Discovery Unit:
Exploring an Aquatic Ecosystem

Unit Description
And
Five Daily Lesson Plans

By:
Tammi Deines
&
Peggy Seibel

St. Mary’s School
Ellis, KS
Expanding An Aquatic Ecosystem

- What are some causes of pollution?
  - "deadly waters" simulation game
  - "poisoned river" activity

- How does pollution affect aquatic plants?
  - collect organisms from Big Creek
  - report and picture organisms from Big Creek

- How does pollution affect aquatic animals?
  - sort and identify organisms from Big Creek

- What does pollution do to aquatic ecosystems?
  - "poisoned river" activity
  - "deadly waters" simulation game

- How does pollution affect aquatic plants?
  - complete H2OIL chart
  - pointed networking project
  - net temperature, turbidity, and pH level of Big Creek

- How does pollution affect aquatic animals?
  - utilized algae experiment
  - net temperature, turbidity, and pH level of Big Creek

- Expanding...

- Speaker
  - position and letters
  - complete H2OIL chart
Discovery Unit:
Exploring an Aquatic Ecosystem

Standards: Math

**Standard 3** The student uses geometric concepts and procedures in a variety of situations.

**Benchmark 2** MEASUREMENT AND ESTIMATION – The student estimates and measures using standard and nonstandard units in a variety of situations.

Science

**Standard 1** Science as Inquiry

**Benchmark 1** All students will develop the skills necessary to do full inquiry. Full inquiry involves asking a simple question, completing an investigation, answering the question, and sharing the result with others.

**Standard 5** Science and Technology

**Benchmark 2** All students will apply their understanding about science and technology.

Writing

**Standard 2** Learners write effectively for a variety of audiences, purposes, and contexts.

**Benchmark 8** The proficient writer uses writing as a tool for learning throughout the curriculum.

Age Levels: 3rd – 4th grade

Teacher Background: This unit uses a variety of hands-on activities, field trips, and journaling to investigate a local aquatic ecosystem, and to determine whether pollution is affecting the plants and animals that live there. Throughout the week-long unit we will be incorporating the scientific process and inquiry based learning in our investigation.

Description: This unit uses a variety of hands-on science experiments as well as cross-curricular activities to learn more about Big Creek.

Major Concept: The students will become aware of the components of an aquatic ecosystem, and be able to identify the effects of
pollution on the organisms that live there.

Objectives:

A. The students will observe an aquatic ecosystem (Big Creek).
B. The students will identify the effects of pollution on aquatic plants.
C. The students will identify the effects of pollution on aquatic animals.
D. The students will identify the different forms of pollution present in Big Creek.
E. The students will determine what solutions are needed to make Big Creek a healthy aquatic ecosystem.

Specimens/Materials:

A. Construction paper for “K” (of KWL) dioramas
   Science process skills logs
   Crayons or markers
   Clear plastic cups
   Cotton swabs
   Water, sugar, vinegar, salt, & citric acid
   Video: The Streamkeepers
B. pH probe (or litmus paper)
   Thermometers
   Secchi disks
   Sampling device
   Two liter pop bottles (with the tops cut off)
   Goggles and plastic gloves
   Science log
   Experiment supplies (three plants, water, motor oil, detergent)
   Experiment supplies (two quart jars of creek water, liquid fertilizer)
C. Collection nets & buckets
   Insect identification books
   Discovery scopes,
   Magnifying boxes
   Goggles and gloves
   Tweezers
   Flashlight
   Art supplies (salt, watercolors, crayons)
   Experiment supplies (feather, oil, water, tub)
D. Silt demonstration supplies (pan, tub, water, watering can, soil, & sod)
   Runoff demonstration supplies (presenter brings props)
   Deadly water simulation supplies (dots and identification cards)
E. Poster board, markers
   Letter writing materials

References:
**F. Teacher**

*Scott Foresman Science (3rd and 4th grade texts) © 2000*
Contains background information and experiments

*Field Manual for Water Quality Monitoring* M. K. Mitchell & W. B. Stapp
Explanations and procedures for specific water quality tests

*LHS-Gems Aquatic Habitats © 1998*
Animal descriptions and illustrations

*The Kingfisher Young Discoverer's Encyclopedia* Larousse Kingfisher Chambers, Inc. © 1997
Contains construction information for dipping nets, oil on feathers and algal bloom experiments, and pollution tolerant/intolerant creature list and illustrations

*Pond and Stream Safari* Karen Edelstein
Activity pack with leader's guide and identification and activity cards

*How Safe is Your Water?* Storey/Garden Way Publishing ©1979 KDWP
Discussed water safety standards

*Through the Looking Glass…A Field Guide to Aquatic Plants* Wisconsin Lakes Partnership ©1997
Aquatic plant information and identification guide

*The View in the Mirror….Reflections on Kansas Streams, Watersheds, and Pollution* Kansas Dept. of Health and Environment
Video and guidebook for observational monitoring

*OBIS Ponds & Lakes (LK-10)* KDWP
Packets of pond/stream monitoring activities

**Videos:**
*The Streamkeeper* the Adopt-A-Stream Foundation (KDWP-- featuring Bill Nye)
*Eyewitness Pond and River* DK Vision (KDWP)
*S.O.S. For America’s Streams* Izaak Walton League (KDWP)
*The Small Life of Ponds and Wetlands* Biomega Associates (KDWP)
*Exploring Ponds and Lakes Ecosystems* MGB Learning Network (KDWP)

**G. Student**

Aquatic plant and animal identification guide

**Insects: a Golden Guide** St. Martin’s Press ©2001
Insect identification guide

**Fish Identification Guide** Ks Dept. of Wildlife and Parks
Photos and descriptions of the common fish of Kansas

**DK Closer Look: Pond Life** DK Publishing ©1992
Great photos and information about pond plants and animals

**DK Closer Look: River Life** DK Publishing ©1992
Great photos and information about river dwelling plants and animals

**One Small Square** D. M. Silver ©1994
A child’s guide to exploring a pond ecosystem—detailed illustrations of pond animals

**Around the Pond** L. B. George ©1996 (KDWP)
Easy read-aloud with large illustrations

**Around the Pond** Ann Cooper (Wild Wonder Series) ©1998
Information about a variety of animals that live in and around ponds

**Eyewitness Books: Pond and River** Eyewitness Books ©1988
Information with detailed illustrations and photos of pond dwelling plants and animals

**Pocket Naturalist** KDWP ©1997
Laminated pamphlet which identifies common plants and animals which are found in and around ponds, lakes, and streams

**Water Insects** Sylvia Johnson Lerner Publications Co. ©1989
Color photos and information about common water insects

**Pond Life Cycle Kit** (VLK-13) KDWP
Manipulative models of the stages of the life cycles of pond animals

**Rivers of Life** poster (PP-72) KDWP

**Content Related Words:**
pollution chemical pollution thermal pollution silt
organic pollution aquatic habitat run off
watershed erosion ecosystem Secchi disk
Projects and Activities:

A. 1. The students will make a “prediction diorama” of the plants and animals they expect to find living in Big Creek.
2. The students will walk along the banks of Big Creek and observe the plants and animals living there.
3. The students will observe forms of pollution in and around Big Creek.
4. The students will experiment with clear water that is polluted.

E. 1. The students will set up an experiment to see how pollutants can affect the growth of plants.
2. The students will test samples of Big Creek water for: temperature, pH, and turbidity levels.

F. 1. The students will collect samples of insects found in Big Creek, count and classify them, in order to determine the water quality.
2. Students will choose one of the insects they observed during the collection process, research, and write a report on it.
3. Students will use their observations of the researched insect to make a picture of it.
4. Students will explore a center that shows what happens to the feathers of birds in an oil spill.

E. 1. Students will observe and participate in two simulations that show the effects of runoff.

F. 1. A speaker will come in and talk about the condition of Big Creek, and give some suggestions on how students can help improve the situation.
2. The students will brainstorm solutions on how they can help clean up the waters of Big Creek.
3. Students will make posters to share what they’ve learned. These posters will be displayed in downtown businesses to raise community awareness of the problem.
7. Students will write letters to the City Council to share their concerns or to ask them to take action based on the information gained through this unit.

Evaluation:

A. The student’s diorama will be a baseline for prior knowledge. It will be looked at again at the end of the unit to determine how each student’s knowledge base has increased. Also, students will record their observations of Big Creek after the walk along the banks, and their
predictions as to whether or not it is polluted in their Science Log.
B. Students will record their findings (Ph, water temperature, & nitrate levels), and make inferences as to meaning in their Science Log.
C. Students will chart their insect findings and make inferences to its meaning in their Science Log. They will also do an in-depth report on one of the insects they observed, as well as a detailed drawing of it.
D. Students will be called on to identify the different forms of pollution, and give examples. They will be asked to make an entry in their Science Log as to what form of pollution is affecting Big Creek.
H. Students will use the knowledge they’ve gained to make posters that discourage pollution. They will also write persuasive letters to city officials encouraging them to take action to protect Big Creek.

Discovery Centers:

Third Grade:
1. Floor puzzle to help identify animals in a pond setting.
2. Discovery Scope observation to let the children observe organisms found in Big Creek on their own.
3. Life cycle manipulative kit will allow the children to look at the life cycles of organisms found in rivers and ponds. This kit also includes a book and organism examples that the children can look at to find more information on organism life cycles.
4. Pond life concentration game will allow the children to play a variety of card games to learn about animals and their lives.

Fourth Grade:
1. Discovery Scope center to more closely observe the aquatic organisms found.
2. Aquatic insect identification cards and books to help identify the specimens found.

Shared:
2. “Clear water” pollution test will help the children realize that just because water look clean that doesn’t always mean that it really is.
2. “Oil Spill” this center will help the children to see the effects of pollution on bird feathers when they are put into water that oil has been spilled into.
3. “Polluted Plants” center where students can observe the long term effects of pollutants on plants.
3. “Fertilized Pond Water” allows the students to observe how algae growth is stimulated when too much fertilizer is present.
4. “Deadly Waters” simulation will help students understand the various ways water can become polluted.
Field Trial:

This unit has proven to be an exciting and interesting adventure. Peggy Seibel and I chose to do a unit close to home. We decided to look at Big Creek through a number of experiments and activities. Our main goal was to make the children more aware of the components of an aquatic system and then to be able to identify the effects of pollution on the organisms that live there.

Overall we feel that our unit went very well. We both definitely feel that we have become more flexible by doing this unit with our classes combined. But after we got our schedules ironed out everything went very smoothly. The children were very good listeners and very enthusiastic about what we were doing daily. Their enthusiasm made the hard work planning and preparing our lessons worth it.

When we started our lessons we decided to have the children make a diorama of what they thought they would find in Big Creek. This was our pre-assessment. A majority of the children put different types of fish and plants. They didn't really draw any insects or other organisms they thought they would see. As a whole group we did a K – W – L chart, which generated a larger variety of animals and plants. As our post assessment we had the children write letters to the city council that described the project we did, what we found out about Big Creek, and ways that we can try to fix these problems. Through reading their letters we were able to determine that a lot of the information we discussed in our lessons sunk in and the children realized that everyone needs to make changes in order to make a difference.

In any unit there are some good points and some thing that need to be changed or revised. One thing we realized after we were done was we could have utilized more outside resources from the Sternberg Museum. Mainly we were thinking about our bug collection and identification day. We feel that having an expert on identifying insects would have been helpful in verifying our findings. We did pretty well identifying the insects, but to have an expert there would have been great. We also noticed that we should have had the children label the insects on the boxes as well as on their science logs. We had them only write down the names in the log and then after school we had to go back and re-identify them.

Another area of concern was that we wanted to videotape most of our lessons and we had a difficult time doing this because the machine was not working properly. This caused us to have to rework the type of presentation we wanted to do for our October 27th meeting.

Overall, we were very excited and glad we were able to participate in this program. It enabled us to look deeply into an area of concern in our town as well as get our children excited about science.
Exploration

Day One: What do we know about aquatic ecosystems?

**Objective:**
The students will observe an aquatic ecosystem (Big Creek).

**Materials:**
- Video
- construction paper
- markers
- crayons
- Science journals
- clipboards
- sugar water
- white vinegar
- salt-water
- water with citric acid
- tap water
- cotton swabs

**Vocabulary:**
- Aquatic
- habitat
- watershed
- pollution
- ecosystem

**Procedure:**
1. Describe project.
2. Have the children make a KWL diorama of what they think lives in and around Big Creek.
3. Have the children help fill in a class KWL chart (K and W only).
4. View video:
5. Partner a third grader up with a fourth grader and discuss what they need to do and how they should act.
6. Walk to Big Creek to observe organisms and types of pollution they see.
8. Conduct polluted water activity.
   a. What do you think polluted water looks like?
   b. Do you think clear water can be polluted?
   c. Now what do you think about clear liquids? How do you think they became polluted?

**Evaluation:**
To evaluate the children we will use the KWL diorama and science journals to see where the students are. We will also be able to see what knowledge was gained in the class KWL chart and oral discussion of what polluted water looks like.
Day Two: How does pollution affect aquatic plants?

**Objective:**
- The students will identify the effects of pollution on aquatic plants.

**Materials:**
- 3 plants
- water
- motor oil
- detergent
- creek water
- fertilizer
- pH probe
- goggles
- plastic gloves
- 3 glass jars
- sampling device
- 3 thermometers
- 3 Secchi disks
- Science Log
- 9 2-liter plastic jugs (with tops removed)

**Vocabulary:**
- thermal pollution
- chemical pollution
- organic pollution
- pH level
- turbidity
- Secchi disk

**Procedure:**
1. Set up and observe a project that displays the effects pollution has on plants. Three plants will be given respectively, water, water with motor oil added, and water with detergent added. Students will be asked to predict how these plants (and also how aquatic plants) will be affected by polluted water.
2. Brainstorm ways water can become polluted.
3. Discuss thermal, chemical, and organic pollution and some tests we can perform to determine if any of these forms are present in Big Creek.
4. Walk to Big Creek and observe plants, and collect water samples (9 jars).
5. Break the students up into small groups to perform sampling duties.
6. Test 3 samples of water to determine the pH level, 3 samples to determine the temperature, and 3 samples to determine the turbidity level.
7. Upon return to classroom, the small groups will communicate their findings to the whole group. (The information will be averaged if necessary).
8. Enter the data collected, and conclusions drawn into the Science Log.
9. Set up a center for further observation, using two jars of creek water. Add fertilizer to one jar. Seal both jars and allow students to predict and observe, and make inferences about the changes that take place. Leave on display for the remainder of the unit.

**Evaluation:**
Each student’s Science Log will be checked to see if their observations, predictions, recorded data, and conclusions reveal understanding.
Day Three: How does pollution affect aquatic animals?

Objectives:
The students will identify the effects of pollution on aquatic animals.

Materials:
- Kick-seine
- Dip nets
- 14 tweezers
- 7 ice cube trays
- Gloves
- Goggles
- Reference books
- Construction paper
- Salt
- Water colors
- Tarp
- Box magnifiers
- Magniscopes

Vocabulary:
tolerant

Procedure:
1. Group the children into groups of four. Identify who will be working with the kicksaine and who will be working with dip nets.
2. Explain and model the procedure for collecting the organisms.
3. Walk to Big Creek to collect our organisms. Collect the organisms in a large container and bring back to the gym for sorting and identification.
4. Classify and count the number of organisms found.
   a. Draw conclusions on how polluted the water is.
5. Have each child chose and identify one organism to research and write a short report on.
6. Children will make a detailed picture of their chosen organism.

Evaluation:
The children’s reports and pictures will reflect what they have learned about their organism. The student’s journals will reflect the most frequent bugs found and they will write a conclusion about how polluted Big Creek is.
Day Four:  **What are some causes of pollution?**

**Objectives:**
The students will identify the different forms of pollution present in Big Creek.

**Materials:**
- Activity A: The presenter will bring the model of a town and other needed supplies.
- Activity B: cookie sheet, piece of sod, dirt, watering can, tub
- Activity C: punched out dots of various colors, and identification cards

**Vocabulary:**
- silt
- run off
- erosion

**Procedure:**
- Activity A: 1. Discuss ways water can become polluted.
  2. Using the model, demonstrate how different pollutants can get into the water through run off (ex: car oil, fertilizer etc).
- Activity B: 1. Using the model, demonstrate how an overabundance of dirt in the water can also be harmful.
  2. Discuss the term silt, and how it can harm a river
- Activity C: 1. Each group receives a supply of dots that they must sort and identify in order to find out if their river is polluted or not.

**Evaluation:**
Students will participate in a small group simulation called “Deadly Waters”. Through this game each group will explore the consequences of different forms of pollution. Each group will communicate the conclusions they came to after playing the game in their Science Logs, and to the whole class.

Students will record what forms of pollution are affecting Big Creek in their Science Log.

Observing each student’s participation in the simulation, and review of the Science Log entries will be used to check understanding of the days’ concepts.
Day Five: What are some solutions to pollution?

**Objective:**
he students will determine what solutions are needed to make Big Creek a healthy aquatic ecosystem.

**Materials:**
- Poster board
- Markers

**Vocabulary:**
- City Council
- Awareness

**Procedure:**
1. Students will listen to a speaker from KDWP who will tell about the water quality of Big Creek, and who will also suggest actions for improving the current situation.
2. Students will brainstorm more actions that could be used to improve the quality of Big Creek’s water.
3. Students will write letters to the City Council about their findings, and possible actions or solutions they would like the Council to be aware of.
4. Students will make “Big Creek Pollution Awareness” posters to be distributed to local businesses to be displayed.

**Evaluation:**
Each student’s letter and poster will be looked at to measure understanding.