

## Aquatic Ecology Field Study Procedures

### Author:

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**Grade Level:** 5-8th

**Lesson Time:** 2.5-3hours

**Suggested Class Structure:** Small groups

**Subject Areas:** Science, Language Arts

### BACKGROUND



See individual lessons.

### GOAL

Students rotate through a series of stations, investigating a different aspect of aquatic ecology at each station. At the end of the field trip, students will discuss how the pieces fit together to determine the overall health of the aquatic ecosystem.

### OBJECTIVES

The students shall:

1. Use chemical and physical test to determine water quality.
2. Identify aquatic macro-organisms and explain what their presence indicated about the conditions of the habitat in which they were found.
3. Make observations about soil color, structure, and texture and draw inferences about the drainage conditions in the area around the ponds and how this relates to water quality.
4. Draw a map of the aquatic ecosystem being studied and identify key landscape features that contribute to the healthy functioning of the pond ecosystem.
5. Use an aquatic plant wheel to identify common wetland and aquatic plants and describe how they contribute to the pond ecosystem
6. Collect and observe algae living in the pond and describe how they are influenced by water quality and what contribution they make to the aquatic ecosystem.
7. Describe the key features of the pond ecosystem and summarize the interactions between the chemical, physical and biological features they have observed and studied.

### MATERIALS

- Alkalinity test kit (Lamotte # 4491)
- Barometric pressure probe
- Board
- Bottle of distilled water
- Calcium test probe
- Calculator
- Carbon Dioxide test probe
- Collection bottle
- Collection trays
- Compass
- Conductivity test kit (Lamotte #5-0039)
- D nets
- Dissolved Oxygen probe
- Dissolved Oxygen test kit (Lamotte #7414)
- Field microscope
- 18 flags
- Geotechnical gauge (Soil color/texture guides)

- GPS instrument
- Hand lenses
- *Kestrel* wind speed gauge
- Liter water
- Macroinvertebrate field study guides
- Meter stick/Yard stick
- Microscope slides and coverslips
- Nitrate probe
- Nitrate test kit (Hach #14161-33)
- Percolation can
- pH paper
- pH probe
- pH test kit (Lamotte #7462)
- Pipette
- Plankton field study guides
- Plankton sampling net
- Plastic spoons
- Protoslo
- Tape measure
- Thermometer
- Turbidity probe
- Turbidity test kit (Lamotte #5887)
- Waste bottles

## ADVANCE PREPARATION

- ✓ Gather all materials and divide into large containers for carrying

## PROCEDURES – Outline and Narrative

### 1. Introduction

Show overhead map picture of Bushkill watershed. Point out Graver. Show overhead of Graver map, point out ponds. Discuss how aquatic ecosystems at Graver are part of the Bushkill stream watershed. Show map of Delaware River Basin. Point out how the Bushkill Stream runs into the Delaware River.

### 2. Assign Stations

Explain stations and station rotations. Divide into groups and start stations. Students should record their data in their field study logbooks.

Stations are:

#### A) Water Chemistry



#### B) Aquatic Indicator Organisms



#### C) Plankton and Biodiversity



## D) Aquatic Landscapes



### 3. Collate Data

After students have completed the four stations, gather the whole class together to record all the data from all the stations. Record other data on large sheets of butcher paper. These sheets can be taken back to class for use in creating the “Aquatic Times” newspaper, or doing the optional extension activity titled “Representing the Study Site in a Diagram.”



### 4. Discussion Questions

Summarize by asking the students the following questions:

- How does the topography (lay of the land) of the area around the pond influence the pond ecosystem?

- What do the chemical parameters you measured tell you about the quality of the water in the pond or stream? Are there any areas of concern—DO, pH, turbidity, conductivity, etc.? How might these chemical parameters change as the season progresses?
- What kinds of plants were found around the pond or stream? What role do they play in the aquatic ecosystem?
- How many kinds of plankton were found in the pond? What role does the plankton play in the pond ecosystem?
- What macro-organisms were found in the pond or stream? What do they tell us about conditions in the pond? What is their role in the aquatic ecosystem?

### Optional Extension – Representing the Study Site in a Diagram - Two 50-minute sessions.

As a follow up back at school, students can create a diagram of the study site incorporating the data from all of the field trip study stations, (water chemistry, aquatic life, plankton and landscapes). A complete lesson plan for this activity can be found on the GLOBE Web site, (GLOBE Observations to Benefit the Earth), at [<http://www.globe.gov>]. Click on "Teacher's Guide/Teacher's Guide Table of Contents/Earth Systems Science/Exploring the Connections/LC2: Representing the Study Site in a Diagram." The URL for this lesson is [[http://archive.globe.gov/tctg/earth\\_la\\_connections\\_lc2.pdf?sectionID=271](http://archive.globe.gov/tctg/earth_la_connections_lc2.pdf?sectionID=271)].

## **ASSESSMENT**

- See “Aquatic Times” activity.

## **RESOURCES**

See individual lessons.

## **STATE STANDARDS FOR ENVIRONMENT AND ECOLOGY**

See individual lessons.

# Field Studies Procedures Appendix



## Copy Masters for:

Aquatic Ecology Field Study Log Book:

Cover & back page

Pages 12, 1

Pages 2, 11

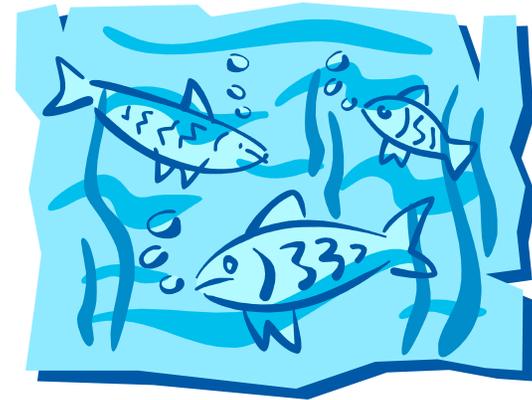
Pages 10, 3

Pages 4, 9

Pages 8, 5

Pages 6, 7

# Aquatic Ecology



**MUHLENBERG**  
COLLEGE



## Field Study Log Book

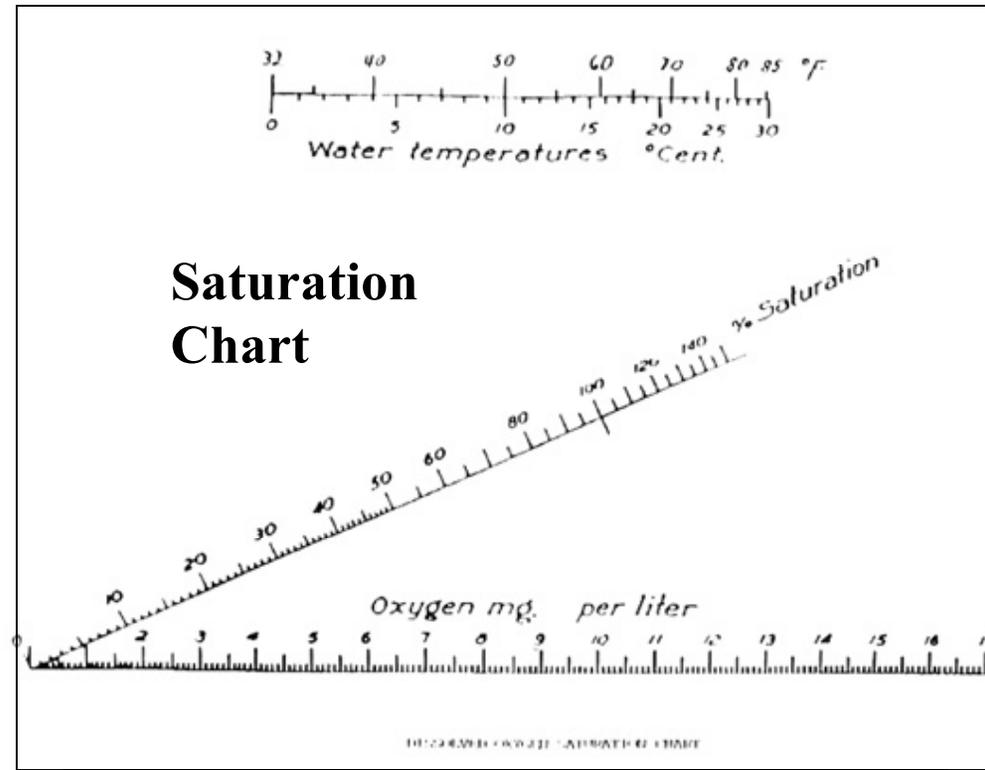
Name: \_\_\_\_\_

School: \_\_\_\_\_

Grade: \_\_\_\_\_ Year: \_\_\_\_\_

# Equipment Checklist

- Alkalinity test kit (Lamotte # 4491)
- Barometric pressure probe
- Board
- Bottle of distilled water
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- pH paper
- pH probe
- pH test kit (Lamotte #7462)
- Pipette
- Plankton field study guides
- Plankton sampling net
- Plastic spoons
- *Protoslo*
- Soil color/texture guides
- Soil moisture probe
- Stopwatch
- Tape measure
- T-bar/square
- Thermometer
- Turbidity probe
- Turbidity test kit
- Waste bottles



<i>When You Know</i>	<i>Multiply by</i>	<i>To Find</i>
<b><u>Length</u></b>		
Inches	2.5	centimeters (cm)
Feet	30	centimeters
Yards	0.9	meters (m)
<b><u>Area</u></b>		
square inches	6.5	square centimeters (cm <sup>2</sup> )
square feet	0.09	square meters (m <sup>2</sup> )
acres	0.4	hectares (ha)
<b><u>Volume</u></b>		
<b><u>Temperature (exact)</u></b>		
degrees Fahrenheit, subtract 32, multiply by 5/9 = degrees Celsius (°C)		

## Hydrology Investigation



Student/Group Name \_\_\_\_\_

Date \_\_\_\_\_

Time \_\_\_\_\_

### Temperature

Name of Test/ Equipment used	Source of Water Sample	Temperature
_____	_____	_____
_____	_____	_____

### pH Test

Name of Test/ Equipment used	Source of Water Sample	pH Result
_____	_____	_____
_____	_____	_____

### Conductivity

Name of Test/ Equipment used	Source of Water Sample	Conductivity Reading
_____	_____	_____
_____	_____	_____

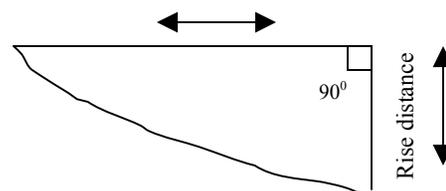
### Turbidity

Name of Test/ Equipment used	Source of Water Sample	JTUs
_____	_____	_____
_____	_____	_____

## Beaufort Wind Scale

Wind Speed (MPH)	Wind Effects Observed on Land	Terms Used in NWS Forecasts
0-1	Calm; smoke rises vertically.	Calm
1-3	Direction of wind shown by smoke drift, but not by wind vanes.	Light
4-7	Wind felt on face, leaves rustle, ordinary wind vane moved by wind.	Light
8-12	Leaves and small twigs in constant motion; wind extends light flag.	Gentle
13-18	Raises dust and loose paper; small branches are moved.	Moderate
19-24	Small trees in leaf begin to sway; crested wavelets form on inland waters.	Fresh
25-31	Large branches in motion; whistling heard in telephone wires; umbrellas used with difficulty.	Strong
32-38	Whole trees in motion; inconvenience felt walking against the wind.	Strong
39-46	Breaks twigs off trees; generally impedes progress.	Gale
47-54	Slight structural damage occurs;	Gale
55-63	Seldom experienced inland; trees uprooted; considerable structural damage occurs.	Whole gale
73 or more	Very rarely experienced; accompanied by widespread damage.	Hurricane

### Slope Calculation



$$\text{Slope} = \text{Rise distance} \div \text{Run distance}$$

### Stream Velocity and Discharge/Flow

Distance Floated \_\_\_\_\_ ft.  
 Float Time 1 \_\_\_\_\_ sec      Average  
 Float Time 2 \_\_\_\_\_ sec      Float  
 Float Time 3 \_\_\_\_\_ sec      Time \_\_\_\_\_ sec

$$\begin{array}{l} \text{Distance} \\ \text{Floated} \\ \text{(ft)} \end{array} \div \begin{array}{l} \text{Average} \\ \text{Float} \\ \text{Time} \\ \text{(sec)} \end{array} = \begin{array}{l} \text{Average} \\ \text{Surface} \\ \text{Velocity} \\ \text{(ft/sec)} \end{array} \quad \underline{\hspace{2cm}}$$

$$\begin{array}{l} \text{Cross} \\ \text{Section} \\ \text{Area} \\ \text{(sq.ft)} \end{array} \times \begin{array}{l} \text{Average} \\ \text{Velocity} \\ \text{(ft/sec)} \end{array} = \begin{array}{l} \text{Stream} \\ \text{Discharge} \\ \text{(cu.ft/sec)} \end{array} \quad \underline{\hspace{2cm}}$$

**Weather Conditions**



**Air Temperature:** \_\_\_\_\_

**Was There Precipitation in the last 48 hrs.?**

Yes  No

**Description:** Sunny  Partly  Overcast  Rain   
Cloudy

**Barometric Pressure:** \_\_\_\_\_

**Wind Speed:** \_\_\_\_\_ **Wind Direction:** \_\_\_\_\_

**Relative Humidity:** \_\_\_\_\_

**Soil Conditions**

**Soil Color:**  Lt Brown  Yellow/Orange  Green/Gray  Olive Gray  Lt Gray  Dark Gray

**Soil Texture:**  Mostly Clay (soil clumps hold their shape)  Mostly Sand  Mixture of Clay and Sand

**Soil Moisture:**  Soggy  Moist  Dry

**Type of Bedrock:** \_\_\_\_\_ **Soil pH:** \_\_\_\_\_

**Soil Percolation Rate:**

Finish Time	Start Time	Total Time	Average Rate

**Slope:** \_\_\_\_\_

**Dissolved Oxygen**

Name of Test/ Equipment used	Source of Water Sample	DO	% Saturation

**Alkalinity**

Name of Test/ Equipment used	Source of Water Sample	Alkalinity Reading

**Nitrate**

Name of Test/ Equipment used	Source of Water Sample	Nitrate Reading

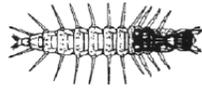
**Carbon Dioxide**

Name of Test/ Equipment used	Source of Water Sample	CO2 Reading

**Calcium**

Name of Test/ Equipment used	Source of Water Sample	Calcium Reading

# Macro Invertebrate Study



Student/Group Name \_\_\_\_\_

Date \_\_\_\_\_ Time \_\_\_\_\_

Intolerant of Low Oxygen Levels	Somewhat Sensitive to Low Oxygen Levels	Tolerant of Low Oxygen Levels
<input type="checkbox"/> case-building caddisfly larvae <input type="checkbox"/> hellgramite <input type="checkbox"/> mayfly larvae <input type="checkbox"/> riffle beetle adult <input type="checkbox"/> stonefly nymph <input type="checkbox"/> water penny larvae <input type="checkbox"/> dobsonfly larvae	<input type="checkbox"/> blackfly larvae <input type="checkbox"/> riffle beetle larvae <input type="checkbox"/> clam <input type="checkbox"/> crane fly larvae <input type="checkbox"/> crayfish <input type="checkbox"/> damselfly nymph <input type="checkbox"/> dragonfly nymph <input type="checkbox"/> scud <input type="checkbox"/> aquatic sowbug <input type="checkbox"/> alderfly larvae <input type="checkbox"/> net-spinning caddisfly larvae <input type="checkbox"/> water snipe larvae Pollution Sensitive Organisms For Ponds: <input type="checkbox"/> water boatmen and giant water bug <input type="checkbox"/> diving beetle	<input type="checkbox"/> segmented worm <input type="checkbox"/> leech <input type="checkbox"/> midge larvae <input type="checkbox"/> lunged/pouch snail <input type="checkbox"/> mosquito larvae <input type="checkbox"/> rat-tailed maggot <input type="checkbox"/> tubifex worm <input type="checkbox"/> planaria <input type="checkbox"/> horsehair worm <input type="checkbox"/> threadworm/nematode <input type="checkbox"/> pyralid/moth caterpillar
		
Boxes checked x 3 = _____ index value	Boxes checked x 2 = _____ index value	Boxes checked x 1 = _____ index value

Key of symbols used:

## Water Quality Rating:

Total Index Value = \_\_\_\_\_

- Excellent (>22)
- Good (17-22)
- Fair (11-16)
- Poor (<11)

## EPT Water Quality Rating (Streams Only)

Total number of EPT species = \_\_\_\_\_

- Excellent (>10)
- Good (6-10)
- Fair (2-5)
- Poor (<2)

Total # of species \_\_\_\_\_

Total # of tolerant species \_\_\_\_\_

EPT Count – Streams Only (Advanced)
Number of Ephemeroptera species (Mayflies)
Number of Plecoptera species (Stoneflies)
Number of Trichoptera species (Caddisflies)

## Field Map

Name of site \_\_\_\_\_

Name of water body \_\_\_\_\_

Date \_\_\_\_\_

Scale: 1/2 inch = 3 feet or 1 meter

# Aquatic Landscapes



## GPS Coordinates of Study Site

### Water Site Description:

Moving Water: Stream  River  Other  Width: \_\_\_\_\_ ft

Standing Water: Pond  Lake  Reservoir  Bay  Ditch  Other

Approximate Area \_\_\_\_\_ sq.ft Approximate Depth \_\_\_\_\_ ft Average Depth \_\_\_\_\_ ft

Cross Sectional Area \_\_\_\_\_ sq.ft = Width \_\_\_\_\_ x Average Depth \_\_\_\_\_

Is Water Bottom Visible: Yes  No  Describe The Bottom: \_\_\_\_\_

### Describe the Makeup of the Bank:

- |   |  |
|---|--|
| <input type="checkbox"/> Boulders or stones around and in the water | <input type="checkbox"/> Manmade structures          |
| <input type="checkbox"/> Fallen logs or branches in the water       | <input type="checkbox"/> Riffle areas (streams only) |
| <input type="checkbox"/> Sand bars or gravel bars                   | <input type="checkbox"/> Pools (streams only)        |
| <input type="checkbox"/> Other                                      |  |

- Erosion Evidence:  Bare soil unprotected by plants  
 Exposed plant roots  
 Cuts, ditches or steep banks where soil is being washed into pond  
 Evidence of grazing, mowing, or foot traffic  
 Trees, shrubs, grasses preserved

Estimated width of the riparian zone: \_\_\_\_\_

- Human Influences:  Drainage pipes  Dams  Litter  
 Trails/Bridges  Swimming  Boating

Describe the Habitat in Shallow Areas Near the Water's Edge: \_\_\_\_\_

- |                                     |                                   |                                      |
|-------------------------------------|-----------------------------------|--------------------------------------|
| <input type="checkbox"/> Vegetation | <input type="checkbox"/> Boulders | <input type="checkbox"/> Gravel      |
| <input type="checkbox"/> Rocks      | <input type="checkbox"/> Logs     | <input type="checkbox"/> Other _____ |

## Additional Aquatic Organisms Observed:

Fish:

Amphibians:

Birds:

Other:

## Describe Vegetation Around the Pond

Trees:

Shrubs:

Herbaceous (not woody) Plants along the Shore:

Emergent Vegetation:

Floating Plants:

# Plankton and Biodiversity



Student/Group Name \_\_\_\_\_  
 Date \_\_\_\_\_  
 Time \_\_\_\_\_

Name of Water \_\_\_\_\_  
 Body Sampled: \_\_\_\_\_

Plankton Name	Food Source	How Many	Picture

Plankton Name	Food Source	How Many	Picture

**How many different types of plankton are in the water?** \_\_\_\_\_

**Draw And Label An Aquatic Food Web of Stream Organisms**  
 Include phytoplankton, zooplankton, herbivores, carnivores, omnivores, and detritivores.