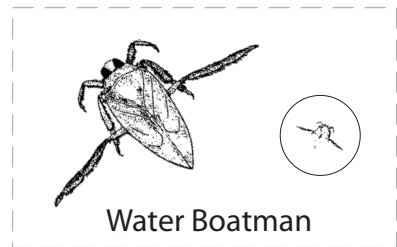
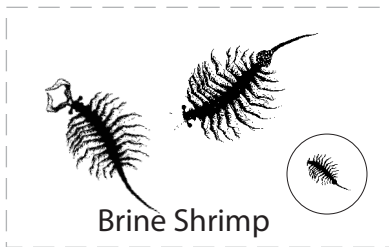
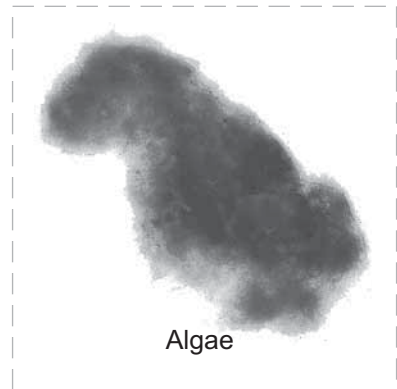
it almost never walks on land! They even build floating nests and lay eggs in shallow water for safety from predators. These **Eared Grebes** have a bright gold “hairdo” of feathers, and red eyes to help see underwater. They dive for brine shrimp or fly larvae, snatching the prey with their bills, then rising to the surface to squeeze the salt water out with their tongues before swallowing. In just one day, grebes can eat a total of 100 tons of brine shrimp; a single grebe can eat over 15,000 shrimp! Over one million grebes can be found at Great Salt Lake.

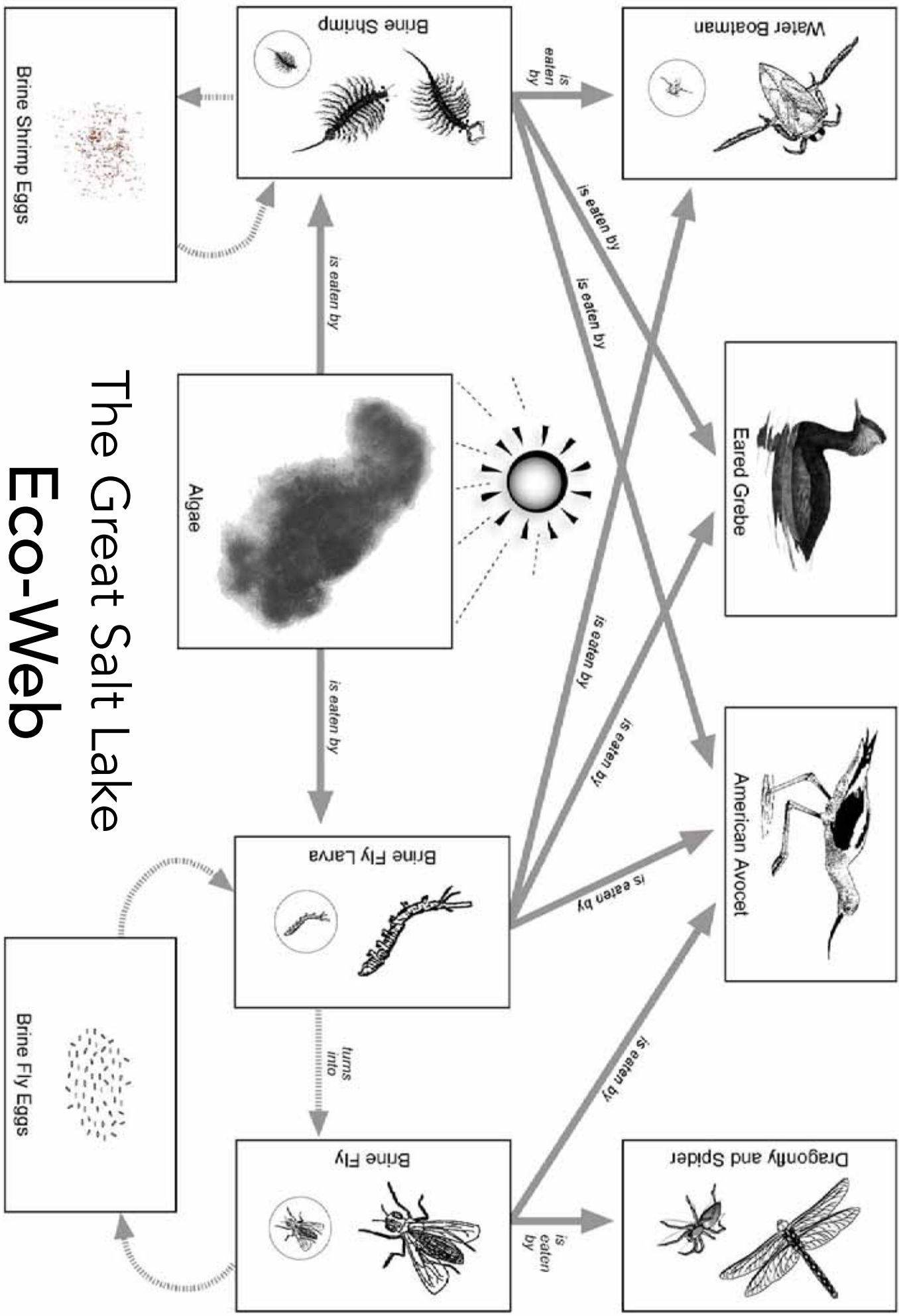
Cutout Page

for the Great Salt Lake Ecology Web Worksheet

DIRECTIONS: Each of the living things on this page helps tell the story of life at Great Salt Lake. You are to cut out each of the pictures on this page and attach them to the *Great Salt Lake Ecology Web Worksheet*. But there is only one correct way to tell this important story. To be sure of the correct place to put each picture on the worksheet, you will need to use the *Great Salt Lake Ecology Web Information Pages*.

Cut carefully only along the light gray dashed lines shown around each picture. (The circles show the animals in actual size.)





The Great Salt Lake Eco-Web