## Forestry Suppliers Lesson Plan

# Aquatic Life

**Forestry Suppliers' Water Monitoring F.I.E.L.D. Kit™**
**Fundamental Investigation of the Environment Leading to Discovery™**
*Study Kit Correlated to National Science Education Content Standards*

If you're interested in water monitoring for classroom activities, consider the Forestry Suppliers' Water Monitoring F.I.E.L.D. Kit. Use the kit for the exercises outlined in this Lesson Plan, as well as other related activities (see "Further Studies" section for a few ideas).

This F.I.E.L.D. Kit is available exclusively from Forestry Suppliers and includes some of the items used in this lesson plan. All kit items may also be purchased individually. Call our Sales Department at 1-800-647-5368 or visit us on the web at www.forestry-suppliers.com.

**Fields of Study:**
- Biology
- Ecology
- Environmental Science

**National Science Education Content Standards Correlation**

| Grades | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| K-4 | ✓ | | ✓ | | ✓ | ✓ | |
| 5-8 | ✓ | | ✓ | | ✓ | ✓ | |
| 9-12 | ✓ | | ✓ | | ✓ | ✓ | |


| **Water Monitoring Kit Contents** Stock Number 36844 | | Required For This Lesson Plan | | | |
|---|---|---|---|---|---|
| Qty. | Description | K-4 | 5-8 | 9-12 | Stock Number |
| 1 | LaMotte® Bug Kit™ | ✓ | | ✓ | 76606 |
| 1 | GREEN Low Cost Water Monitoring Kit | | | | 76648 |
| 1 | Turbidity & Transparency Tube | ✓ | | ✓ | 77107 |
| 1 | Water Sample Bottle | ✓ | ✓ | ✓ | 77220 |
| 1 | Pocket Case Thermometer | ✓ | ✓ | ✓ | 89120 |
| 1 | Hydrometer | | | | 77949 |
| 1 | Economy Vinyl Stocking Foot Waders | ✓ | ✓ | ✓ | 93967 |
| 1 | Leaf Pack Flash Cards | | | | 76609 |

## Background

Water makes up about 70% of the Earth's surface. We cannot live without it. Our bodies are 50%-70% water. Through the processes of the water cycle, the water that is found in a particular source is recycled. Since we will not be receiving new supplies of water from outside the earth's environment, we must be good stewards of our aquatic sources.

Having a strong knowledge and understanding of our aquatic ecosystems enables us to know how to take the necessary steps in "taking care" of these important environments. Whether it is a small pond or a large winding river, each aquatic source provides a specific home for certain plants and animals. There are many aquatic species of plants and animals. The water is their home. A lot of "life" is found in just one drop of pond water. You can easily find euglena, paramecium, "water bears" (tardigrades), water fleas (daphnia), planaria, algae, and many other species of plants and animals. We tend to be unaware of all the organisms that exist within an aquatic system because they are not seen by our eyes without magnification. Sometimes we mistake a common aquatic plant, duckweed, for slime without taking an important second look. While passing by an aquatic source, we could easily think the green stuff floating on the water's surface is "slime" and not an aquatic plant that serves as an important food source for many organisms.

Ponds, lakes, streams, rivers, and marshes are affected by surrounding land areas. If farmland surrounds an aquatic system, attention and care must be given to the possible effects farming chemicals may have on the water source. Herbicides and pesticides are used by farmers to ensure the production of healthy and high yield crops. However, consideration must be given to the possible effects the use of herbicides and pesticides may have on aquatic life now and in the future.

Atmospheric pollution can also have an adverse effect on water sources. Acid rain is caused by the introduction of chemical compounds from the burning of petroleum products and other industrial pollution. Sulfur and nitrogen compounds originate from this pollution and are introduced into the atmosphere where they combine with water and "fall" as acidic precipitation in the form of rain, snow, or sleet.

It is important that even the youngest student has a true understanding of the aquatic ecosystems within his or her environment. Identifying the flora and fauna within an ecosystem as well as understanding the behavior and interrelationships will open a new area of enlightenment and understanding. The following activities will provide an introduction and foundation for continued aquatic studies. With this kind of knowledge base, young people can be and will become better stewards of their environment.

## Procedure

1. Select an aquatic source site where safe collection of water and aquatic specimens can be performed. For safety reasons, students must be accompanied by the teacher at all times. A stream, creek, pond, or marsh area is desirable.
2. Secure the water sampler. Follow included instructions so that sampler can be thrown or "cast out" into the water source and then deployed for water collection. Younger students may need assistance with the sampler. Place water in a plastic container or bucket for later observations.
3. With an eyedropper, obtain a drop of the collected water. Using a field, student or standard microscope, view a drop of collected water that has been placed on a depression slide. If you do not have a depression (well) slide, then carefully place on a regular microscope slide. Do not use a cover slip. View the water droplet on low magnification, careful not to place objective into water droplet.
4. Look for movement of small organisms. When you have located this movement, increase the magnification and focus to view the organisms for possible identification. Use a guide (pictorial) for pond life identification. The following two sources are good for identification sources:

   LaMotte Leaf Pack Flash Cards
   LaMotte Bug Kit™
5. Commonly found aquatic organisms:

   **Euglena** has a whip-like tail called flagella.
   **Daphnia** (water fleas) resembles a flea. You can easily see internal movement caused by the circulatory system.
   **Hydra** equipped with tentacles for capturing food.
   **Amoebae** changes shape, projects a pseudopodia, false foot for movement.
   **Paramecium** about the size of a period at a sentence's end, elongated and resembles a slipper or footprint.
   **Volvox** a colony organism with hundreds of bi-flagellated cells embedded in a gelatinous wall.

   Viewing larger organisms through a DiscoveryScope® is an excellent optional activity. This provides 10x magnification while the organism is held in an enclosed clear plastic case.
6. If possible, take soil or sand samples at the water's edge. This can easily be accomplished by using a digging tool, shovel or aquatic suction sampler. After the sample has been obtained, place in a small opening sieve. "Wash" the soil or sand through the sieve with water. Retrieve the now visible, collected organisms carefully; use extra caution to avoid being pinched by crayfish or other similar organisms. Place collected organisms in bucket or plastic bag with a small amount of water if needed. Make sure that organisms are not retained in plastic bags for too long.
7. Contact your local Soil and Water Conservation Agency to find out what the normal expected pH level should be for such an aquatic source. Check and record the pH of the water from the aquatic source using Hydrion™ pH Paper or a pH meter. For accuracy, repeat the test twice. For background information on pH, see the Lesson Plan "Determining Soil pH", K-4 and 5-8.
8. Using an appropriate thermometer, measure the temperature of the aquatic source and record. For accuracy, repeat the process twice.
9. Prepare a data sheet for recording and analyzing the collected data. Include all observed aquatic plant and animal life, pH value, and temperature reading.

## Further Studies

- Guide students in completing research concerning aquatic insect larvae and adult forms found in the water source. A listing of common aquatic insects would be helpful.
- For a good comparison, conduct the same procedure outlined at one or two additional aquatic sites. Attention should be given concerning the population of aquatic flora and fauna found at each site. If detectable differences are noted, then discuss whether pH and temperature variations may be affecting the presence and growth of particular species. Use a pH meter to test pH value for comparison.
- If possible, isolate daphnia and hydra found in the water sample and place together on depression slide. The hydra is a natural predator of the daphnia. Observe for possible aggressive behavior toward the daphnia by the hydra.
- A daphnia's heart rate can be measured or observed. Use a descriptive drawing of the daphnia's anatomy to find the heart area and measure the heart rate during 30 seconds, 60 seconds, etc. A watch with a sweep second hand or stopwatch will need to be used.
- Discuss an aquatic ecosystem and food chains, giving attention to the importance of all species within an ecosystem as well as the negative effect pollution run-off can have on a system.
- Using a Tasco® Big Screen Microscope, prepare a well slide with water samples to provide a more detailed view of the organism and plant life present.
- Students may study the turbidity of the selected aquatic source, perform a macroinvertebrate study, determine the dissolved oxygen level, phosphate and nitrate level, and presence of coliform bacteria by using the Forestry Suppliers Water Monitoring F.I.E.L.D. Kit. Other extended study kits include the LaMotte Leaf Pack Experiment Kit and the LaMotte Bug Kit.

# Grades K-4

## Rubric

- Students should be able to identify the selected aquatic source as a river, stream, marsh, pond, etc.
- Students should be able to discuss and identify common aquatic plants and animals.
- Students should be able to explain the procedure(s) for determining pH and temperature of an aquatic source.

## Assessment

- Teacher will ask students to list five common aquatic insects and three common aquatic plants.
- Teacher will have students discuss the definition and importance of an ecosystem.
- Students will describe in detail the life cycle habits and "uniqueness" of their favorite insect or plant found in the aquatic source.

*These lesson plans are provided for the benefit of science educators and can be freely downloaded from our web site at www.forestry-suppliers.com. If you have an idea or other suggestions for future lesson plans, we'd like to hear from you! Send an e-mail to fsi@forestry-suppliers.com.*

## Content Standards Covered

**A** Science as inquiry
- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry

**C** Life Science
- Characteristics of organisms
- Life cycles of organisms
- Organisms and environments

**E** Science and Technology
- Abilities of technological design

**F** Science in Personal and Social Perspectives
- Changes in environments
- Science and technology in local challenges

## Required Materials

| | |
|---|---|
| Student Water Sampler | 77220 |
| Student Microscope | 60054 |
| Bucket | 54028 |
| Plastic Collection Bags | 79147 |
| Shaker Sieve | 77252 |
| Hydrion pH Paper | 78105 |
| Armor Case Pocket Thermometer | 89318 |
| Glass Eyedropper | 53679 |

## Additional Materials Needed

*Supplied by Teacher/Student(s)*

- Student Water Sampler
- Microscope and Microscope slides
- Data Collection Sheet
- Identification Key for Aquatic Plant & Animal Life
- Collection Container
- Sieve
- Hydrion pH Paper
- Thermometer
- Shovel or Digging Tool

## Optional Items

Optional Items that can be used to enhance the lesson plan.

| | |
|---|---|
| Waders | 93967 |
| DiscoveryScope | 61098 |
| Tasco Big Screen Microscope | 61040 |
| Aquatic Suction Sampler | 77254 |
| Digital Stopwatch/Clock | 92637 |
| Lighted Portable Microscope | 61232 |
| LaMotte Leaf Pack Flash Cards | 76609 |
| LaMotte Leaf Pack Experiment Kit | 76605 |
| LaMotte Bug Kit | 76606 |

## Background

Water is very important to our lives. We cannot live without it! Water composes 70% of the Earth's surface environment. Our body weight is made up of 50%-70% water by weight. In our environment, we are surrounded by water; above us in the earth's atmosphere, water droplets compose clouds and eventually fall as rain, sleet, or snow. Below the surface of the earth, water can be found in aquifers. An aquifer is an underground formation of permeable rock or loose material that can produce useful quantities of water when tapped by a well. The rain that fell on early man thousands of years ago is still around today. It has been recycled thousands of times.

Water is known as the universal solvent because it successfully dissolves so many substances. Man has sometimes overlooked the value of water's composition and the great need for water. We have not always been sensitive enough to the responsible stewardship of natural resources, specifically water. Currently, there is much concern about water pollution, global warming of oceans, the introduction of acid rain into aquatic sources, and agricultural run-off composed of pesticides and herbicides. These sources of pollution can affect all types of aquatic sources including streams, rivers, lakes, ponds, and marshes.

Knowing the composition of an aquatic body or water source is very important. Significant compositional factors are temperature, pH level, dissolved oxygen level, nitrate levels and turbidity. Turbidity indicates the clarity or “clearness” of the water. The more “murky” the water, the higher the turbidity level. Visibility is limited in a very turbid water source. The ability of light to penetrate a body of water is directly related to the turbidity. If only a small amount of light can “pass through”, the light will not reach the entire depth of the water. Without light, plants cannot complete the photosynthetic cycle. If they are unable to complete this cycle, the plant cannot survive. A high turbidity level can be caused by suspended particles from a specific run-off source, over-growth of algae, or elevated activity of “bottom-dwellers”. An elevation in turbidity can cause depletion in oxygen content, thus having a negative effect on the ecosystem.

Dissolved oxygen content is crucial to the health of an aquatic ecosystem. The need for appropriate oxygen levels is vital for optimum growth and health of aquatic plants and animals. Some fish species prefer higher oxygen content while "bottom-dwellers" thrive in lower dissolved oxygen environments.

By completing this activity, students will learn how many different factors influence the overall health of an aquatic environment as well become better stewards of their own environment.

## Procedure

1. Select an aquatic source site where safe collection of water and aquatic specimens can be performed. For safety reasons, students must be accompanied by the teacher at all times. A stream, creek, pond, or marsh area is desirable. Test three different sites if possible for comparative studies.
2. Secure the water sampler. Follow included instructions so that sampler can be thrown or “cast out” into the water source and then deployed for water collection. Place water into plastic container or bucket for later observations.
3. With an eyedropper, obtain a drop of collected water. Using a field, student or standard microscope, view a drop of collected water that has been placed on a depression slide. If you do not have a depression slide (well slide), use a regular microscope slide. Do not use a cover slip, and carefully view the water droplet on low magnification. Do not place the objective into the water droplet.
4. Look for movement of small organisms. When you have located this movement, increase the magnification and focus to view the organisms for possible identification, using a guide (pictorial) for pond life identification. The following two sources are good for identification sources:
   LaMotte Leaf Pack Flash Cards
   LaMotte Bug Kit
5. Commonly found aquatic organisms:
   **Euglena** has a whip-like tail called flagella.
   **Daphnia** (water fleas) resembles a flea. You can easily see internal movement caused by the circulatory system.
   **Hydra** equipped with tentacles for capturing food.
   **Amoebae** changes shape, projects a pseudopodia, false foot for movement.
   **Paramecium** about the size of a period at a sentence’s end, elongated and resembles a slipper or footprint.
   **Volvox** a colony organism with hundreds of bi-flagellated cells embedded in a gelatinous wall.

   Viewing larger organisms through a DiscoveryScope is an excellent optional activity. This provides 10x magnification while the organism is held in an enclosed clear plastic case.
6. If possible, take soil or sand samples at the water’s edge. This can easily be accomplished by using a digging tool, shovel or aquatic suction sampler. After the sample has been obtained, place into a small opening sieve. “Wash” the soil or sand through the sieve with water. Retrieve the now visible, collected organisms carefully; use extra caution to avoid being pinched by crayfish or other similar organisms. Place collected organisms in bucket or plastic bag with a small amount of water if needed. Make sure that organisms are not retained in plastic bags for too long.
7. Check and record the pH of the water from the aquatic source by using Hydrion™ pH Paper or a pH meter. Determine if the measured pH is normal by contacting your local Soil and Water Conservation Agency. For accuracy, repeat the test twice. For background information on pH, see the Lesson Plan “Determining Soil pH”, K-4 and 5-8.
8. Using a thermometer that measures in Celsius degrees, take a temperature reading of the body of water. Repeat the process twice for accuracy.
9. Measure the dissolved oxygen level of the selected water source by completing the steps listed in the kit instructions. If possible, repeat the test twice for accuracy.
10. Using a secchi disc or a turbidity tube, measure the turbidity of the source. You will also want to repeat this test twice for accuracy.
11. Using an aquatic net, sweep through the water’s upper level taking care to collect surface organisms and plants. Remove organisms and place in plastic collection bags or a suitable container. Do the same for plants collected.
12. Record all readings and observations on a data sheet.
13. Review data when completed with all testing and observations. Make specific observations for any noted differences if two or three sites were involved in the testing. Using a reference book on aquatic plants, insects, macro-invertebrates and micro-invertebrates, attempt to identify as many species as possible.

## Further Studies

- Have students sketch drawings of collected plants and organisms when viewed with the naked eye or microscope.
- Have students graph numerical data from each of the three sites and make correlated observations.
- Using the Forestry Suppliers’ Water Monitoring F.I.E.L.D. Kit, complete an extended study of the macro-invertebrates present in the selected aquatic sites.
- Using a depth recorder, compare the depth and temperature differences of the selected aquatic test sites.
- Using an aquatic suction sampler and a sieve, collect organisms which may burrow into the sand or mud found at the water’s edge. After collecting in the sieve, place organisms in a plastic bag or collection container.
- Using the LaMotte Pondwater Tour, complete the directed activities and record observations.
- Students will conduct research concerning the following terms:
  - Storm Run-off
  - Aquifers
  - Herbicide
  - Non-point Source Pollution
  - Pesticide
  - Acid Rain
  - Agricultural Run-off
  - Industrial Pollution
  - Hydrologic Cycle
  - Ground Water
  - Aquatic Ecosystems
  - Aquatic Food Chain

# Grades 5-8

## Rubric

- Students should be able to describe the different categories of aquatic sources (marsh, pond, lake, etc).
- Students should be able to describe the testing procedures completed and the purpose of each.
- Students should exhibit a specific knowledge of what organisms would be found in a similar aquatic system to that which was tested.

## Assessment

- Teacher will have students sketch three to five of the plant species found, as well as, three to five aquatic insects or other macro-organisms.
- Students will describe the different factors that can be measured and affect aquatic life.
- Teacher will have students explain how each observed or collected plant or organism plays an important role in the life of an aquatic system.

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## Content Standards Covered

**A** Science as inquiry
- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry

**C** Life Science
- Structure and function in living systems
- Populations and ecosystems
- Diversity and adaptations of organisms

**E** Science and Technology
- Abilities of technological design

**F** Science in Personal and Social Perspectives
- Populations, resources, and environments

## Required Materials

| | |
|---|---|
| Student Water Sampler | 77220 |
| Student Microscope | 60057 |
| Oakton Waterproof pH Testr2 | 76235 |
| Bucket | 54028 |
| Plastic Collection Bags | 79147 |
| Shaker Sieve | 77252 |
| Hydrion pH Paper | 78105 |
| Armor Case Pocket Thermometer | 89318 |
| Glass Eyedropper | 53679 |

## Additional Materials Needed

*Supplied by Teacher/Student(s)*

- Microscope slides
- Data Collection Sheet
- Identification Key for Aquatic Plant and Animal Life
- Collection Container
- Secchi Disc or Turbidity Tube
- Dissolved Oxygen Test Kit
- Aquatic Net
- Shovel or Digging Tool

## Optional Items

Optional Items that can be used to enhance the lesson plan.

| | |
|---|---|
| Waders | 93967 |
| DiscoveryScope | 61098 |
| Tasco Big Screen Microscope | 61040 |
| Aquatic Suction Sampler | 77254 |
| Lighted Portable Microscope | 61232 |
| LaMotte Leaf Pack Flash Cards | 76609 |
| LaMotte Leaf Pack Experiment Kit | 76605 |
| LaMotte Bug Kit | 76606 |
| LaMotte MacroMania | 76696 |
| LaMotte MacroMania Expansion Kit | 76697 |
| Protozoan Quieting Solution | 76590 |
| Reference: Vernal Pools Natural History & Conservation | 76595 |
| Reference: Guide to Common Freshwater Invertebrates of North America | 76591 |
| Resource: Poster Ecology of Vernal Pools | 76655 |

# Grades 9-12

## Background

Water is very important to our lives. We cannot live without it! Water composes 70% of the Earth's surface environment. Our bodies are 50%-70% water by weight. In our environment, we are surrounded by water; above us in the earth's atmosphere, water droplets compose clouds and eventually fall as rain, sleet, or snow. Below the surface of the earth, water can be found in aquifers. An aquifer is an underground formation of permeable rock or loose material that can produce useful quantities of water when tapped by a well. The rain that fell on early man thousands of years ago is still around today. It has been recycled thousands of times.

Water is known as the universal solvent because it successfully dissolves so many substances. Man has sometimes overlooked the value of water's composition and the great need for water. We have not always been sensitive enough to the responsible stewardship of natural resources, specifically water. Currently, there is much concern about water pollution, global warming of oceans, the introduction of acid rain into aquatic sources, and agricultural run-off composed of pesticides and herbicides. These sources of pollution can affect all types of aquatic sources including streams, rivers, lakes, ponds, and marshes.

Knowing the composition of an aquatic body or water source is very important. Significant compositional factors are temperature, pH level, dissolved oxygen level, nitrate levels and turbidity. Turbidity indicates the clarity or "clearness" of the water. The more "murky" the water, the higher the turbidity level. Visibility is limited in a very turbid water source. The ability of light to penetrate a body of water is directly related to the turbidity. If only a small amount of light can "pass through", the light will not reach the entire depth of the water. Without light, plants cannot complete the photosynthetic cycle. If they are unable to complete this cycle, the plant cannot survive. A high turbidity level can be caused by suspended particles from a specific run-off source, over-growth of algae, or elevated activity of bottom-dwellers. An elevation in turbidity can cause depletion in oxygen content, thus having a negative effect on the ecosystem.

Dissolved oxygen content is crucial to the health of an aquatic ecosystem. The need for appropriate oxygen levels is vital for optimum growth and health of aquatic plants and animals. Some fish species prefer higher oxygen content while bottom-dwellers thrive in lower dissolved oxygen environments.

Acid rain pollution also affects an aquatic system in a negative manner. The optimum pH level is important for the survival of aquatic plants and animals.

An aquatic system is a complex ecosystem of interdependence between plants and animals and a delicate balance of compositional factors. Only with a specific knowledge of this can we really take care of these systems. By completing this activity, students will learn how many different factors influence the overall health of an aquatic environment as well become better stewards of their own environment.

## Procedure

1. Select three different aquatic source sites where safe collection of water and aquatic specimens can be performed. For safety reasons, students must be accompanied at all times. A stream, creek, pond or marsh area is desirable. Test three different sites if possible for comparative studies.

2. Secure the water sampler. Follow included instructions so that sampler can be thrown or "cast out" into the water source and then deployed for water collection. Place water into plastic container or bucket for later observations.

3. With an eyedropper, obtain a drop of the collected water. Using a field, student or standard microscope, view a drop of collected water that has been placed on a depression slide. If you do not have a depression slide (well slide) then carefully place on a regular microscope slide. Do not use a cover slip. View the water droplet on low magnification, careful not to place objective into water droplet.

4. Look for movement of small organisms. When you have located this movement, increase the magnification and focus to view the organisms for possible identification, using a guide (pictorial) for pond life identification. The following two sources are good for identification sources:
   LaMotte Leaf Pack Flash Cards
   LaMotte Bug Kit

5. Commonly found aquatic organisms:
   **Euglena** has a whip-like tail called flagella.
   **Daphnia** (water fleas) resembles a flea. You can easily see internal movement caused by the circulatory system.
   **Hydra** equipped with tentacles for capturing food.
   **Amoebae** changes shape, projects a pseudopodia, false foot for movement.
   **Paramecium** about the size of a period at a sentence's end, elongated and resembles a slipper or footprint.
   **Volvox** a colony organism with hundreds of bi-flagellated cells embedded in a gelatinous wall.
   Viewing larger organisms through a DiscoveryScope is an excellent optional activity. This provides 10x magnification while the organism is held in an enclosed clear plastic case.

6. If possible, take soil or sand samples at the water's edge. This can easily be accomplished by using a digging tool, shovel or aquatic suction sampler. After the sample has been obtained, place into a small opening sieve. "Wash" the soil or sand through the sieve with water. Retrieve the now visible, collected organisms carefully; use extra caution to avoid being pinched by crayfish or other similar organisms. Place collected organisms in bucket or plastic bag with a small amount of water if needed. Make sure that organisms are not retained in plastic bags for too long.

7. Check and record the pH of the water from the aquatic source by using Hydrion pH Paper or a pH meter. Determine if the measured pH is normal by contacting your local Soil and Water Conservation Agency. For accuracy, repeat the test twice. For background information on pH see the Lesson Plan "Determining Soil pH", K-4 and 5-8.

8. Using a thermometer that measures in Celsius degrees, take a temperature reading of the body of water. Repeat the process twice for accuracy.

9. Measure the dissolved oxygen level of the selected water source by completing the steps listed in the kit instructions. If possible, repeat the test twice for accuracy.

10. Using a secchi disc or a turbidity tube, measure the turbidity of the source. You will also want to repeat this test twice for accuracy.

11. Using an aquatic net, sweep through the water's upper level taking care to collect surface organisms and plants. Remove organisms and place in plastic collection bags or a suitable container. Do the same for plants collected.

12. Record all readings and observations on a data sheet.

13. Review data when completed with all testing and observations. Make specific observations for any noted differences if two or three sites were involved in the testing. Using a reference book on aquatic plants, insects, macro-invertebrates and micro-invertebrates, attempt to identify as many species as possible.

## Further Studies

- Guide students in completing research concerning the following topics:
  - Total water supply of earth
  - How much water evaporates into the atmosphere?
  - Hydrologic cycle
  - Where is freshwater stored?
  - Water table
  - Aquifers
  - Urbanization
  - How much water is stored in glaciers and icecaps?
  - Storm run-off
  - Sinkholes
  - Storm sewers
  - Urban run-off
  - Pesticides present in groundwater
  - Waterborne pathogens
- Have students research the aquatic needs of trout versus catfish.
- Have students specifically compare the population make-up of each of the selected sites. Cite plants, insects, micro and macro invertebrates present.

# Grades 9-12

## Rubric

- Students should be able to specifically describe, based on population make-up, three aquatic macro-invertebrates.
- Students should be able to describe and give the life cycle of three aquatic plant species and three aquatic macro-invertebrates.
- Students should be able to discuss possible pollution sources that may affect the test sites.

## Assessment

- Teacher will quiz students concerning importance of the factors tested (dissolved oxygen, pH level, etc.).
- Teacher will have students explain the importance and delicate balance of an ecosystem.
- Teacher will have students explain and define pollution sources, specifically those that may affect their local aquatic sources.

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## Content Standards Covered

**A** Science as inquiry
- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry

**C** Life Science
- Interdependence of organisms
- Behavior of organisms

**E** Science and Technology
- Abilities of technological design

**F** Science in Personal and Social Perspectives
- Natural resources
- Environmental quality

## Required Materials

| | |
|---|---|
| Student Water Sampler | 77220 |
| Student Microscope | 60057 |
| Oakton Waterproof pH Testr2 | 76235 |
| Bucket | 54028 |
| Plastic Collection Bags | 79147 |
| Shaker Sieve | 77252 |
| Hydrion pH Paper | 78105 |
| Armor Case Pocket Thermometer | 89318 |
| Glass Eyedropper | 53679 |
| Secchi Disc | 77179 |
| Turbidity Tube | 77107 |
| Dissolved Oxygen Test Kit | 77152 |

## Additional Materials Needed

*Supplied by Teacher/Student(s)*

- Microscope slides
- Data Collection Sheet
- Identification Key for Aquatic Plant and Animal Life
- Collection Container, Bucket or Re-sealable Bags
- Aquatic Net
- Shovel or Digging Tool

## Optional Items

Optional Items that can be used to enhance the lesson plan. Available from Forestry Suppliers, Inc.

| | |
|---|---|
| Waders | 93967 |
| DiscoveryScope | 61098 |
| Tasco Big Screen Microscope | 61040 |
| Aquatic Suction Sampler | 77254 |
| Lighted Portable Microscope | 61232 |
| LaMotte Leaf Pack Flash Cards | 76609 |
| LaMotte Leaf Pack Experiment Kit | 76605 |
| LaMotte Bug Kit | 76606 |
| LaMotte MacroMania | 76696 |
| LaMotte MacroMania Expansion Kit | 76697 |
| Protozoan Quieting Solution | 76590 |
| Reference: Vernal Pools Natural History & Conservation | 76595 |
| Reference: Guide to Common Freshwater Invertebrates of North America | 76591 |
| Resource: Poster Ecology of Vernal Pools | 76655 |