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How the Great Salt Lake Relates to Us: Introductory Lesson

Abstract: The resources that are harvested from the Great Salt Lake are used for a wide array of products and are marketed around the globe.

Grade Level: 3

Utah Elementary Core Curriculum Standards:

Standard: 3030-0101- Students compare and contrast similarities of various habitats.

- Observe and describe a variety of habitats.

In Class Instruction Time: 30 min

Background for Teacher Use: This lesson is considered an introductory lesson on the Great Salt Lake. Designed for the third grade classroom, the lesson allows students to become familiar with the resources the lake is made up of. In addition, students learn about products that come from Lake Resources and regions all over the world where Great Salt Lake products are marketed. The "Lake" is located in Salt Lake City Utah, and is one of the most unique lakes in the world. The uniqueness is mostly related to the high salinity of the lake, the ecosystem living in and around the lake, and the many markets the lake provides resources for; along with many alluring characteristics of the Lake itself. The principal resources from the Great Salt Lake are listed below, in the terminology section. An explanation of what they are, their common uses, and major markets will be disclosed in the procedures section of the lesson.

Advance Preparation: In this lesson there is an activity that will need to be prepared for in advance to teaching the lesson. Prepare index cards by printing the name of the resource on one side of the card. On the other side of the card, list either a product that is made from the resource, or a place that it is sold. For example: On one side you might write, SODIUM CHLORIDE (NaCl), and on the other side you would write, is used to melt ice on roads. Write each resource name in a different color. Make sure that the colors you use for the information cards match the colored pencils or crayons that the students have, and also the makers you use for the overhead to write out the terminology. (For example, sodium chloride will be marked in yellow, magnesium metal in purple, etc.) Here is a list of possible examples to use on your index cards for the activity:

Sodium chloride- is used to melt ice on roads.

Sodium chloride- is used for cattle, sheep, and rabbit licks.

Sodium chloride-is used in canning and making pickles.

Sodium chloride-from the Great Salt Lake is sold as far away as Michigan.

Potassium sulfate-is used to make fertilizer.

Potassium sulfate-is used on crops such as oranges and grapefruit.
Potassium sulfate- is used on golf courses and commercial lawns.
Potassium sulfate-from the Great Salt Lake is sold to China and Japan for growing tobacco.
Potassium sulfate-from the Great Salt Lake is used on potato fields in Idaho.
Sodium sulfate- is used as filler in detergent.
Magnesium metal-is used in aluminum beverage cans.
Magnesium metal- is used to give lightweight strength to cars and airplanes.
Magnesium metal-from the Great Salt Lake is used in the automotive industry in Detroit, Michigan.
Magnesium metal-from the Great Salt Lake is used to make Volkswagens in Brazil.
Magnesium chloride-is used in sugar refining.
Magnesium chloride-is used to extract gold from the mines in Nevada.
Chloride-is used to purify drinking water.
Brine shrimp-are used to feed tropical fish in aquariums.
Brine shrimp-are fed to prawns and lobsters, which are raised for humans to eat.
Brine shrimp-from the Great Salt Lake are sold to prawn farms in Asia (China, Japan, Thailand).

Terminology:

- Sodium chloride (NaCl), or common salt
- Potassium sulfate (K_2SO_4), also called sulfate of potash
- Sodium sulfate (Na_2SO_4), known as salt cake.
- Magnesium metal (Mg)
- Magnesium chloride ($MgCl_2$)
- Chloride (Cl)
- Brine shrimp eggs

Intended learning Outcomes:

- Students will name at least three resources that come for the Great Salt Lake.
- Students will describe at least one product that is made from each resource.
- Students will name and locate on a map at least five different geographic regions where Great Salt Lake products are marketed.

Materials:

- **Large world map (laminated)**
- **Small world maps (1 per student)**
- **Colored pencils or crayons (1 set per student)**
- **Colored sticky dots**
- **Clear tape**
- **Pictures of: icy road, cattle, jar of pickles, bag of fertilizer, orange grove, golf course, box of laundry detergent, aluminum beverage can, automobile, gold jewelry, bag of sugar, drinking fountain or water tap, aquarium or tropical fish, frozen prawns.**
- **Index card with name of resource and use**
- **Overhead projector with at least two blank transparencies.**

Prior Knowledge Assessment:

Open the lesson with a freethinking exercise. Place a clear transparency on the overhead projector and write Great Salt Lake in the center of the transparency, then put a circle around the words. Ask your students to tell you any words, ideas or facts that they know about the Great Salt Lake. You will receive a variety of comments; write them all/most in a web style connected to the phrase "Great Salt Lake." Students may know quite a bit about the lake. Students from outside the state of Utah may only be able to state the lake's location in a general fashion, and that's a fine starting point. Teacher's may want to bring in books about the Great Salt Lake's well know attributes. Discuss the lakes famous man made art formation, The Spiral Getty, an (Earth Work), by artist Robert Smithson, completed in 1970. Finding information on the "Getty" should be available in art history books, and perhaps over the Internet. A picture of the Spiral Getty and a small portion of information on Earth Works, can be found on the following web site:

<http://trumpet.sdsu.edu/x157/line/line.html>

(This activity allows you to assess what your students might already know, and gives you the opportunity to tie in other curriculum to all of the lessons on the Great Salt Lake throughout this unit).

Procedures:

To start focusing your students on the key aspects of the lesson inquire about what resources they think come from the Great Salt Lake. Add correct resources to the mind web or map. Explain to students that many resources come from the Great Salt Lake. Tell your students that we have come to depend on them as sources of income, and for products we use in our everyday lives. Discuss what some of those products might be with your students, while adding the appropriate/relevant ones to the mind map. Following a brief discussion, ask students where some of the resources from the Great Salt Lake are marketed/sold throughout the world, (listen to ideas, adding the appropriate ones to the mind map). Tell your students that resources from the Great Salt Lake are sold all around the world.

Pass out to the students their individual world maps and colored pencils (there must be at least 7 different colors per package for each student). Then post your class size world map at the front of the classroom with the taped pictures around the outside of the map, or on a bulletin board. Place tape and sticky dots below it for the students to use for the activity.

Using an overhead projector and transparency write down what the major resources from the Great Salt Lake are, their common uses, and the major markets or countries they are sold to, and discuss them with your students. (To save time you may want to have all of the resources and their definitions/explanations already written and color-coded on a transparency, so you can just go down a list). Have the class write down the name of the resource, not the definition etc, due to the lengthy explanation behind each resource. Remind students to color-code each resource name exactly as you have so the activity they later participate in is effective. The students can write the resources on the back of their world maps.

***Refer to the principal resources section, for teaching this section of the lesson.** Discuss these after or during your teaching, to check for understanding and to assess their learning. You might ask students, which if the products made with Great Salt Lake resources do you use at home? At school?

Where do the products for the Great Salt Lake go? Are they supplying demands only locally or are they marketed more widely?

Why is the Great Salt Lake an important economic resource for the state of Utah? (Many different products, worldwide markets)

What environmental concerns might arise from marketing these products worldwide? (Energy concerns from transportation)

After completing section A, pass out an index card with product information to each student, or group of students (how and what to do for these is in the advanced prep section of the lesson). Explain to the students that if their index card describes a product, he/she should find the appropriate picture and then tape the information card next to it. If the student's card lists a place that the product is sold, the students should locate the place on the world map and mark it with a sticky dot. Have the students take turns reading the information on their cards. As each one reads the card, he or she should come up to the map and pictures at the front of the classroom, and find either the product or the place that is described on the card. (Some cards may have both a product and a place.)

During this activity, have all students follow along with their small world maps. Each time a location is given, they should use the appropriate colored pencil or crayon to draw a line from the Great Salt Lake to the location. Each time a product is named, they should list it on their papers (backside of world map) next to the name of the resource.

Closure: When all students have read their cards, and marked their maps, discuss the results. Refer back to the mind map used at the beginning and add new learned information about the Great Salt Lake.

***Principal resource section:** The principal resources from the Great Salt Lake, their common uses, and major markets are:

- **Sodium chloride (NaCl), or common salt**, from the lake is used mostly as road salt, in water softeners, in brines for canning, and for livestock. Much of it is used in the Intermountain West including Nevada, but some goes as far east as Michigan.
- **Potassium sulfate (K₂SO₄), also called sulfate of potash**, is used in fertilizers. Because it is virtually chloride free, as opposed to potassium chloride (KCl), it is used on crops that are sensitive to chlorides, such as citrus fruits (southeastern U.S. and California), potatoes (Pacific northwest), and tobacco (China and Japan). More than half of the potassium sulfate produced from the Great Salt Lake goes to Asia. Turf growing for commercial lawns and golf courses is an increasing domestic market. Potassium sulfate from the lake is also used in the manufacture of dry wall, where it helps speed up the drying process.
- **Sodium sulfate (Na₂SO₄), known as salt cake**, is used as detergent filler, and in the production of paper and ceramics.
- **Magnesium metal (Mg)**, is used in alloying metals, especially aluminum. Over half of the magnesium produced from the Great Salt Lake goes to the aluminum companies, much of it to produce beverage cans (Pacific northwest, among other places). A lot of it goes to the Detroit; Michigan area for use in the automotive

industry, and about 10% goes out of the country, to places such as Brazil, where Volkswagen uses it. It is also used for marketing flares, and because of its high purity, there is a small pharmaceutical market (production of chemotherapy drugs, etc.).

- **Magnesium chloride (MgCl₂)** from the lake is used in the gold fields of Nevada to help extract the gold from the rock. It is also used in the early refining stages of sugar making, where it is mixed with the brine to aid in the crystallization of the sugar. In the drilling of oil wells, magnesium chloride brine is used to make a heavy drilling mud and to help increase oil recovery. The brine is also used as a dust suppressor on dirt roads.
- **Chloride (Cl)** is a byproduct in the production of magnesium metal. It is used principally for water purification, and in the production of plastics (PVC's) and certain chemicals.
- **Brine shrimp eggs** are another important resource of the lake. Most of the eggs are shipped to Asia, where they are hatched and fed to prawns and lobsters, which are later reimported to the United States and sold to supermarkets and restaurants. The brine shrimp sold in the United States are used mostly as aquarium fish food.
- **Assessment:** Have students turn in their individual world map work. Assessment opportunities should be happening during discussion throughout the lesson, as you check for students understanding of the concepts. Additional assessment might include, passing out a questioner with questions pertaining to the lesson; or returning to the original mind map to ask students the following questions, to check for understanding, in a group discussion:
 - Have students name at least three resources that come from the Great Salt Lake.
 - Have students describe at least one product that is made from each resource.
 - Have students name at least five different geographic regions where Great Salt Lake products are marketed.

References: This lesson is adapted from a lesson called "*To Market, To Market,*" (pg. 181-184), from **THE GREAT SALT LAKE STORY**, curriculum writing team: Patricia Anderson, Tamera Bell, Nancy Peterson, Elaine Barton, Jerry DeMond, Bonita Thacker, and Sandra Zicus. Revised edition (1997).

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Lesson II
Effect of Salt on Great Salt Lake Ecosystem:
The Lake Effect

Abstract: Students explain how rain is formed and name ways in which the Great Salt Lake affects precipitation in the Salt Lake Valley.

Grade level: 3rd

Utah Elementary Core Curriculum Standards:

Standard: 3030-0101

- Compare and contrast similarities and differences of various habitats.

In-class instructional time: 1 hour

Terminology:

Condensation: The process by which a gas or vapor changes to a liquid.

Precipitation: Any form of water, such as rain, snow, sleet, or hail that falls to the earth's surface.

Intended Learning Outcomes: Students participate in a class discussion of the weather and rain. In groups they create concept maps of rain and share with the class. Students experiment to see how rain forms and predict if the presence of a lake affects the formation of rain. They record in lab notebooks what they learned, what they want to learn, and what they still wonder as well as recording their experiment.

Background information:

Rain is not only vital for our survival, but it is also very interesting. Especially when you realize that rain is impacted by what lies beneath, like lakes. In the fall and spring there are major changes in the weather. The temperature in the air can change from really warm to really cold. The temperature of the water in the Great Salt Lake doesn't change the same way as the air above the lake. This makes big differences between the two temperatures. This difference in the air and lake temperatures causes instability, and often leads to a lot of rain. This extra rain, or *precipitation*, is called the "lake effect."

There are three main reasons why this "lake effect" happens. Besides the temperature contrasts, which are the most important reason, there is a great deal of extra moisture in the air from evaporation off the lake. Also, the wind that come with the

storms picks up salt crystals from the nearby salt flats, which are flat areas where the lake used to be, as well as from the tips of waves, known as whitecaps, in the lake itself. These airborne salt crystals absorb moisture from the air and form especially large raindrops. That is why the snow at nearby ski areas in the canyons has more salt than in most snow. Maybe this is why people say Utah has the best snow on Earth.

Materials: 3 clear shallow containers, 3 clear plates (to cover containers), soil, warm water, cold water, ice cubes, a measuring cup, and lab notebooks.

Prior Knowledge Assessment: Remind students of the previous lesson and their new knowledge in regards to how the Great Salt Lake affects us by providing products that are used throughout the world. Ask the students if they can brainstorm any other ways that the Great Salt Lake might affect us. Ask if they think the Great Salt Lake affects the weather in the surrounding areas and ask them to explain. Facilitate a class discussion of the weather and rain. Have the students' work in groups to create concept maps of rain and then share them with the class.

Procedures:

- Read Pink Snow and other Weird Weather by Jennifer Dussling.
- Discuss the book, weather, and especially rain with the class.
- Divide the students into small groups and have them create a concept map of rain.
- Select one member from each group to share with the class their groups' concept map.
- Share pictures of the Great Salt Lake, for example pictures of Saltair and people floating in the lake from the book Saltair by Nancy D. McCormick and John S. McCormick.
- Individually have the students record in their lab notebooks what they know, what they wonder, and eventually what they learned about the Great Salt Lake. Included in this section should be at least one fact they discovered from the High Country News article *The Great Salt Lake Mystery* found online at www.hcn.org.
- Divide the students into small groups.
- Explain the experiment to the class and ask all the students to record in their lab notebooks their hypothesis if the presence of the lake affects the formation of rain and also the experiment.
- Have the students put $\frac{3}{4}$ cup of soil in one container, $\frac{3}{4}$ cup of hot water in another, and $\frac{3}{4}$ cup of cold water in the third. They should quickly cover the containers with the plates, and put 6 ice cubes on top of each one.
- After 3 minutes, have the students carefully remove the ice cubes and turn the plates over. What do they see? (Water droplets will have formed on the plate that was over the warm water, and only a slight film of moisture on the other two.)
- At this time introduce the concept of condensation by pointing out the droplets of water that formed on the plate that was covering the warm water. Explain the process by which a gas or vapor changes to a liquid.
- Then explain when enough water droplets gather and fall to the ground it is called precipitation. Ask them what precipitation reminds them of? (Rain, snow, sleet, or hail.)

- Relate the warm water in the cups to the warm water of the Great Salt Lake and explain in the fall and spring there are major changes in the weather. The temperature in the air can change from really warm to really cold. The temperature of the water in the Great Salt Lake doesn't change the same way as the air above the lake. This makes big differences between the two temperatures. This difference in the air and lake temperatures causes instability, and often leads to a lot of rain. This extra rain, or precipitation, is called the "lake effect."
- Ask the students how the experiment compares to the "lake effect" and why water droplets or a film form on the plates? (The ice cubes made the plate colder than the air in the containers. Warm air can hold more water vapor than cold air – the concept of relative humidity. As the warmer air in the containers came in contact with the cold plate, the air was cooled and some of the water vapor in the air condensed to form water droplets.)
- Ask students which container showed the most condensation on the plate? (the warm water) Which one showed the least? (the soil) Why? (Because of the water, there was more moisture in the air. The air immediately above the warm water was warmed by the water, and could hold more vapor. The temperature contrast with the cold plate was greater, so more water vapor condensed.)
- Explain to the students that there are three main reasons why this "lake effect" happens. Besides the temperature contrasts, which are the most important reason, there is a great deal of extra moisture in the air from evaporation off the lake. Also, the wind that come with the storms picks up salt crystals from the nearby salt flats, which are flat areas where the lake used to be, as well as from the tips of waves, known as whitecaps, in the lake itself. These airborne salt crystals absorb moisture from the air and form especially large raindrops. That is why the snow at nearby ski areas in the canyons has more salt than in most snow. Maybe this is why people say Utah has the best snow on Earth.
- Ask students how this experiment relates to the Great Salt Lake? (The lake is a large body of water that puts a lot of water vapor into the air from evaporation. The lake also retains heat, so when a cold air mass passes over the lake, there is a lot of moisture in the air to condense. When enough water vapor condenses, the water droplets coalesce and form rain or snow.)
- Ask students how else might the Great Salt Lake affect the precipitation in the region? (The salt crystals picked up by winds during storms serve as hygroscopic nuclei, which absorb moisture from the air and form large raindrops. Also, as the moisture laden air hits nearby mountain slopes and rises, it is cooled more, which causes even more water vapor to condense.)

Closure: Original concept map groups reconvene to add to their map what they learned.

Assessment: Students participate in class discussions. They create a group concept map of rain. Individually they record what they know, what they want to know, and what they learned in lab notebooks as well as the experiment.

As a result of this unit of work on The Great Salt Lake _____ is able to:

	Comments	
1. Student will explain formation of rain.		
2. Student will name ways in which the Great Salt Lake affects precipitation in the Salt Lake Valley.		
3. Student will record in lab notebook a hypothesis (and why), purpose of experiment, results, and conclusions (if hypothesis was accepted).		
4. Student will include one fact found from hcn.org in lab notebook.		
5. Student contributed at least 3 ideas to group concept map.		

Extension: Have the students design a way to demonstrate the hygroscopic characteristics of salt. This can be shown by putting salt in a humid environment and observing how the crystals will tend to clump together. Make sure to use a salt that doesn't have any anti-humidity additives.

Adapted from: The Great Salt Lake Story. *Stormy Weather*. Utah Museum of Natural History. Revised Edition. 1997. Pages 53-54.

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Great Salt Lake III –Science Lesson

Topic: Buoyancy

Abstract: This lesson will help students to discover buoyancy through experimenting with objects in attempt to make them float in three different types of water. (Distilled, Tap Water, Salt Water.) Students will make predictions on based on previous knowledge and weight and size of the objects.

Grade Level: 3rd

Utah Elementary Core Curriculum Standards:

STANDARD: [3030 - 01](#)

“Students will explore ecosystems and discover relationships among living organisms and the nonliving world.”

Objective:

3030-0101

Compare and contrast similarities and differences of various habitats.

- Observe and describe a variety of habitats.
- Distinguish living and nonliving elements of different habitats.

In Class Instructional Time: 1 hour

Terminology:

Buoyancy: *“the power to float or rise in a fluid.”*

Salinity: *“salty or salt like.”*

Intended Learning Outcomes:

- Students will identify the salt content in the Great Salt Lake
- Students will use skills such as predicting and experimenting to find results.
- Students will identify the properties of buoyancy.

Background Information:

The Great Salt Lake is a very important learning tool for many Utah students. Through the lake students are introduced to ecosystems, salinity, and a important part of Utah’s history. The Great Salt Lake is a very important part of Utah and will continue to be for years to come. Having such a resource allows students to learn science hands on with something that many of us take for granted.

Next introduce the topic of buoyancy and salinity. Talk about past events of the Great Salt Lake when people would travel from all over the world to float in the Great Salt Lake. Talk about the rides and activities that there used to be out at the Great Salt Lake.

Materials:

For the three types of water fill each beaker 3/4

Distilled Water	3 Beakers
Tap Water	Table salt
Conductivity Meter	Teaspoons
Pumice (3)	White rocks (sedimentary) (3)
Wood blocks (3)	Small rubber balls (3)
Small scale (digital)	Timer

Prior Knowledge Assessment:

To begin the lesson start by asking the students what they know about the Great Salt Lake's water? Have students talk about possible experiences in the water and their current knowledge of the water.

Procedure:

- Do not tell students the 3 types of water (Salt, distilled and tap) (Salt formula: 4 cups of water to 14 tsp of salt. 250ml = 1 cup)
- Have students weigh the different objects that will be placed in to the beakers of water.
- Have students make predictions based on appearance and weights of objects as to what items will sink or float in the beakers.
- Inform students about the objects that will be tested.

Before the students drop each object in to the different liquids introduce the class to the Conductivity Meter. Tell the students what it measures and how it is used. Then place the Conductivity Meter in each beaker of water to show them the level of salinity in each beaker.

Next tell the students the procedures of the experiment.

- 1.) Drop each material into the different liquids.
- 2.) Note the rate of how fast each object drops or how quickly the objects float in the liquid.
- 3.) What objects sink? What objects float?
- 4.) What connections do you see in the objects that float? What connections do you see in the objects that sink?

Closure: Talk with students about the possibility if there was a higher salinity in the water would more objects float in it? What other items would float in the water?

Assessment: The assessment is an informal assessment that is done through the worksheet and through the final closure of the lesson.

