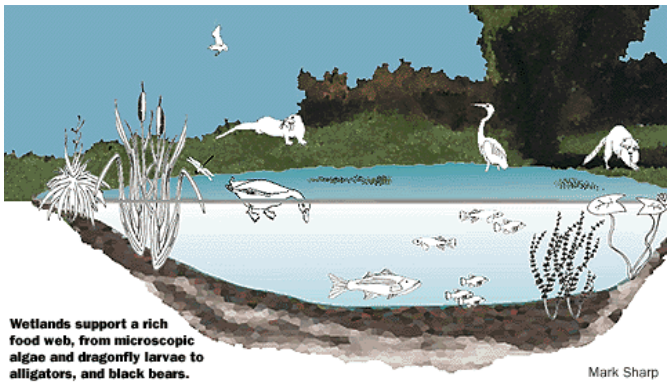
SCHOOLYARD INQUIRY WIP



Title	Comparing Health of Campus Ponds/Wetlands
Age Group	9-12
Lesson Duration	3 class periods
Year	2009
Cost	$300.

Abstract: The Mandarin High School campus in Jacksonville, FL has 4-ponds. One of them is a retention pond and the other three are in the wetlands behind the school. All of them are accessible for water quality testing and sampling of biota. This will provide an excellent site for inquiry into the human impact on the pond ecosystem in each location. This procedure will be repeated in the winter and spring.

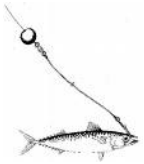
Lesson Goals: This investigation will allow the students to work together to measure and determine the biodiversity of the various ponds on campus. Students will learn the importance of biodiversity and the impact of anthropogenic disturbance. Through this investigation the students will become familiar with the inquiry process that will be used throughout the year. By learning through "guided inquiry" the students will take ownership of the learning and hopefully become informed voters and better stewards of their community.

Biology Standards, Duval County Public Schools

SC.G.1.4.1 There is great diversity and interdependence of living things on Earth.
SC.G.2.4.4 The world's ecosystems are shaped by physical factors that limit their productivity.
SC.G.2.4.5 The amount of life any environment can support is limited and that human activities can change the flow of energy and reduce the fertility of the Earth.
SC.G.2.4.6 The ways in which humans today are placing their environmental support systems at risk (e.g., rapid human population growth, environmental degradation, and resource depletion)
SC.H. 2.4.2 Scientists control conditions in order to obtain evidence, but when that is not possible for practical or ethical reasons, they try to observe a wide range of natural occurrences to discern patterns.

AP Environmental Science

1. Science is a process.
   - ❖ Science is a method of learning more about the world.
   - ❖ Science constantly changes the way we understand the world.
2. The Earth itself is one interconnected system.
   - ❖ Natural systems change over time and space.
   - ❖ Biogeochemical systems vary in ability to recover from disturbances.
3. Humans alter natural systems.
   - ❖ Humans have had an impact on the environment for millions of years.
   - ❖ Technology and population growth have enabled humans to increase both the rate and scale of their impact on the environment.



The Hook: The class will walk out to a pond that has a great deal of duckweed floating on the surface. Many of the students think that this is algae and that the pond is polluted. The students will be asked to write observations in their journals. Students will make similar observations of the other ponds on campus, including the retention pond in the front of the school.

Possible Student Questions:

Leading questions:

- What one thing stood out when you observed pond #1?
- Do you think the green stuff is affecting the living things in the pond?
- Did you see the green stuff on the other ponds?

Student Questions:

- Is pond #1 more polluted than the other ponds?
- Why is there more green matter on pond #1 than on the other ponds?
- Which pond has the most organisms living in it?

Questions for investigation:

- Does the pond with the least coverage of green floaters have greatest biodiversity?
- Does the pond most covered with green floaters have the least biodiversity?

Hypothesis:

The pond least covered with green floaters will have the greatest biodiversity.

Prediction:

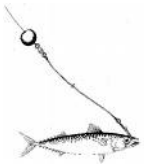
If the pond with the least coverage of green has the greatest biodiversity then the total number of species and the different species will show this as calculated with the Shannon-Weiner Diversity Index*.

Materials

Petri dishes	index cards	Microscopes
pipettes	pencil	Alcohol
Forceps	Collecting nets	Tape measure
Dissecting kits	buckets	Sling Psychrometers
Collection jars	Plastic pans	waders
Identification jars	Camera	calculators

Pre-visit: I will sample each pond for organisms and mark each pond that we will be studying. Check for fish in the ponds. Assign class historian or recruit from Photography or TV Production. Borrow waders and seine nets from Lex.

Procedure:



Day One: **The class will walk out to a pond that has a great deal of duckweed floating on the surface. Many of the students think that this is algae and that the pond is polluted. The students will be asked to write observations in their journals. Students will count off into 4-groups and record observations of the other ponds on campus, including the retention pond in the front of the school.**

- Students will return to the class and compile observations on poster paper.
- Each group will share their findings with the class.
- The class will generate a hypothesis and a prediction.

Homework: Students should view links on teacher website on how to take samples and practice on identification of macroinvertebrates. Notes on this should be included in their journal.

Day Two

- Groups will gather at the large pond for a lesson on how to gather samples using the collecting nets. Each group will be assigned a pond to sample.
- Groups will disperse to their sites and collect samples. Students will collect D-net samples in a bucket.
- Collect materials, return to class and identify samples.
- Transfer sample from bucket to flat pan
- Fill a small jar with pond water from the bucket
- Draw up organisms with a "wide mouth" pipette.
- Put the organisms in the jar
- Use the dissecting microscope to identify the macro invertebrates
- Use the compound microscope to identify plankton

Note: If we run out of time, the organisms will be preserved for the next class.

Day Three

- Finish identification. Have each group compile their data on poster paper and share with the class.
- Class will compile new questions that arise from experimental results.

Homework

- **Each group will produce a digital lab-write-up using the MS Word template for the formal lab write-up. You may include pictures. These will be printed out on the poster maker by Mr. Rekau, laminated and posted in the media center.**

  Results will be published on the APES room and The Mustang News.

This procedure will be repeated in the winter and spring.

* Shannon-Weiner Diversity Index

The Shannon Index is a measurement used to compare diversity between habitat samples. This comparison can be between two different habitats or a comparison of one habitat over time. The actual formula for the Shannon-Weiner Diversity Index is:

$$H=-\sum p_i \ln(p_i)$$

Other Shannon measurements include "S" which is the number of species present in the sample, and E which is the evenness of those species. If the E value is 1, the species are equally present in the habitat. The formula to find E is: E = H//*n*(S).

More information can be found in the math review handouts.

Resources:

Pond Sampling Procedures:
The Buglab; **BLM / USU National Aquatic Monitoring Center Department of Watershed Sciences (WATS); Utah State University, 5210 Old Main Hill, Logan, UT 84322-5210; Website: http://www1.usu.edu/buglab/**

Lentic Habitat Sampling Protocol: Same as above

Pictures of Macroinvertebrate Sampling:
Pokrzywinski, Andrea (2005). Macroinvertebrate Sampling. Retrieved June 16, 2009 from flickr: website: http://www.flickr.com/photos/andreagp/sets/1093785/

Benthic Macroinvertebrates of Our Water: EPA home (2009) Retrieved June 16, 2009. Website: http://www.epa.gov/bioindicators/html/benthosclean.html

Practice Samples (includes key): The Stream Study (1999). Retrieved June 16, 2009, from Department of Environmental Sciences, University of Virginia, Charlottesville, VA 22903 Website: http://people.virginia.edu/~sos-iwla/Stream-Study/Samples/SampleIntro.HTML

Make Your Own Plankton Net: Curry, Warren; The Plankton Net (ND) Retrieved June 16, 2009 Webpage: http://www.biosci.ohiou.edu/faculty/currie/ocean/makeanet.htm