

The Ag Pond: Dead or Alive?

A week-long *School Yard Investigation Plan* designed by Sam Long
for the Earth and Space Science students of Union County High School, Lake Butler, Florida

developed during the Oxford Institute for Environmental Education Summer Workshop, June 2009



Goals and Objectives – At the conclusion of this investigation, the student should be able to:

- ✓ determine the health of our campus' agricultural pond through measurements of water quality, chemistry, and biodiversity
- ✓ develop observation and questioning skills
- ✓ practice a scientific "method" of experimentation as a process to learn about the world
- ✓ communicate results of an experiment to expand the body of knowledge that is Science
- ✓ institute good will through co-operation with Agriculture, and English departments
- ✓ establish a foundation for extensions leading to a science fair projects

Correlations –

Florida Sunshine State Standards for Science

- ✓ **SC.912.L.17.1** – Discuss the characteristics of populations, such as number of individuals, age structure, density, and pattern of distribution.
- ✓ **SC.912.L.17.2** – Explain the general distribution of life in aquatic systems as a function of chemistry, geography, light, depth, salinity, and temperature.
- ✓ **SC.912.L.17.3** – Discuss how various oceanic and freshwater processes, such as currents, tides, and waves, affect the abundance of aquatic organisms.

- ✓ **SC.912.L.17.4** – Describe changes in ecosystems resulting from seasonal variations, climate change and succession.
- ✓ **SC.912.L.17.5** – Analyze how population size is determined by births, deaths, immigration, emigration, and limiting factors (biotic and abiotic) that determine carrying capacity.
- ✓ **SC.912.L.17.7** – Characterize the biotic and abiotic components that define freshwater systems, marine systems and terrestrial systems.
- ✓ **SC.912.L.17.8** – Recognize the consequences of the losses of biodiversity due to catastrophic events, climate changes, human activity, and the introduction of invasive, non-native species.
- ✓ **SC.912.N.1.1** – Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:
 1. pose questions about the natural world,
 2. conduct systematic observations,
 3. examine books and other sources of information to see what is already known,
 4. review what is known in light of empirical evidence,
 5. plan investigations,
 6. use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),
 7. pose answers, explanations, or descriptions of events,
 8. generate explanations that explicate or describe natural phenomena (inferences),
 9. use appropriate evidence and reasoning to justify these explanations to others,
 10. communicate results of scientific investigations, and
 11. evaluate the merits of the explanations produced by others.
- ✓ **SC.912.N.1.2** – Describe and explain what characterizes science and its methods.
- ✓ **SC.912.N.1.3** – Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented.
- ✓ **SC.912.N.1.6** – Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.
- ✓ **SC.912.N.1.7** – Recognize the role of creativity in constructing scientific questions, methods and explanations.

National Science Education Content Standards, Grades 9 – 12

- ✓ **A.1** – abilities necessary to do scientific inquiry
- ✓ **A.2** – understandings about scientific inquiry

✓ **C.4** – the interdependence of organisms

✓ **F.4** – environmental quality

✓ **G.2** – nature of scientific knowledge

The Investigation

Background – the pond on our school’s agricultural campus is a place largely avoided by students and has, to all appearances, fallen into disuse

Engaging students – “field trip” to the ag pond, students make observations, and record in their journals, that lead to student questions. [NOTE: precede with or include guidance on observations and “good” questions (?)] Things to consider may include: Would you swim in the ag pond? Why or why not? Is it an ecologically “healthy” pond? Why or why not? Are these two different things?

Observations – student generated. *Examples may include:* the pond is too “icky” for anything to live in it; the pond is not safe for human use, but is ecologically sound; observations of activity, species, etc.

Questions – student generated. *Examples may include:* What constitutes a “healthy” pond? What kinds of organisms are able to live in the ag pond? What kind of organisms might we expect to find? Why are certain types of organisms absent?

Hypothesis – student generated. *Should be similar, and can be guided toward if necessary, to:* A ‘healthy’ pond will have a wide diversity of species, both in number of species and number of organisms.

Methodology for Designing and Implementing the Investigation

Experimental design – student generated, but should include: getting samples of plankton, macro invertebrates, and fish from the pond; testing water quality for pH and various chemical elements, i.e. dissolved oxygen, nitrogen, phosphates, etc.

Materials – would include student journals, water sampling kits, various nets (seines, plankton throw nets, scoop nets), trays, and sample containers, pipettes, forceps, probes, petri dishes, stereomicroscopes, isopropyl alcohol, etc. Waders! (cheerleaders hate to get their feet wet)

Sampling sites – various locations in and around the ag pond

Predictions – student generated. *Should be linked to or restate the hypothesis, such as:* if the pond is ecologically healthy, then there should be a great diversity of life both in numbers of species and numbers of organisms.

Procedure – brainstorm to generate questions, hypotheses, procedures; work as a class, or small groups; maybe divide various aspects of the investigation (i.e. water quality, plankton, macro

invertebrates, fish) among groups and then they would have to co-ordinate/communicate their results with each other (remember how we did it @Oxford!)

Day One – “field trip” to the ag pond to make observations and questions. Return to the classroom to compare and discuss
Day Two – decide on a question and a hypothesis, develop a plan of action for testing / sampling
Day Three – return to the ag pond to collect samples – dragging the seine net, throwing and retrieving plankton net, using scoop nets to collect samples from the banks and the bottom of the pond; cleanup and storage of equipment and specimens
Day Four – analyze the samples, count and identify numbers of organisms and types of species; begin discussion of “what does it mean?” – indicate numbers of tolerant or intolerant species present [this may need to be preceded by a discussion on identifying species]
Day Five – analyze/discuss data; compare to hypothesis; derive a conclusion

Analysis & Communication – write up experiment, results, and analysis in a “professional” format

Resources – *Pond Life*, a Golden Guide from St. Martin’s Press, by George K. Reid, 2001 printing

Budget – most equipment is already available at my school, however:

✓ Water testing kit	WF-18-1540	\$310.00	tests for 100 samples
✓ D-frame net	WF-65-1297	\$158.00	
✓ Plankton net	WF-65-1260	\$123.00	150μ mesh – 5” dia
✓ Minnow Seine	WF-65-1310	\$39.95	
✓ Stereomicroscope	WF-59-1823	\$215.00	
✓ Chest Waders	WF-65-0736	\$120.00	size 8 (others available)

Prices for one each piece of equipment. SOURCE: Carolina Science Catalog (www.carolina.com)

Cross-curricular Opportunities

- ✓ Publish data and results in a “professional” format paper (coordinate with English dept). [NOTE: precede with examples of other professional writing, preferably written by students if possible]. Have students conduct peer review of each other’s work.
- ✓ Write an article and submit it for publication in the school newsletter and local newspaper

Extensions

- ✓ to perform the same analysis in other bodies of water in our county and compare results – maybe this would be an opportunity for the students to break into small groups if the initial investigation was done at a class-wide level

- ✓ if this is done at the beginning of the school year, then students would have a basis for science fair projects!
- ✓ to determine and implement a course of action that would restore the health of the ag pond, if necessary and if it meets with requirements and goals of the ag department
- ✓ students may be able to incorporate their experimentation into their future ag or biology courses
- ✓ get papers publish in student scientific journals, or even create and publish our own. Present them for peer review
- ✓ have students research similar investigations and compare results, possibly co-ordinate and collaborate with other schools in the area, or from the schools of my esteemed colleagues from OIEE!

