Lesson Title	Water Quality and Indicator Species
Length of Lesson	One (50 minute) class period
Created By	Bo Cherry
Subject	General Science
Grade Level	7th grade
State Standards	7th: 1 a,d,e (Inquiry); 4 d (Earth and Space Science)
DOK Level	DOK 3
DOK Application	Distinguish, Compare, Classify
National Standards	5-8: A (Inquiry); C (Life Science)
Graduate Research Element INTERNATIONAL: Poland	My thesis research is about water quality in Smith County, Mississippi

Student Learning Goal:

MS 7th Grade:
(Inquiry) 1 (a) Design, conduct, and draw conclusions from an investigation that includes using experimental controls. (DOK 3); 1 (d) Organize data in tables and graphs and analyze data to construct explanations and draw conclusions. (DOK 3); (e) Communicate results of scientific procedures and explanations through a variety of written and graphic methods. (DOK 2); (Earth and Space Science) 4 (d) Conclude why factors, such as lack of resources and climate can limit the growth of populations in specific niches in the ecosystem. (DOK 2)

National Science Education Standards of Content 5-8:
(Inquiry - A) Use appropriate tools and techniques to gather, analyze, and interpret data; (Life Science - C) Diversity and Adaptations

Materials Needed (supplies, hand-outs, resources)
Handout for note-taking and exercise (INSPIRE_HO_Cherry_04_15_12), Graph Paper, Computer, Projector, Powerpoint (INSPIRE_PP_Cherry_04_15_12), Paper Bags (~30), Poker chips or other colored objects

Lesson Performance Task/Assessment:
This lesson will discuss water quality, how waters are impaired, and how scientists measure water quality. A brief lecture will provide students with the information that they need to complete the activity for the lesson. Because it is hard to find a time and the budget to take students to the streams and actually perform water quality monitoring, a in-class activity is designed to help students understand the fundamentals of what scientists actually do in the field. After the powerpoint presentation, students will be put into assigned groups of 3-4. Each group will be given a bag of colored objects (poker chips or candies). The bags represent "grab samples" taken at various streams. In order to complete the activity in one class period, students will be given three bags. Each bag should represent a local stream, and each contains a certain number of each colored object. The objects should represent indicator species found in the local environment. A handout will be given to each group which contains all the information they need to assess their samples (INSPIRE_HO_Cherry_04_15_12). Students will count their indicator species and decide if the water quality is poor, fair, good, or excellent. They will then create a bar graph depicting their data. If time permits, each group can present their data to the class and discuss their conclusions.

Lesson Relevance to Performance Task and Students:
Students will understand the importance of water quality as it relates to drinking water and ecosystems. Many students neglect the importance of healthy ecosystems when considering water quality. This lesson will provide students the understanding to realize that there are many ways water quality is important. Not only will students see this was an academic learning experience, but the lesson will also show students a potential career path as an environmental scientist or ecologist.

Anticipatory Set/Capture Interest:
The instructor will set out three glasses of water. One will be clear, one muddy, and the third will appear to be muddy and contain solid particles. This third glass will actually be drinking water with crushed Oreos inside to make it appear muddy. The students will guess which of the two glasses were collected from nearby streams, but the instructor will drink the third glass, causing the students to be interested!

Guided Practice:
Guided Practice will be included in the lecture portion of the lesson when the instructor explains how indicator species are used by scientists and gives real-world examples.

Independent Practice:
The students will work independently in groups to determine the quality of their "grab samples." Each group will also be challenged to graph their data on graph paper.

Remediation and/or Enrichment:
Remediation - Individual IEP; allow this to be a two day lesson.
Enrichment – Plan a trip to a local stream to actually identify some of the indicator species present in the water systems. Also, have students identify activities in their town that could be harmful to water quality.

Check(s) for Understanding:
The check for understanding in the lesson is the finished graph along with the groups' explanation of the quality of their water "samples." If students understand, then they will understand that streams with greater biodiversity are typically of better water quality, and that certain species are better indicators of good water quality.

Closure:
Question 1: Why do organizations continue to monitor streams over several years?

Question 2: What are some ways that you see that humans could negatively affect the local streams?

Possible Alternate Subject Integrations:
Life Science, Earth Science, Ecology

Teacher Notes:
Lux 1 – few species and what few species you have, low numbers of each. This is the "worst" stream and students should note the industrial setting from which the sample was taken.
Lux 2 – all species should be present and in relatively high numbers. This is the "best" stream as it is away from urban areas, and covered mostly by forest.
Lux 3 – around half of the species present and the numbers varying. This is representative of an agriculturally affected area and should be second in the ranking order.