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Unit Overview: Living & Nonliving with Ponds

Abstract: In this unit students will be determining how healthy in-land pond water (non-living) is when considering the amount of birds (living) that occupy it. The students will also be discovering how to determine if a body of water is healthy using chemical tests such as the ph, nitrogen, and ammonia levels.

Science Benchmark:
For any particular environment, some types of plants and animals survive well, some survive less well and some cannot survive at all. Organisms in an environment interact with their environment. Models can be used to investigate these interactions.

Standard 2: Students will understand that organisms depend on living and nonliving things within their environment.

Objective 2: Describe the interactions between living and nonliving things in a small environment.

a. Identify living and nonliving things in a small environment (e.g., terrarium, aquarium, flower bed) composed of living and nonliving things.

b. Observe and record the effect of changes (e.g., temperature, amount of water, light) upon the living organisms and nonliving things in a small–scale environment.

c. Pose a question about the interaction between living and nonliving things in the environment that could be investigated by observation.

Intended Learning Outcomes:

- Use science process and thinking skills.
- Understand important science concepts and principles
- Communicate effectively using science language and reasoning
- Understand the nature of science.

Time: This unit covers the course of five days. Each day will build upon prior knowledge and conclude in an inquiry investigation in which the students will be able to perform a simple, hands-on experiment.

Assessment: The assessment for this unit will be an ongoing journal the students will record individually. Information may include observations, procedures, experiment ideas, illustrations, questions, etc. Each lesson will require a specific item to be entered

into the journal by the individual student. The following lesson will determine which specific items are to be included for that particular lesson.

Resources:

- Utah State University – "Utah Stream Team": Utah State University

Part I: Opening with Guest Speaker

Abstract: Students will be introduced to the concepts of water, living and nonliving things with the aid of a guest speaker from Project Wet. Students will brainstorm what they know and want to know about water during the unit with a KWL chart. Students will also construct questions on index cards to ask the presenter concerning water, living and nonliving things.

Duration: 45-50 minutes

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d. Identify living and nonliving things in a small environment (e.g., terrarium, aquarium, flower bed) composed of living and nonliving things.

e. Observe and record the effect of changes (e.g., temperature, amount of water, light) upon the living organisms and nonliving things in a small–scale environment.

f. Pose a question about the interaction between living and nonliving things in the environment that could be investigated by observation.

Learning Objectives:

- Students will be introduced to the unit by first constructing a KWL chart which shows what they know about healthy bodies of water, and what they want to know about healthy and unhealthy bodies of water.
- Students will be able to identify questions they have for a guest presenter.
- Students will be able to determine features of appropriate behaviors to exhibit during a guest speaker. Students will brainstorm these behaviors and analyze their behavior during the presentation to assess their abilities to follow their own developed list of expectations.

Terminology:

living- **alive** not dead (as defined in Utah State CORE)
nonliving-**not living:** dead, inanimate, or no longer used or existing(as defined in Utah State CORE)
healthy-**in good condition:** in good physical condition, maintained, good quality of water(as defined in "Utah Stream Team")
unhealthy-**not in good condition**: chemical, and physical indications show bad conditions, bad quality of water (as defined in "Utah Stream Team")

Materials:

- Science journals
- Index cards
- Large poster board

- KWL chart on poster or overhead

Prior to Lesson:

Utah Contact:

Current Coordinator (Andree' Walker)

Project WET Coordinator Office (435) 797-2580
Fax (435) 797-1871
5210 Old Main Hill
Logan UT 84322-5210
andree.walker@usu.edu
www.extension.udu/waterquality

National Contact:

http://www.uwsp.edu/cnr/uwexlakes/wet/

Prior Knowledge Assessment:

Prior to guest speaker coming, introduce the unit on water to prepare the students. Ask them to think about water; how they use it, where it comes from, what constitutes a healthy versus unhealthy body of water, etc. Have them write three to four questions down on index cards. Also discuss and brainstorm specific behaviors and expectations while a guest is present in the classroom. Write down their ideas. Have students as a whole pick the five most important behaviors and list them on a poster.

Anticipatory Set:

Have students pull out their note cards and review their questions. Develop a KWL chart reviewing what the class had discussed in the prior knowledge assessment. List what the students know, want to learn and leave a space for what they students will learn by the end of this unit. Ensure that the guest speaker is present so he or she knows what the students grasp and understand and what concepts need to be covered in more depth. Introduce the guest presenter who has come to introduce them to the unit on water, living and nonliving things.

Procedures:

- Talk with the guest speaker prior to coming to the classroom. Discuss time, and content wished to be covered. For this particular unit ask the guest to cover activities that have to do with the healthy versus unhealthy bodies of water. Also, include how living and nonliving elements affect a stream or body of water. Ask the presenter about his/her ideas and activities he/she plans to implement and any materials needed in the classroom prior to implementing the introductory lesson.
- While students are participating and learning during the guest speakers' activities, observe students and ensure they are actively engaged and participating. Jot down specific comments and questions during the presentation as a guide to shows where students' prior knowledge is and which concepts and areas that need further instruction or scaffolding during the duration of the unit. Also observe students' prior knowledge and experiences with healthy and unhealthy bodies of water. Allow the guest speaker at least 40-45 minutes for the lesson and activities.
- Once the lesson is finished allow students time to ask questions from their index cards, or any other questions they formed during the presentation.

Conclusion: Allow students about 10 minutes to write or draw in their science journals. Provide a prompt if needed such as: an experience you have had concerning healthy or unhealthy bodies of water, or a something you learned you had not known before, or questions that they still may have. Tell students the following criteria will be looked at in their entry: in depth thought, reasoning and evidence as to why they included what they did as an entry, and that the entry applies to what was covered in the presentation.

Have students use thumbs up or thumbs down to assess their own behavior during the presentation using the criteria listed on the poster (may need to have students close their eyes or put heads on desks). Discuss any problem areas if needed.

Assessment:

Look at students' journals and assess what was absorbed during the presentation and what topics need further instruction. Look for the following criteria: in depth thought, reasoning and evidence as to why they included what they did as an entry, and that the entry applies to what was covered in the presentation. Use the KWL chart to make changes to unit as needed.

Part II: Testing & Experimenting

Abstract: In this lesson the students will first review what they learned from the guest presenter. They will then be introduced to how to test whether a pond is healthy or unhealthy using pH, nitrogen, and ammonia levels. Students will also be discussing and diagramming living and nonliving things and how they can affect a body of water.

Duration: 45-50 minutes

Standard 2: Students will understand that organisms depend on living and nonliving things within their environment.
Objective 2: Describe the interactions between living and nonliving things in a small environment.

g. Identify living and nonliving things in a small environment (e.g., terrarium, aquarium, flower bed) composed of living and nonliving things.

h. Observe and record the effect of changes (e.g., temperature, amount of water, light) upon the living organisms and nonliving things in a small–scale environment.

i. Pose a question about the interaction between living and nonliving things in the environment that could be investigated by observation.

Learning Objectives:

- Students will be able to practice testing water by using pH, nitrogen, and ammonia kits in order to determine whether the water is healthy or unhealthy.
- Students will be able to brainstorm both living and nonliving things that can have a negative affect on bodies of water such as human or animal impacts.
- Students will be able to draw and diagram what affects a body of water (stream, river, pond, or lake). They will label and write or pictorially demonstrate why these elements affect the body of water.

Materials:

- ***Table IV-3. The pH Scale*** overhead (included @ end of lessons)
- pH Kits, one for each pair of students
- litmus strip
- ***pH Field Instructions*** copy for each pair of students (included @ end of lessons
- cups
- Nitrate Sampling Kits
- Ammonia Sampling Kits
- journals

Terminology:

pH- is the measurement used to determine how acidic or basic water is. Using litmus strips and a scale of 0 to 14 we measure the pH of water. The colors on the strips react with the water and change. The change is compared to the chart to

determine the water's pH. The water should be sampled at the site or as soon as possible. *The allowable range of pH is 6.5 to 9.0 in Utah.

nitrogen- is used in building proteins and is an essential nutrient for plant and animal growth. Nitrogen concentrations change throughout seasons for example in Utah in the spring when snow is melting and runoff is occurring from lawns, farms, and other areas nitrogen levels are high. Inorganic (nonliving) elements can affect nitrogen concentrations such as fertilizers, animal manure, broken septic systems, and acid rain.

ammonia- formed when organic (living) nitrogen is broken down by bacteria. Plants prefer ammonia to nitrate, but is typically less abundant in natural waters.

testing- both nitrate and ammonia tests are color tests, where the amount of color change is proportional to the amount of pollutant measured. *The maximum concentration of nitrate allowed in drinking water is 10mg/liter. Utah considers nitrate concentrations of 4 mg/liter to be an indicator of pollution problems. (See ***Nitrate Field Instructions*** and ***Ammonia Filed Instructions*** for step-by-step instructions on how to test nitrogen and ammonia levels on water).

*For more detailed description see ***IV-3. Introduction to Chemical Monitoring***- Utah Stream Team (included @ end of lessons).

Prior Knowledge Assessment:

Ask students to pull out their science journals from the previous day. Ask each student one thing that they can share with the class, such as something they learned, a question they had, or an experience they wrote about or drew. If students are able to describe and review the highlights of the presentation move on with the lesson. If not, then review the activities showing living and nonliving things and the differences between a healthy and unhealthy body of water.

Procedures:

- Tell students since they know about healthy and unhealthy water from the presentation, ask them ways they think they can measure a healthy versus unhealthy body of water. Write down ideas on the whiteboard.
- Tell students that today they are going to use different tools and testing materials in order to measure and have concrete data to conclude whether a body of water is healthy or unhealthy. Tell them that we will also be looking at the differences between living and non-living elements and their affects on bodies of water. Review with students proper behavior when using science materials and expected behaviors.
- Ask students for their ideas on pH levels. Tell them to pull out their science journals to write down various key words and definitions. Tell them that pH measures how acidic or basic water is. Tell them that fruit are very acidic and blander foods like eggs and bread would be more basic. Write terms and definitions down and have students record them in their science journals. Show the students the ***Table IV-3. The pH Scale*** overhead. Ask students for more ideas of foods that could be added to the acidic side and the basic side (checking for understanding). Write their ideas in the approximate places on the overhead pH scale.

- Explain to the students that a litmus strip (provide a visual) can measure the pH of water. Demonstrate by taking the pH of tap water. Tell students that it should be taken and determined either exactly where the water is located or as soon as possible.
- Hand out the ***pH Field Instructions*** page to a pair of students. Allow them to take the pH of tap water using pH kits and cups. They will then compare their litmus strip to the pH color key located on the box.
- Ask students why they think the pH would indicate a healthy or unhealthy stream. Explain that seasons, living and non-living things can have an impact on the pH of water. Ask for suggestions as to what students think would affect the pH of water (review from guest speakers presentation). Have students list these elements in their science journals. Elements could include seasons, soils, pine needles, leaves, acid rain, animal droppings, etc.
- **Nitrogen and ammonia levels could be another lesson or Day if desired.*
  Ask students what the living organisms need in order to survive in a pond (nutrients). Have students brainstorm ways in which they think we could measure nutrients in a pond. Write down their ideas on the whiteboard. Explain to students that not all plants and nutrients are visible. There are tiny microscopic plants called algae that float freely in lakes, reservoirs, and other bodies of water. Nitrogen is a nutrient for plants and animals and can be tested and measured. Explain that ammonia is formed when even smaller living things called bacteria break down living nitrogen. Write terms and definitions down and have students record them in their science journals. Ask students why the nitrogen and ammonia levels would be important for a healthy stream?
- Show and demonstrate for students how to measure nitrate and ammonia levels. Allow student volunteers to aid in measuring and determining the levels. Do the nitrogen test first because it requires about 10 minutes of wait time.
- During wait time ask students what living or nonliving things might affect the nitrogen and ammonia levels such as: fertilizers, animal manure, broken septic systems, acid rain which is are nonliving and carried in the surface water as is travels through soils and groundwater. Have them include their ideas in their science journals.
- Also explain that there can be too many nutrients like when there is heavy plant growth and floating "scum" that can be seen and the water is "cloudy." This is not good for the pond or body of water because if there is too much plant material in the water, the bacteria takes over and uses up all the oxygen.

Conclusion: Review with students the various ways to test and measure how to determine if a body of water is healthy on not. Ask students what living or nonliving things can impact water? How do they impact water? Have students draw or diagram a body of water (stream, lake, pond, river) as either healthy or unhealthy and have them write or show what is causing that body of water to be healthy or unhealthy. Clearly indicate what needs to be included in this journal entry.

Assessment:

- Student journals should include key terms and definitions, living and nonliving elements that affect water and a drawing or diagram.

- Observation of students will determine if they were actively participating in the lesson with appropriate behavior.

Part III: Field Trip

Abstract: Special attention will be paid to the amount of birds that occupy each pond as well as other living and nonliving things.

Duration: 1/2 day

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b. Observe and record the effect of changes (e.g., temperature, amount of water, light) upon the living organisms and nonliving things in a small–scale environment.

c. Pose a question about the interaction between living and nonliving things in the environment that could be investigated by observation.

Lesson Objectives:

- Students will be able to predict the healthiness of a pond.
- Students will be able to collect samples from different ponds.
- Students will be able to behave appropriately during a field trip.
- Students will be able to identify living and nonliving things at each sight.

Materials:

- Journals
- Pencils
- Jars (9) – plastic works best
- Permission notes from parents for field trip
- Bus and driver or parent volunteers to drive
- Digital cameras (optional)

Terminology:

- Inland pond – a pond in which there are no outlets (streams).

Background:

In the Salt Lake area there are many inland ponds. The ones being used for this particular unit are ones found at Red Butte Gardens, Sugarhouse Park and Fairmont Park. These ponds are somewhat equal in size but have a noticeable difference in the number of birds that occupy each. Red Butte Gardens has very few birds living by the pond, Sugarhouse

Park has a medium amount of birds and Fairmont Park typically has a large amount of birds.

Prior to Lesson:
This lesson/day is primarily a field trip. Before leaving, procedures for field trips should be reviewed with the class. They can include but are not limited to staying with a buddy, sitting quietly on the bus, not wandering off, etc. If parent volunteers are joining the trip, make sure that they know exactly what their roles are. Also, assign each parent or aide to a particular group of students so that accountability will be easier. Also, since the students will be leaving the school grounds it will be necessary to obtain permission from parents and guardians.

Prior Knowledge Assessment:

- As a class, quickly review the previous lessons from this unit including what constitutes a healthy body of water. Tell the class that they will be going on a field trip to different bodies of water to gather samples. Afterwards, they will test the samples to determine if the water is healthy.

Procedures:

- Discuss the definition of an inland pond – one in which there are no outlets.
- Introduce the procedures for conducting an experiment. This may be a review depending on if the students have had experience in this area. Be sure to go over the steps for conducting an experiment, particularly forming a prediction (hypothesis). Discussion should also include an explanation as to why scientists retest several times during an experiment. Explain the importance of obtaining at least samples at each pond – to get an accurate result.
- Discuss possible predictions that can be made about this experiment. Each student will record his or her own prediction in his or her science journals. Predictions should include a "because" statement. E.g. "The pond in Red Butte Gardens will be healthier <u>because</u>…"
- Divide students into nine groups (three students per group). Each group should be responsible for bringing one jar. Assign each group to collect a sample from one pond so that three groups will be collecting samples from each pond.
- At each pond, every student will draw/sketch the pond and surrounding areas. Ask that each student get an approximate number of birds that occupy each pond. Since there is no way to count accurately averages will be made back in the classroom. (One option would be to allow the students to take digital photos of the ponds to examine in the classroom.)
- The groups assigned to this particular pond will be responsible for obtaining a water sample in the jar.
- Travel to each of the three ponds making sure that there are three water samples collected at each pond and each group has had a chance to collect a sample. Students should sketch pond and count birds at each location.

Conclusion:

- Back in the classroom discuss what the students observed/learned/questioned.

- Were there a lot of birds or not very many?
- How big were the ponds?
- What observations did you make?
- Did anything surprise you?
- Has your prediction for the experiment changed? Why or Why not?
- Are there any questions you have?

Assessment:

- Students' journals should contain the following information: prediction on the healthiness of the ponds, sketch of the three different ponds, approximate number of birds at each pond.
- Observation will determine if students were able to behave appropriately according to the classroom standards set before the field trip.

Part IV: The Experiment

Abstract: Students will be revisiting the procedures for testing nitrogen, ammonia and pH levels of the water samples they gathered during the field trip.

Duration: 60 minutes

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f. Pose a question about the interaction between living and nonliving things in the environment that could be investigated by observation.

Lesson Objectives:

- Students will be able to conduct a simple experiment.
- Students will be able to recognize the relationship between living and nonliving things.

Materials:

- Journals
- Pencils
- Water samples (gathered from field trip)
  -3 samples from 3 different ponds – one with a low concentration of birds, one with a medium concentration of birds, one from a high concentration of birds
  (Red Butte Gardens, Sugarhouse Park, Fairmont Park)
- Nitrogen testing kit (Available from USU)
- Ammonia testing kit (Available from USU)
- PH testing kit (Available from USU)
- Directions for testing kits are attached at the end of this unit

Background Information & Terminology:

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compared to the chart to determine the water's pH. The water should be sampled at the site or as soon as possible. *The allowable range of pH is 6.5 to 9.0 in Utah.

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*For more detailed description see ***IV-3. Introduction to Chemical Monitoring***- Utah Stream Team.

Prior Knowledge Assessment:

Procedures:

- Review as a whole class what constitutes a healthy stream. Review procedures for testing for nitrogen, ammonia and pH.
- Groups should be formed with three to four students per group. (The same groups should be kept from the previous day on the field trip but is not necessary.) Remind students that each student needs to record the results in their own journal.
- Each group will test their water sample. Review the procedures for using the tests if necessary. Directions for using each of the testing kits are attached at the end of this unit. Charts should be made in the students' journals to keep track of results.
- After each group has tested their samples record the results from each group on a chart where the entire class can view it.
- Discuss with the class what they have found out and if they can make any conclusions. Discussion questions should include:
    - Were the results what you thought they would be?
    - Were there any surprising results?
    - What were they?
    - Why do you think that was?
    - Can you draw any conclusions based on the results? Why or why not?
    - What could you do differently to arrive at a more concrete conclusion?
    - Guide the students in forming conclusions about the relationship between living (birds) and nonliving (ponds).

Assessment:

- Observation of students working cooperatively in groups.
- Students' ongoing journal should include the following for this particular lesson: experiment results recorded in a chart, conclusions written based on experiment results, further questions regarding the relationship between birds and inland ponds, adaptations that might be made to the experiment.