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LESSON 3

Aquatic Ecosystems—Lakes, Springs & Rivers

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LESSON 3: Aquatic Ecosystems - Lakes, Springs & Rivers

OBJECTIVES: For youth to:

- Define the terms; lake, spring, and river.
- Locate the major lakes, springs, and rivers in your county and around the state.
- Identify ways in which aquatic ecosystems are connected.
- Discover how aquatic ecosystems function.
- Describe the effects of vegetation on water quality and soil erosion in aquatic ecosystems.
- Identify common and endangered plant and animal species found in aquatic ecosystems.
- Describe examples of food webs and energy flow in aquatic ecosystems.
- Explain the ways in which humans value and utilize aquatic ecosystems.
- Explain how human activity can enhance or damage aquatic ecosystems.
- Describe ways in which people can protect aquatic ecosystems.

LESSON TIME: 45–60 minutes (up to 2 hours for field visits)

ADVANCED PREPARATION:
Read the BACKGROUND BASICS on Aquatic Ecosystems. Review activities and choose appropriate one(s) to use. Secure necessary materials as described.

PURPOSE:

To become familiar with aquatic ecosystems such as lakes, springs and streams.

DO:

Here are some learning activities and suggested ways to implement the activities in Lesson 3.

3.1 Use WHAT'S A WETLAND to locate the major bodies of freshwater in each youth's county.

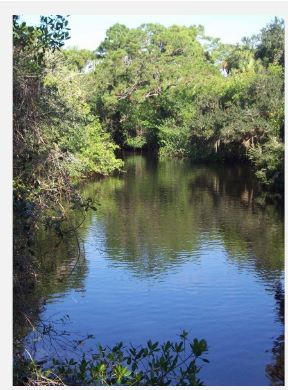
3.2 Learn to measure velocity and volume related to stream flow in RUNNING RIVERS.

3.3 Understand why stream banks, and pond edges are an important part of an aquatic ecosystem with STREAM BANK BOXES.

3.4 Use HEALTHY WATER = HEALTHY ECOSYSTEMS to learn how to perform water quality tests for a pond, lake, or river.

3.5 Analyze the kinds and numbers of species present in an aquatic ecosystem to evaluate water quality with HOW MANY BUGS DO YOU HAVE?

3.6 Discover many common and endangered plant and animal species found in local ecosystems with AQUATIC FLORA AND FAUNA.



REFLECT After completing the activities in this lesson, help youth reflect on what they learned with these questions:

- **What is the main difference between aquatic and marine ecosystems?**

  Aquatic ecosystems are comprised of all water ecosystems (including fresh and salt water) and marine ecosystems refer to saltwater ecosystems only.

- **Consider the watershed of the stream you measured. What types of human activities in the watershed might be affecting stream volume?**

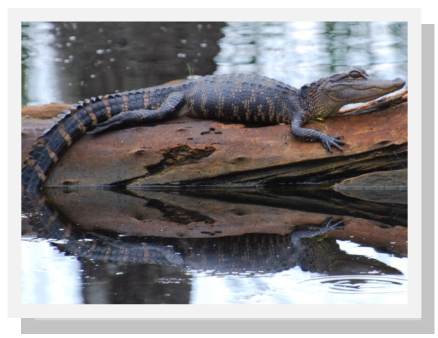
  Every change in the surface flow of water in a watershed can affect stream volume. Examples may include impoundments or diversions which reduce the volume, or many different activities that prevent rainwater absorption and increase stream volume.

- **What happens when heavy rains fall on an undisturbed watershed?**

  The water is slowly filtered through the system. The roots of the grasses, shrubs, and trees help hold the soil in place (less erosion occurs) resulting in better water quality for lakes, ponds, rivers and streams.

- **Name an animal that was threatened with extinction, but with protection is now doing better.**

  The American alligator and the bald eagle were both close to extinction, but with protection are recovering. In fact, the alligator has recovered so well it is now harvested for hide and meat in some areas of Florida.



APPLY Help youth apply what they have learned to their daily lives.

- Select another river to trace on the map. Identify its source (where it begins) and where it discharges, and any streams or springs that feed the river you have selected. If you or someone else pollutes the source of the river, could it affect other places along the river?
- How would changes in stream volume affect plant and animals in this aquatic ecosystem?
- Visit a construction site or a newly plowed farm field after a rainstorm. Can you identify the soil erosion caused by the lack of trees and plants? Write a description or draw a picture of what this erosion looks like. How might erosion effect aquatic ecosystems?

- If the temperature, dissolved oxygen, pH, alkalinity or nitrate level is not adequate for a healthy aquatic ecosystem, what could be the cause of the problem? Are the parameters interrelated?

- Plan a field trip to a nearby pond, river, or stream and make a list of common and endangered plant and animal species seen there.

BACKGROUND BASICS…

Aquatic Ecosystems: Lakes, Springs, Rivers and Streams

Florida has an abundance of fresh water with more than 7,500 **lakes** (inland bodies of standing water over one half acre in size), 1700 **rivers** and **streams** (flowing bodies of water of all sizes). Florida also has numerous **springs** (water that freely flows from an aquifer into another body of freshwater) of which 27 are of the first magnitude in volume (Meyers and Ewel, 1990). These numbers translate into a tremendous area of aquatic ecosystems that millions of Floridians and visitors enjoy and depend upon. These water resources have developed over long geologic periods. During that time many lakes and rivers have come and gone from the Florida peninsula. The aquatic ecosystems we utilize are the result of interactions between climate, past geological events, and some human intervention.

The current climatic conditions produce 50-60 inches of rain on most parts of the state during most years. The excess rainfall not used in the **evapotranspiration** process nourishes Florida's lakes, rivers and springs by surface runoff and percolation into layers of rock beneath the soil surface. This rainfall is sufficient to maintain a lush vegetative cover with many subtropical plant species present, particularly in southern Florida. Extensive pine and hardwood forests occupy much of the upland areas; cypress swamps, bayheads and wet prairies occur in the lowland areas.

Past geological events have played an important role in the formation and continuation of aquatic ecosystems. During the past several million years the Florida peninsula has been inundated by rising sea levels several times. These marine conditions allowed the formation of limestone layers that are hundreds of feet thick and underlie most of the state. These limestone layers or formations contain water that are collectively known as the **Floridian Aquifer**.

Aquifer formation occurs as water moves downward through the cracks and crevasses in the rock mantle slowly dissolving the limestone. This dissolution (by acids that naturally occur in the environment) has created an immense system of underground caverns, a natural system of "water pipes." The Floridian Aquifer not only supplies the artesian springs we see bubbling forth, but is connected to many of Florida's lakes and rivers by seepage through layers of sand and rock.

Much of Florida's lake formation occurred as recently as 3,000 to 6,000 years ago when the sea began to approach its present level. However, some lakes such as Lake Annie and Lake Tulane in Highlands County are thought to be over 30,000 years old. Lakes formed under various environmental conditions; some were simply shallow depressions that filled with the rising water table, while others were blowouts in large sand dunes left behind when sea levels fell. Lake Okeechobee, the second largest lake entirely in the United States, is believed to be an uplifted sea-floor depression (Meyers and Ewel, 1990).

Another lake formation process occurs when an immense cavern of the Floridian aquifer collapses to create a depression or "**sinkhole**." These sinkholes, may become clogged with debris, fill with water and in some instances form a circular lake. Notable examples of these types of formations are Kingsley Lake in Clay County and Deep Lake in Collier County (Meyers and Ewel, 1990).

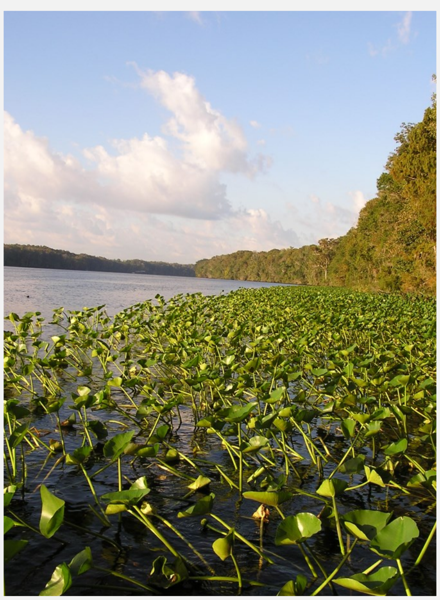
The formation of lakes is an ongoing process: new sinkholes are formed when groundwater levels fall; and humans create reservoirs, abandon phosphate mines, or create borrow pits. Whatever the process, lake ecosystems in Florida continue to undergo change caused by a variety of factors. These factors include the gradual filling of shallow lakes by sediments and decaying plant matter, as well as by human causes such as the rapid eutrophication of systems like Lake Apopka.

Florida has over 300 springs, with many of the larger springs set aside as recreational areas (Meyers and Ewel, 1990). These boils of crystal clear water attract thousands of visitors each year who come to enjoy the year round 70-74 degree water temperatures found in the springs. The spring ecosystems of Florida are far fewer in number than the lake ecosystems, but function as critical habitats for a number of plants and animals.

Some species, such as the manatee, depend on the constant temperatures of the spring water as winter havens from the cold. A number of **endemic** (organisms found only in a particular location) species are also present in the subterranean caverns associated with the larger springs.

Springs, like many of the lakes in Florida, are directly connected to the aquifers below. Therefore water quantity and **water quality** (physical, chemical, and biological attributes) are determined by the **watershed** and variations in sediments and rock strata through which the water travels. Some springs have very **soft water** (small amounts of dissolved minerals), while others including Silver Springs and Weeki Wachee have very **hard water** (large amounts of dissolved minerals). Some springs like Salt Springs and Silver Glenn Springs even have salty water that can support certain forms of marine life far from the ocean (Meyers and Ewel, 1990).

Florida's rivers and streams are also unique and varied in both water quality and the physical features within the watersheds. Water quality is directly influenced by the watershed in which the river originates and travels through; from the muddy Choctawhatchee, with the load of silt and clays it carries through the panhandle, to the St. Johns River that flows north and forms an extensive estuary at its discharge point into the Atlantic Ocean at Jacksonville.



River and stream ecosystems include habitats that are critical for the survival of endemic and endangered species such as the Okaloosa darter found in only a few sand bottomed streams of the western panhandle, and the Gulf sturgeon found in the Suwannee and other panhandle rivers. The state's rivers and streams form a web of life that directly connects the lakes and springs discussed earlier. The many dark tea colored rivers and streams are also linked to the wetland areas discussed in Lesson 2. The flow of water from these wetland areas leaches natural acids, particularly tannic acid, that are present in the decomposing vegetation and “stain” the water.

Our aquatic resources have become workhorses in many ways. Rivers are used to transport goods by barge or ship and are used to the discharge unwanted effluents from our cities and towns. Lakes, springs and aquifers provide water for residential, agricultural, and industrial consumption. Floridians have one of the highest per capita water consumption rates in the nation. Demands for domestic water use run almost twice the national average, and when coupled with agricultural uses, demand for water is exceeding available supplies in some areas of the state.

The demand for water has caused Florida to become a leader in the management of water quantity and quality. The state is divided into five water management districts, each with a respective governmental agency (e.g., the South Florida Water Management District), that are responsible for the basic protection of water within their boundaries. These agencies do not control the distribution of water to municipalities, but rather function as protectors of the watershed. Their functions include: water use permitting, wetlands protection, land acquisition, flood control and water conservation education.

Activity 1: Wetlands on the Map

OBJECTIVES: For youth to
- Define the different types of aquatic ecosystems (in addition to wetlands) in Florida.
- Locate the major bodies of freshwater in youth's county and state.

LIFE SKILLS:
- Acquiring, analyzing and using information.

SUNSHINE STATE STANDARDS
SC.6.E.6.2 Recognize that there is a variety of different landforms on Earth's surface such as coastlines, dunes, rivers, mountains, glaciers, deltas, and lakes and relate these landforms as they apply to Florida.

SC.8.N.4.2 Explain how political, social, and economic concerns can affect science and vice versa.

MATERIALS
Map of Florida (a highway will work)
- Available local maps

TIME: 45 minutes

SETTING
A comfortable room with tables and chairs.

ADVANCED PREPARATION:
Read Background Basics. Obtain materials.

INTRODUCTION

Florida has many freshwater and saltwater ecosystems. Can you guess what makes a freshwater ecosystem different from a saltwater ecosystem? (One contains a higher concentration of salts.) Florida's aquatic ecosystems include a complex system of lakes, springs, rivers and streams. Let's take a look at our aquatic ecosystems, and discover some of the similarities and differences among them.

Lakes are inland bodies of standing water over one half acre in size. Florida has many lakes, the largest one is Lake Okeechobee. There are four other large lakes in Florida (Lake George, Lake Apopka, Lake Kissimmee, and Lake Istokpoga) and more than 7,500 small lakes. Most of the lakes in Florida are shallow, usually less than 15 feet deep.

Streams and **rivers** are bodies of flowing or running water. The water in Florida's rivers may be naturally clear, muddy, or tannin stained water (tea colored). A few of the larger rivers in Florida are the St. John's, Suwannee, Withlacoochee, and Apalachicola.

Springs are places where water freely flows from an aquifer into surface water. Spring runs are the rivers or streams that result from the flow of water from a spring. Florida has more than 300 springs, many of which are very large, relative to daily flow. Some of the springs you may have heard of are Crystal River Springs, Weeki Wachee Springs, and Silver Springs.

DO

- If multiple maps are available, divide youth into groups to utilize all maps. If not, place the map in a position where everyone can see.
- Locate the lakes, rivers, and springs mentioned in italics in the introduction.
- Have youth locate rivers, lakes, and springs in their county.
- Discuss with youth that these aquatic ecosystems may be connected with each other, as well as with other types of ecosystems. For example, trace the St. John's River. The river's headwaters (source) start at Lake Helen and flow through a series of grassy marshes, widening into many lakes, such as Sawgrass, Washington, Winder, Poinsett, Harney, and Monroe. The St. John's River widens into Lake George, then flows north to Jacksonville where it empties into the Atlantic Ocean at St. George Inlet.

REFLECT

- **What is the main difference between freshwater and saltwater ecosystems?**

  Saltwater (marine) ecosystems contain much higher concentrations of salts than freshwater ecosystems.

- **What are some different types of aquatic ecosystems?**

  Lakes, springs, rivers and streams are all types of aquatic ecosystems.

- **Describe a lake.**

  A lake is a large inland body of standing water.

- **Describe a river.**

  A river is an inland body of flowing or moving water.

- **Describe a spring.**

  A spring is a place where water comes up from an underground source.

- **Name a lake, a river, and a spring (if present) in your county.**

- **Is a lake or a river an isolated ecosystem, meaning that it is not affected by and does not affect other ecosystems? Use Lake George as an example in answering this question.**

  No, a lake or river is not an isolated ecosystem. For example, Lake George is part of the St. John's River and may be affected by changes in other parts of the river. Changes in Lake George may affect other ecosystems along the river, as well as ecosystems at the inlet where the river empties into the Atlantic Ocean.

- **Why did we look at a map?**

  We looked at a map to identify different aquatic ecosystems in Florida.

- **What other things appear on the map?**

  Roads, cities, counties, state parks, national parks.

APPLY

- Select another river to trace on the map. Identify it's source (where it begins) and where it discharges, and any streams or springs that feed the river you have selected. If you or someone else pollutes the source of the river, could it affect other places along the river.
- Maps are often used to help people find their way to a particular place. Draw a map from your house to your school, naming roads and drawing in any special landmarks on the way.
- What could you use a map for besides looking for aquatic ecosystems?
- Contact your local or regional planning council and request a map of the flood zones. Determine where bodies of water are located. Would you be affected by rising water if a flood were to occur?

Activity 2: Running Rivers

OBJECTIVE: For youth to
- Define velocity and volume in relation to stream flow.
- Compute the velocity and volume of a stream.
- Explain why currents differ in different parts of a stream.
- Predict in which parts of a stream most vegetation will be found.
- Differentiate between meandering and channelized streams.

LIFE SKILLS:
- Acquiring, analyzing and using information.
- Problem Solving
- Working with groups

SUNSHINE STATE STANDARDS
SC.8.N.1.1 Define a problem from the eighth grade curriculum, plan and carry out scientific investigations such as observations, identifying variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.

MATERIALS:
- 8 sticks for markers (2-3 ft. long)
- 20 short sticks (2-3 inches long)
- 4 (at least) small oranges
- 4 stopwatches or watches with second hands
- 4 yard sticks (or any stick marked off in 6 inch increments for at least 3 feet)
- data sheet for each youth
- Pencils

TIME: 2 hours

SETTING: Stream which has been previously visited by leader.

ADVANCED PREPARATION:
Read Background Basics. Visit stream to identify areas where stream widens, narrows, and bends or curves. Review and practice the calculations for stream velocity and volume. Make copies of data sheet (1 per youth).

INTRODUCTION

In Florida, there are many different kinds of rivers and streams. There are crystal clear streams and muddy rivers, slow moving and fast moving, large, small, curvy and straight rivers and streams. There are even underground rivers. Despite these differences, most river ecosystems function similarly in nature. For example, most rivers naturally **meander**, meaning they follow a winding or curving path.

The inside and outside portions of a curve in a river can be quite different. In one part, the water moves at a slower rate. This allows more plants to grow, thus providing habitat for wildlife such as aquatic insects, snails, frogs, turtles, and fish. Can you predict in which part of a curve the water moves at a slower rate? On the other side of the curve, the current is more swift. Can you predict how this part of a river may be different than the slow moving part?

Some rivers have been **channelized** (straightened) by humans to make boat navigation easier or for drainage purposes. The **velocity** or rate of speed usually changes when a river is channelized. At higher velocities, larger particles of sediment, sand, and soil can be carried away by the current. What effect do you think that straightening a river would have on the plant and animal life?

Stream **volume** is the total amount of water flow during a given period of time. Every change in the surface flow of water in a watershed can affect stream volume. Different levels of volume can change the width, depth and velocity of a stream. In some ways rivers, streams and catchments offer an easier and less expensive source of water than wells. You don't need expensive drilling equipment and pumps to bring water deep from underground. If pollution could be kept out of our streams and catchments, these sources could be used for agricultural, industrial and residential consumption in Florida.

Today we are going to explore a river or stream and look at how the **current** (flow of water) varies in different locations. We will take some measurements to determine the velocity of the stream in these different areas. Additional measurement will also allow us to measure the stream volume.

DO

- Read through the entire activity first, then select a river or stream that will be appropriate for measuring velocity and volume.
- Timing of this activity may be important as rainy weather will affect stream flow. Do not conduct the activity after extremely hard, long rains as there may be flood danger.

(Part 1)

- Through guided inquiry, go over the information covered in the “Introduction” with youth.
- Provide an overview of what youth will be doing in the activity.
- Divide youth into four groups of at least two persons each.
- Select four sites along the stream. Select two sites where the river bends, using the outside of the curve for one and the inside of the curve for another. Use a third site where the river or stream is straight and narrow, and the fourth where it is straight and wider.
- Assign each group to one site. Have youth set up stakes ten feet apart on the bank at their site. Place stakes as close to the water as possible, without being in it.
- Have each youth sketch the river study site on the back of their data sheet, noting the placement of markers at all four sites.
- Have youth name and describe their study site on the data sheet (i.e., inside curve, outside curve, narrow straight, or wide straight).
- Ask youth to measure depth of the water somewhere between their 2 markers using the meter stick or tape measure. Record depth on data sheet.

- Ask youth to fill in observations about their site on the data sheet, commenting on type and amount of vegetation, river bank appearance (steep or gradual slope, sandy, muddy, covered with plants, etc.), and any fish, insects, or wildlife present in and around the water.
- One youth will stand at the second stake (downstream) with the watch. Another youth will hold one of the short sticks (2-3 inches) in the water next to the first stake. Youth at stake 1 should let go of the stick slightly upstream from stake 1 allowing it to travel downstream. When the small floating stick passes stake 1, youth at stake 1 should say, "GO" and timing should begin.
- The youth with watch will announce aloud the time when the stick reaches the second stake. The rest of the group should record the times on their data sheets. Have each group repeat this procedure 4 times to obtain an average speed. Have each youth take turns being the timer and releasing the stick.
- Ask someone to calculate average elapsed time (add 4 elapsed times and divide by 4), then velocity, V=D/T (divide 10 feet by average elapsed time in seconds to obtain feet per second).
- Gather all youth and visit each site together. Have group assigned to each site tell the rest of the group about their observations and their calculated velocity. Ask youth to write in velocity for each site on their sketch of the study area.

(Part 2)

- Find the width of the stream at three places within the 25 foot distance you marked. Find the average in feet.
- Find the depth of the stream in three places within the 25 foot distance you marked. Take this measurement in the center of the stream. Find the average in feet.
- Multiply the average width by the average depth. Next, multiply this product by the speed of the stream. This gives you volume of water flow, in cubic feet per second.
  Volume = Width x Depth x Velocity.

REFLECT

- **What is the name of the river or stream you visited?**

- **What do we mean when we say a stream follows a meandering course?**

  A stream following a meandering course does not flow in a straight line, but has curves and bends.

- **What is velocity?**

  Velocity is a measurement of the speed with which something is traveling. In this activity velocity is expressed in feet per second.

- **What is the formula for calculating velocity?**

  A formula is an equation for calculating a certain measurement.

  Velocity = distance divided by time.

- **How did we obtain the velocity of the stream?**

  We obtained the velocity by measuring the amount of time it took a stick to travel a certain distance with a stopwatch. Then we used the velocity formula.

- **What was the velocity at your study site?**

- **Were the velocities at the 4 sites the same or different?**

- **In which part of a bend in a stream does the water move faster: the inside or the outside? What effect does the faster water have on the bank structure? on the vegetation? and on the wildlife?**

  The water moves more quickly on the outside of the curve. It wears away the bank, making it steeper than the inside of the curve. Fewer plants grow there, making less habitat for wildlife.

- **Compare the velocities from the narrow and wide sections of the stream. Is there a difference? Why do you think this difference occurs?**

- *There is a difference. Since the same amount of water is moving through the wide and narrow sections, the water has to move more quickly through the narrower areas.*

- **Were parts of the river deeper than others? Did velocity vary according to the depth?**

  As a general rule deeper water will have a slower velocity, however there are a number of other factors (width, sediment load, obstacles) that may also affect velocity.

- **What is stream volume?**

  Volume is the total amount of water flowing during a given period of time.

- **How did we obtain the volume measurement of the stream?**

  Find the width of the stream at three places and figure the average. Find the depth of the stream in three places and figure the average. Multiply average depth times average width times the velocity.

- **Consider the watershed of the stream you measured. What types of human activities in the watershed might be affecting stream volume?**

  Every change in the surface flow of water in a watershed can affect stream volume. Examples may include impoundments or diversions which reduce the volume, or many different activities that prevent rainwater absorption and increase stream volume such as; parking lots, paved roads, and building roof areas.

- **How would changes in stream volume affect plant and animals in this aquatic ecosystem?**

  Changes in stream volume could increase or decrease stream width and depth. These conditions could provide more or less habitat for different organisms in the ecosystem.

- **When you are working in a group, sometimes only one or two members are able to participate in a given task. How did you decide who would hold the watch and who would release the small stick?**

- **By repeating the activity four times, what was accomplished.**

  By repeating the timing four times, an average time was obtained. Also, more members of the group were able to actively participate.

APPLY

- Look at a map of your area (topographic maps will show the most detail). Observe and discuss the shapes and patterns of rivers and streams that you see. Are any of these rivers (or parts of them) straight?

- Sometimes, humans remove the curves from a river or stream, making it straighter for flood control, boat navigation or other reasons. This process is called channelization. Imagine that your river study site was going to be straightened. Draw what you think the river would look like, including changes in vegetation, wildlife, bank structure, etc. What do you think would happen to the velocity of the river?

- Identify rivers or streams that you think may have been channelized. Do a library study on one of these bodies of water to find out more about it, including its history and current uses.

- Contact your water management district office for information on any river restoration projects in your area. Ask if they would arrange a guided tour for your group.

Observation Sheet

Site name and description: ____
(inside curve, outside curve, narrow and straight, or wide and straight)

Observations:

Depth: ____

Vegetation (types of plants in or around the water):

____

____

River bank (steep or gradual slope, sandy, muddy, covered with plants, etc.):

____

Wildlife (types of fish, insects, and animals, in or around the water):

____

____

Record in chart below the time it takes for the stick to travel from stake 1 to stake 2. Repeat for a total of 4 times. Add times together.

Elapsed time (Stake 2, in seconds)

Time 1 _______________ Time 2 ______________

Time 3 _______________ Time 4 ______________

TOTAL: _______________

To obtain average elapsed time, divide total above by 4.

_____________ divided by 4 = ____________Seconds

(TOTAL TIME) (AVG ELAPSED TIME)

To calculate the velocity, divide the distance (10 ft) by the average elapsed time from above.

Velocity = Distance / Time = 10 Feet / Seconds = ____________ft/sec

Activity 3: Stream Bank Boxes

OBJECTIVES: For youth to
- Discover why stream banks, and lake and pond edges are important parts of aquatic ecosystems.
- Demonstrate how plants help prevent soil erosion.
- Identify the effects of rainfall on aquatic ecosystems.

LIFE SKILLS:
- Acquiring, analyzing and using information.

SUNSHINE STATE STANDARDS
SC.7.E.6.6 Identify the impact that humans have had on earth, such as deforestation, urbanization, erosion, and air and water quality, changing the flow of water.
SC.6.E.6.1 Describe/give examples of ways in which the Earth's surface is built up and torn down by weathering, erosion, and deposition.

MATERIALS
- Two boxes of equal size (about 2' wide x 1' deep x 3'-6' long) made of wood or sturdy cardboard, lined with plastic so they will hold water
- Rich soil
- A block of sod (approx. 2' x 3'-6') with sturdy grasses growing from it.
- Watering can with sprinkler head
- Small glass
- Clean water
- Bricks to prop up one end of each box 1-2 inches from ground.

TIME: 30 minutes
SETTING: Outdoors

ADVANCED PREPARATION:
Read Background Basics. To prepare each box; fill one half about 10" deep with soil, add soil to the remaining area and smooth it to create a slope from the center down to the bottom of the other end. Make sure the soil is packed solidly but not too firmly. In one of the boxes, arrange the layer of sod so that it covers the soil surface completely, including the sloping area.

Introduction

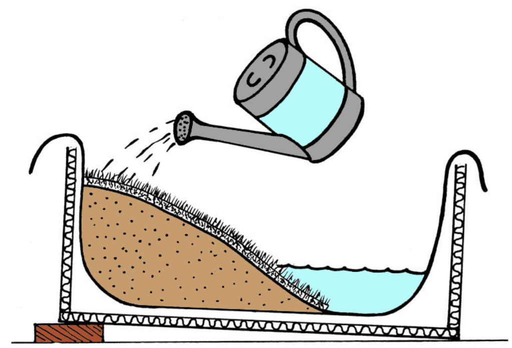
Springs, rivers, lakes, and ponds are different types of aquatic ecosystems. However, there are some similar characteristics found in all of them. For example, many contain aquatic plants and similar aquatic invertebrates such as dragonfly naiads. Another shared characteristic is that they are all bordered, at least partially, by land. The lands bordering these ecosystems and the plants that grow there are very important to the aquatic ecosystem. Can you guess why?

The plants bordering along aquatic ecosystems help to prevent erosion. What is erosion? **Erosion** is the movement of soil from one place to another. It can be caused by rain, when raindrops splash on bare soil. If water moves downhill across the land's surface it is called **runoff**. Runoff often carries topsoil into rivers, streams, lakes and ponds. When the soil settles in a body of water it is known as **sediment**. How do the plants help prevent erosion and sedimentation from happening? The plants protect the soil surface from raindrop splash. They also act as filters, to remove solid particles and impurities, from the water supply in the surrounding environment. Let's visit Muddville and Grasstown to see how this works.

Do

- Take youth outside and divide them into two equal groups. Have the two prepared boxes standing side by side, each with the end containing the most soil propped up 1-2 inches.

- Explain that the first group are the residents of "Muddville" and ask them to gather around the soil box without the grass. The second group will live in "Grasstown" and the other box will be their land. Show everyone how both towns are situated along a "stream" which is represented by the lower half of each box.
- Have the residents of Muddville elect a "rainmaker" and hand that person the watering can full of clean water. Ask the rainmaker to sprinkle water slowly onto the land in Muddville. Allow the rain to continue until the "stream" (lower end of the box) is about half full of water (try not to let it overflow).
- Observe what has occurred in the box. Then ask the people of Grasstown to elect a rainmaker, hand over the watering can, and repeat the same procedure in their box of soil.
- Compare the effects of the rain in each place. Discuss what has happened to the "stream" water in each of the boxes.



- Take the small glass and dip it into the "stream" water in Muddville. Look at the color of the water, then slowly pour it over the land at the top of Grasstown. You may do this several times, depending on the size of the glass and boxes.

REFLECT

- **What happened to the land in Muddville when it rained?**

  Some of the soil was splashed loose by the raindrops and carried away in the runoff.

- **How did this affect the water that flowed into the "stream"?**

  The water turned muddy and brown.

- **How does the "stream" in Muddville compare with the "stream" in Grasstown?**

  The "stream" in Grasstown is much less muddy.

- **What kept the soil from being carried away in Grasstown?**

  The plants protect the soil surface from the power of raindrops and the roots help to hold the soil in place. The plants also reduce the speed of the water moving down the slope.

- **Why is erosion harmful?**

  Erosion can damage the land by carrying away the topsoil layer that is valuable for plant growth. When erosion is caused by rain, the water often carries topsoil into rivers, streams, lakes and ponds. This runoff may also contain chemicals and fertilizers that can contaminate the water. The topsoil becomes sediment in lakes and rivers, which can effect water quality.

- **What happened when you poured the dirty water from the river in Mudville over the grassy land in Grasstown?**

  The dirty water was filtered by the grassy land in Grasstown, so when it flowed into the stream it was much cleaner.

- **What happens when heavy rains occur?**

  The water is slowly filtered through the plants. The roots of the grasses, shrubs, and trees hold the soil in place resulting in better water quality for lakes, ponds, rivers and streams.

APPLY

- Visit a construction site or a newly plowed farm field after a rainstorm. Can you identify the soil erosion caused by the lack of trees and plants? Write a description or draw a picture of what this erosion looks like.
- Sediments can have an important impact on life in an aquatic ecosystem. Place a handful of marbles in a small aquarium filled with clean water. Pour some of the Muddville stream water over the marbles. Ask the youth to imagine that the are marbles are fish eggs being covered by water borne sediment. Explain that these conditions can greatly reduce reproductive abilities of organisms in an aquatic ecosystem.
- Think about a coral reef in the shallow water near the ocean's edge. What effect do you think soil erosion would have on the coral and the other organisms living nearby?
- Take a walk in your neighborhood. Can you identify places where erosion might occur? What could be done to stop this erosion from occurring?

Activity 4: Healthy Water = Healthy Ecosystems

OBJECTIVES: For youth to

- Define water quality parameters for temperature, dissolved oxygen, pH, alkalinity, and nitrate.
- Perform water quality tests for the above parameters on a pond, lake, or river.
- Interpret results of water quality tests.

LIFE SKILLS:

- Acquiring, analyzing and using information.

SUNSHINE STATE STANDARDS

SC.7.L.17.3 Describe and investigate various limiting factors in a local ecosystem and their impact on populations, including food, shelter, water, space, disease parasitism, predation, and nesting sites.

SC.7.E.6.6 Identify the impact that humans have had on Earth, such as deforestation, urbanization, desertification, erosion, air and water quality, flow of water.

MATERIALS

- Water test kit (see source list) (can be borrowed from one of the four 4-H camps)

TIME: 90 minutes

SETTING: Outdoors to collect water samples, analysis may be conducted for the water test kit before conducting the tests with youth. Make copies of the water quality parameters information for each group.

ADVANCED PREPARATION:

Read the introduction. Read the instructions for the water test kit before conducting the tests with youth. Make copies of the water quality parameters information for each group.

INTRODUCTION

Some lakes, ponds, and rivers have many different kinds of plants and animals living within them. Others have few or none. There are numerous factors that contribute to the amount of different organisms to be found. In freshwater ecosystems, parameters such as temperature, dissolved oxygen, pH, alkalinity, nitrate, and other nutrients may be measured with various tests. The results of these tests give us information with which we may estimate the quality of the water and its effects on the biotic community.

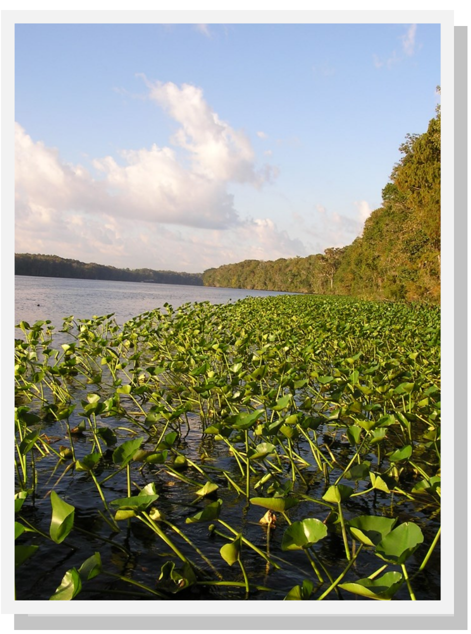
Let's pretend we are laboratory scientists trying to determine the water quality of a particular lake, pond, stream or other freshwater ecosystem. We will conduct tests and compare the results to the goals established by the Water Quality Control Act. This act set recommended levels for water quality that provide for the protection and propagation of fish and other aquatic life, and for recreation in and around the water. We will study five measures of water quality in this activity: temperature, dissolved oxygen, pH, alkalinity, and nitrate.

TEMPERATURE: Water temperature is controlled mainly by climate. Temperature requirements vary for different organisms. Many of the aquatic species in Florida require temperatures greater than 68° (20°C) to survive. Salmon and trout do not live in Florida's freshwaters because they require temperatures between 55°-68°F (12.8°-20°C). Colder water usually contains higher concentrations of dissolved oxygen than warmer water.

DISSOLVED OXYGEN (dO2): The level of dissolved oxygen in a system is one of the best indicators of water quality. Aquatic plants produce oxygen through photosynthesis. Oxygen is required by fish and other aquatic organisms for respiration (breathing). Oxygen is also important in the natural decomposition of organic matter. The minimum dissolved oxygen requirement for warm water species (above 68°F) for fish and other aquatic organisms that live in Florida is 5.0 mg/L.

pH: pH is a measure of the hydrogen ion (H+) concentration. The pH range is on a scale of 0-14, with 14 being the most alkaline, 0 being the most acidic, and 7 being neutral. Our drinking water supply has a pH between 5-9. Healthy aquatic communities maintain a pH of 6.5-9. Outside of this range, toxic substance may form and fish and other organisms may suffer adverse effects. Examples of pH levels below that which a species survival is threatened include: mayfly-below 6.0, or bullfrog-below 5.0, all fish will die in water with pH below 4.5.

ALKALINITY: Alkalinity is a measure of the capability of water to neutralize acids. This buffer system (carbonates, bicarbonates or hydroxides) neutralizes excess acids. The more alkaline compounds present the greater the capacity to neutralize acids without altering the pH of water. Limestone, which is common is Florida , is a major source of a bicarbonate buffer system. A healthy aquatic system should have a minimum of 20 mg/l expressed $CaCO_3$ (calcium carbonate). A number of "blackwater" streams and sandhill lakes exist in Florida with naturally low alkalinity levels and yet support "healthy" communities. These lakes and streams generally are more acidic resulting in the lower alkalinity levels.



NITRATE: Nitrogen is essential for life. Nitrate is a form of nitrogen which is produced by bacteria or found in some fertilizers. This form is readily available for plant uptake. Although nitrogen is necessary, excess nitrates can become a health concern for humans and other warm-blooded animals, and can cause eutrophication and other problems in aquatic systems. Ten mg/l (10 ppm) is the Environmental Protection Agency's safe limit for nitrates in drinking water supplies. There is no specific surface water standard for nitrates in Florida. The standards call for concentrations that "shall not alter or cause an imbalance" in natural communities.

Do

- Choose one freshwater ecosystem. Conduct the tests by the water side or collect the water in clean containers and conduct the tests inside, as soon as possible.
- Divide youth into groups of 2 or 3. Assign one test to each group. Follow instructions in test kit. Have each group conduct the tests simultaneously or take turns performing their test.

Reflect

- **What were the results of the test (temperature, dissolved oxygen, pH, alkalinity, nitrate)?**

  The answers will vary depending on the time of year, weather conditions and water body.
- **How do the results of the tests compare with the safe levels?**

  Varied answers.
- **Based on the results of the tests conducted, is this a healthy aquatic ecosystem?**
- **What animal and plant species would you expect to find in this aquatic ecosystem?**
- **How would the amount of dissolved oxygen affect freshwater ecosystems?**

  If there is not enough dissolved oxygen available for organisms that live in the water, then the type of organisms will change and the number of organisms in the water may be reduced. Water quality and ecosystem health may also be reduced.
- **What animal and plant species would you expect to find in this aquatic ecosystem?**

  An ecosystem could become polluted because of runoff containing excess fertilizers in water that flows into it, or due to any sources that are directly adding contaminants into the water.

APPLY

- If the temperature, dissolved oxygen, pH, alkalinity or nitrate level is not adequate for a healthy aquatic ecosystem, what could be the cause of the problem? Investigate what would cause the levels of each to be inadequate.

- Are the parameters of temperature, dissolved oxygen, pH, alkalinity and nitrate levels inter-related? If so, how are they?

Water quality testing kits can be order through a number of companies by phone or online. Some examples are Hach (www.hach.com); LaMotte (www.lamotte.com); and Aquatic Ecosystems (www.aquaticeco.com)

Activity 5: How Many Bugs Do You Have?

OBJECTIVES: For youth to
- Identify different types of invertebrate organisms present in aquatic ecosystems.
- Analyze the kinds and numbers of species present in an aquatic ecosystem.
- Use bioassessment to evaluate water quality of aquatic ecosystems.

LIFE SKILLS:
- Acquiring, analyzing and using information.

SUNSHINE STATE STANDARDS
SC.7.L.17.3 Describe and investigate various limiting factors in a local ecosystem and their impact on populations, including food, shelter, water, space, disease parasitism, predation, and nesting sites.

SC.8.N.1.1 Define a problem from the eighth grade curriculum, and carry out scientific investigations such as observations, identifying variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.

TIME: 90-120 minutes

SETTING: Indoors with tables/chairs for the bio assessment simulation game (Do part 1). Outdoors to collect and analyze samples of invertebrate organisms (Do part 2).

ADVANCED PREPARATION: Copy all "Group 1, 2, and 3 Bugs" sheets, and "BIO-ASSESS Stream Quality Assessment Form." Make a copy of the stream map for the simulation game. Identify and visit an aquatic site for the invertebrate sampling.

INTRODUCTION

Biological assessment, or **bioassessment**, is the use of living organisms to tell us something about the environment. Bioassessment of lakes and streams is done by scientists using a variety of organisms. In this exercise, we will be doing bioassessment of water quality using organisms that live on the bottom of aquatic ecosystems called **benthic macro invertebrates** or **benthos**. The words **macro invertebrate** suggest large animals without backbones. It is true that these benthic organisms don't have backbones, but they are usually less than one inch long. The "macro" simply means that many other invertebrates are much smaller.

The aquatic macro invertebrate community consists of animals like snails, clams, crayfish and aquatic worms. They are generally familiar to us and are commonly called "bugs." Many people can recall catching crayfish, snails, and other "critters" in streams or ponds as kids, but never realized the important story they have to tell us about water quality.

All living things have a range of tolerances to physical, chemical, and biological conditions. The presence or absence of organisms, and their relative abundance in a community of similar organisms is an indicator of environmental quality. When environmental conditions decline, intolerant species are the first to disappear. This usually lessens the variety of species (biodiversity) and leaves an "opening" which is filled by greater numbers of more tolerant organisms.

The importance of macro invertebrates in bioassessment will be experienced by participation in a simulation game

MATERIALS

- Newsprint paper or flipchart
- Markers
- Copies of macro invertebrate groups picture key, "Group 1, 2, and 3 Bugs" sheets, and "BIO-ASSESS Stream Quality Assessment Form" for each small group of participants. Copies of sample data for Team 1, Team 2, and Team 3 and copies of stream map to be used in bioassessment simulation Do part 1.
- Supplies for collecting Macro invertebrate samples:
- Sampling nets with 1mm mesh net in bottom,
- Large white plastic pans,
- White paper plates,
- Magnifying lens,
- Tweezers,
- Basters,
- Eyedroppers
- Suggested reference: Golden Nature Guides Series: Pond Life.

during the first half of the activity. A simulation is useful to become familiar with the concepts and procedures of bioassessment. This will acquaint youth with some of the many species that may be collected in the field during the second half, when benthic macro invertebrates are collected in an aquatic ecosystem.

DO (Part 1)

- Before the meeting, copy all needed "Group 1, 2, and 3 Bugs" sheets and "BIO-ASSESS Stream Quality Assessment Form." Make a copy of the stream map that will be large enough for the entire group to see.
- Assign the group into three bio-assess sites (white, blue, and yellow) for the simulation game. Divide larger groups into teams with each team composed of three sites.
- Ask everyone to look at the stream map; locate their site, and notice the natural and manmade conditions around it.
- Distribute copies of the "Group 1, 2, and 3 Bugs" sheets, and "BIO-ASSESS Stream Quality Form"; one each per bio-assess site.
- Give each site a set of sample data. Ask them to use the keys to sort out the species and report them under Group 1, 2, or 3; on the "BIO-ASSESS Stream Quality Assessment Form." Use the "letter code" to note each species found. This gives a feel for the abundance of each taxa.

Help the members for each assessment site to complete the following steps:

- Add up the number of taxa for Group 1 and record the number on the "Number of Taxa" line at the bottom of the column. Multiply this number by 3 to get the Index Value for Group 1. For Group 2, multiply by 2 to get the Index Code and for Group 3 taxa, multiply by 1.
- Add the total number of taxa for Groups 1, 2, and 3; then record this number in the box called "Total Number of Taxa" on the left below the table.
- Add up the index values listed for each group and record this number in the box called "Cumulative Index Value" on the right below the table.
- Put a check in the "Stream Quality Assessment" box that corresponds to your "Cumulative Index Value."
- Record the total number of taxa, the cumulative index value of your water quality assessment (excellent - poor) on the stream map.
- Ask each youth to think about why their site has the level of water quality found in this simulated biological assessment. Discuss the findings at all three sites and try to explain them. Identify possible sources of impacts, (pollution) on the stream in this study.

DO (Part 2)

- Locate a stream, pond, or lake to use as the site for collecting macro invertebrate samples to conduct a bioassessment.
- Before leaving for the site, locate it on a (topographic) map and show it to all in the group. Note factors related to the surroundings of the site such as slope, and land use.
- As you travel to the site look for any facilities or activities that may have an impact on the water quality at your site.
- The species are collected using a handled net that has openings (mesh size) of about one millimeter. If your site is a stream, place the net on the bottom substrate (rocks, gravel, sand) and stir the area up just upstream of the net opening with a hand or foot to dislodge the "bugs" from their habitats. If your site is the shoreline of a pond or lake move the net forward along the bottom and/or under vegetation to find the "bugs."
- It is best to work in teams, with one person holding the net firmly in place while someone else disturbs the substrate. Another team member can hold the large collection pan.

- Raise the net, empty it into the pan, and estimate the number of specimens you have collected. Keep sampling until you have collected 100 macro invertebrates from the area of your study.
- Place three pans where the group can spread out and get comfortable. Put one pebble in the first pan; this will be used to put the Group I (intolerant) organisms that you find into this pan. Two pebbles in another pan shows where Group II bugs are put, and a pan with three pebbles is used for the Group III (tolerant) organisms.
- Form small teams (2-4 people) and give each team a copy of the identification keys, a magnifying lens, a pair of tweezers, an eye dropper and a baster. Small white paper plates or something similar will also be useful.
- Select a record keeper in each team who will make a count of bugs as they sort them into Groups I, II, and III.
- Begin sorting your total sample between the pans. You've probably got more bugs than you will see at first, some of them are very small. After all the easily seen organisms in the sample have been sorted, dump the remaining contents onto a white cloth. As the water drains out, bugs will crawl out of the substrate material making them easier to spot and capture.
- The larger bugs are easiest to catch and can be picked up with the tweezers (be careful not to squeeze too hard). One way to get smaller bugs is to suck up a little water in the baster and squirt it out on a plate. You can use an eye dropper to pick up the smallest organisms and transfer them to the white pans for Groups I, II, and III.
- Keep identifying bugs from the large sample until they all have been separated into the three groups. If you find something that can't be identified at all you can (1) put into a separate pan of "unknowns," (2) make a good guess at its group, or (3) throw it back. Keep this information with the records for each team.
- When the sorting is finished use the bug counts from each team record keeper to fill in the Bio-assess Water Quality Form. Complete the form in the same way as done for the simulation in Part 1.

REFLECT

- **How many invertebrates in Groups I, II, and III were found?**
- **What can you tell about the quality of the water in the stream by the kinds and numbers of invertebrates found?**
- **If applicable, what are some possible sources of pollution in the stream? Do you think these pollution sources be corrected?**
- **What other factors could indicate water quality?**

  Abundance or absence of other forms of wildlife, water clarity, algae growth and smell of the water are other water quality indicators.

APPLY

- Make an appointment to take a trip with a biologist from your Water Management District or from the Department of Environmental Protection when they test a local aquatic ecosystem. Is the testing method the same or different from the biological assessment you performed?
- Determine ways you can help maintain high water quality in your area. What are local businesses, agriculture or other industries in your area doing to ensure healthy aquatic ecosystems?

Source: This activity has been adapted from Evaluating Sustainability Water Quality by Dr. William Deutsch, Fisheries Department, Auburn University.

SAMPLE DATA

Team 1:

Blue Site
4 Hellgrammite
27 Mayfly
1 Pouch Snail
12 Dragonfly
14 Stonefly
2 Sowbug
9 Caddisfly
3 Riffle Beetle
3 Crayfish
6 Snail
16 Crane Fly
3 Asiatic Clam

White Site
9 Mayfly
16 Hellgrammite
12 Sowbug
8 Crayfish
3 Caddisfly
17 Midge
9 Dragonfly
15 Crane Fly
4 Aquatic Worm
7 Stonefly

Yellow Site
23 Midge
14 Blackfly
14 Sowbug
6 Stonefly
11 Dragonfly
12 Filtering Caddisfly
8 Crayfish
12 Cranefly

Team 2:

Blue Site
8 Midge
4 Water Penny Beetle
26 Mayfly
8 Caddisfly
24 Crane Fly
8 Filtering Caddisfly
14 Stone Fly
8 Crayfish

White Site
12 Midge
20 Hellgrammite
4 Mayfly
8 Pouch Snail
2 Caddisfly
14 Dragonfly
18 Crane Fly
8 Stonefly
14 Sowbug

Yellow Site
21 Sowbug
23 Blackfly
28 Midge
12 Crane Fly
8 Asiatic Clam
8 Hellgrammite

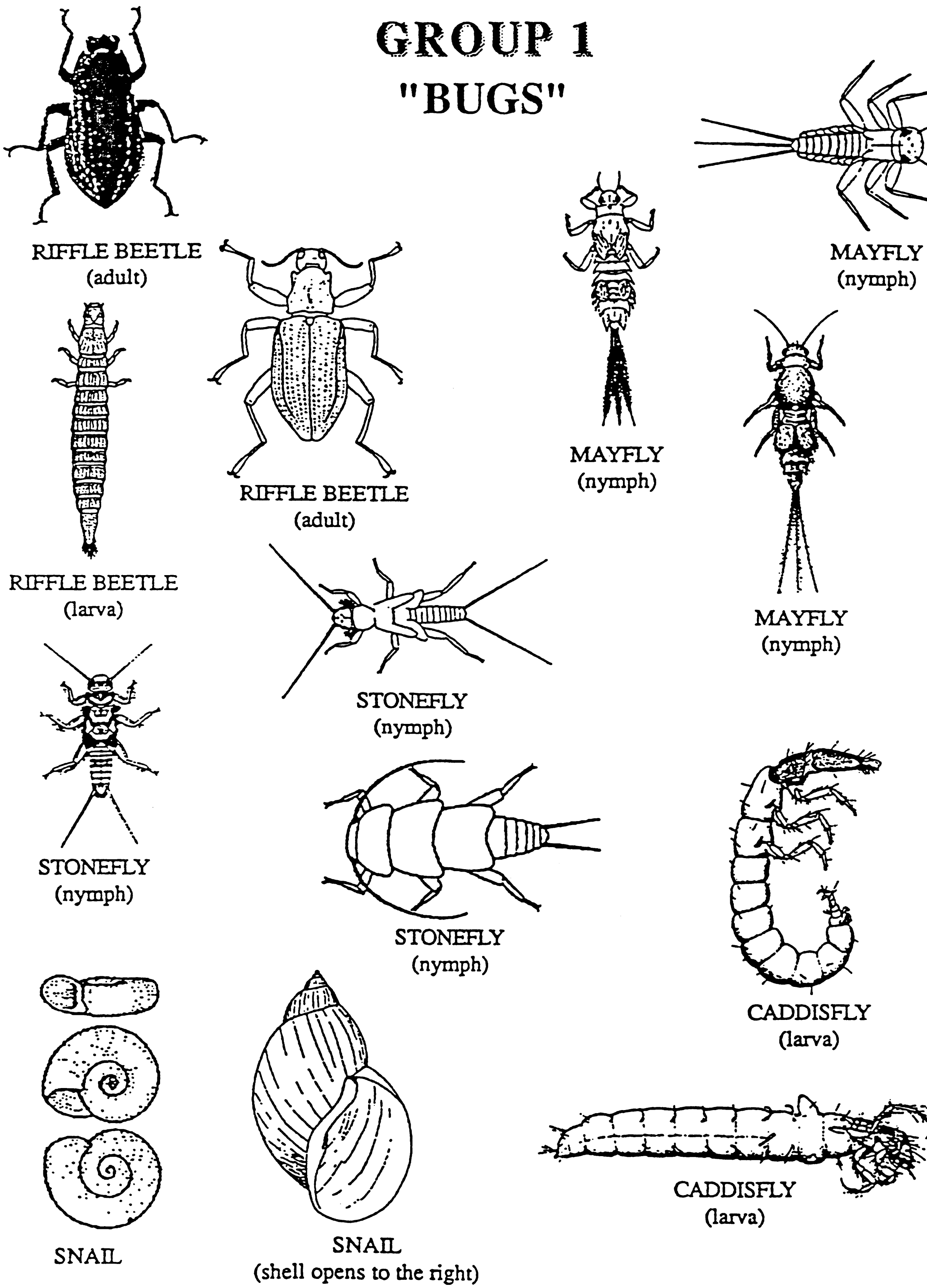
Team 3:

Blue Site
15 Black Fly
5 Hellgrammite
18 Mayfly
9 Crane Fly
6 Riffle Beetle
7 Water Penny Beetle
12 Caddisfly
4 Asiatic Clam
15 Stonefly
9 Pouch Snail

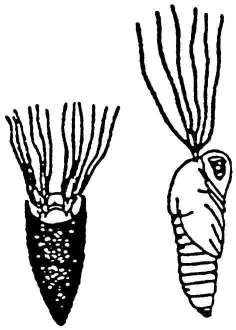
White Site
9 Mayfly
12 Hellgrammite
11 Blackfly
6 Filtering Caddisfly
20 Midge
5 Caddisfly
10 Dragonfly
12 Sowbug
15 Cranefly

Yellow Site
16 Sowbug
10 Filtering Caddisfly
9 Caddisfly
16 Midge
16 Hellgrammite
18 Crane Fly
15 Blackfly

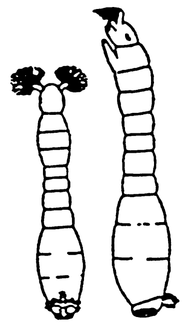
GROUP 1
"BUGS"


RIFFLE BEETLE
(adult)
RIFFLE BEETLE
(adult)
MAYFLY
(nymph)
MAYFLY
(nymph)
RIFFLE BEETLE
(larva)
MAYFLY
(nymph)
STONEFLY
(nymph)
STONEFLY
(nymph)
STONEFLY
(nymph)
CADDISFLY
(larva)
CADDISFLY
(larva)
SNAIL
SNAIL
(shell opens to the right)

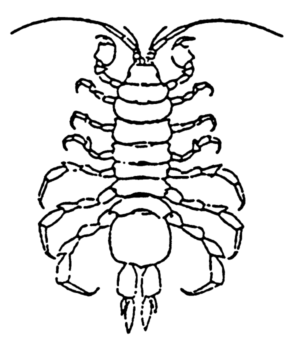
GROUP 2
"BUGS"



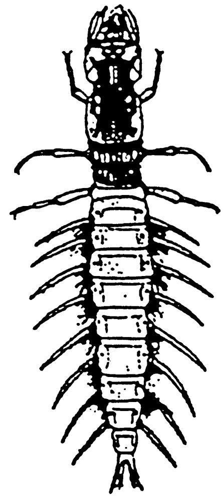
BLACKFLY
(pupa)



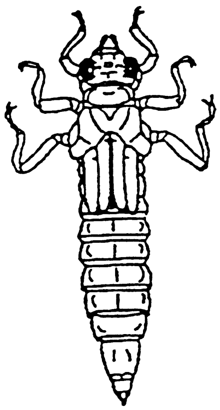
BLACKFLY
(larva)



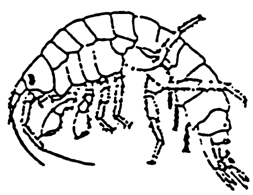
SOWBUG



HELLGRAMMITE
(Dobsonfly)
(larva)



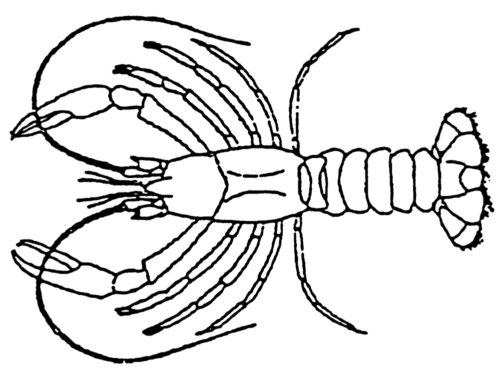
DRAGONFLY
(nymph)



SCUD

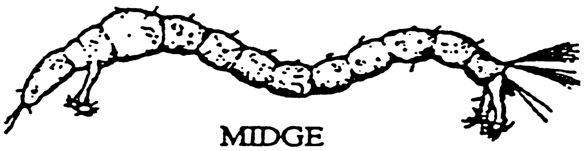
SNIPE FLY
(larva)

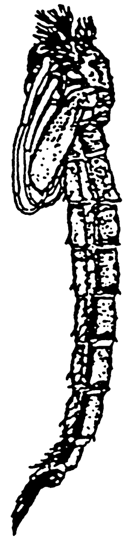
FILTERING CADDISFLY
(Hydropsychidae)
(larva)

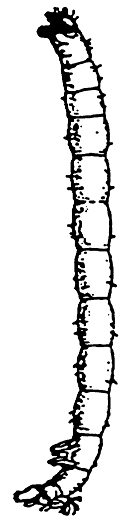


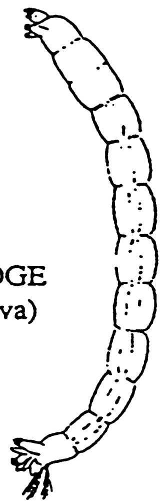
CRAYFISH

GROUP 3
"BUGS"

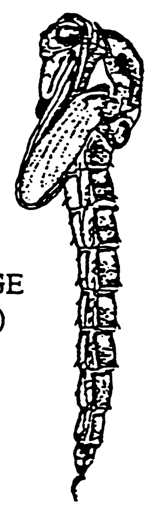

MIDGE
(Larva)

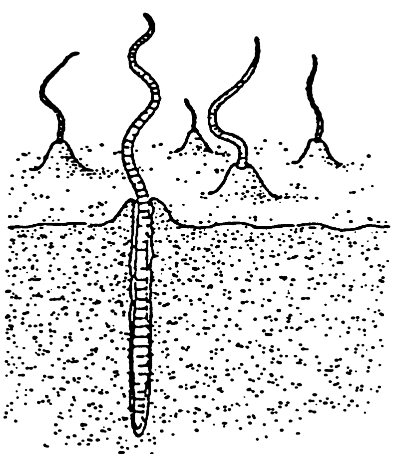

MIDGE
(Pupa)

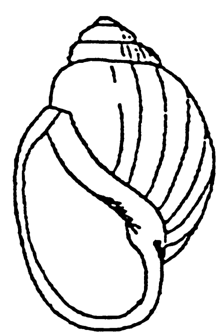

MIDGE
(Larva)


MIDGE
(Larva)


MIDGE
(Pupa)


MIDGE
(Pupa)


AQUATIC WORM


SNAIL
(shell opens to the left)

BIO-ASSESS Stream Quality Assessment Form

Site (color of deck)

____

Letter Code:

R (rare) 1 to 3 individuals in the taxa
C (common) 4 to 9 individuals in the taxa
A (abundant) 10 or more individuals in the taxa

Group 1 Taxa	Letter Code	Group 2 Taxa	Letter Code	Group 3 Taxa	Letter Code
Mayfly		Hellgramite		Aquatic Worm	
Stonefly		Dragonfly		Midge	
Caddisfly		Crane Fly		Pouch Snail**	
Riffle Beetle		Filtering Caddisfly*			
Snail		Crayfish			
		Scud			
		Sowbug			
		Snipe Fly			
		Blackfly			
Number of Taxa _______ **Index Value (Taxa x 3)** _______		**Number of Taxa** _______ **Index Value (Taxa x 3)** _______		**Number of Taxa** _______ **Index Value (Taxa x 1)** _______	

☐ **Total Number of Taxa** (Sum of Number of Taxa in Each Group)

☐ **Cumulative Index Value** (Sum of Index Values for Each Group)

STREAM QUALITY ASSESSMENT

☐ Excellent (>22)

☐ Good (17-22)

☐ Fair (11-16)

☐ Poor (<11)

* Filtering Caddisflies are in the family Hydropsychidae (gills on abdomen; most common caddisfly)
** Pouch Snails are in the family Physidae (shell opens to the left; air-breathing snail)

Activity 6: Aquatic Flora & Fauna

OBJECTIVES: For youth to

- Define the terms; extinction, threatened, endangered, native, endemic, and exotic.
- Identify common and endangered plant and animal species found in aquatic ecosystems.
- Match plant and animal species with clues in crossword puzzle.

LIFE SKILLS:

- Acquiring, analyzing and using information.
- Problem Solving and Decision Making

SUNSHINE STATE STANDARDS

SC.7.L.17.2 Compare and contrast the relationships among organisms such as mutualism, predation, parasitism, competition, and commensalism.

SC.7.L.17.3 Describe and investigate various limiting factors in a local ecosystem and their impact on populations, including food, shelter, water, space, disease parasitism, predation, and nesting sites.

MATERIALS

- Copy of AQUATIC FLORA AND FAUNA activity page for each youth
- Pencils
- Field guides

TIME: 1 hour

SETTING

A comfortable room with tables and chairs.

ADVANCED PREPARATION:

Read Background Basics.

INTRODUCTION

Plants and animals are a part of every ecosystem. We call these living parts of the ecosystem the biotic community. Some plants and animals are more common than others. Some may be so few in numbers that they are in danger of extinction. **Extinction** is when the last individuals of a kind of plant or animal dies. There will never be another one of that species again. When a species becomes too low in numbers, the government may list it as an endangered or threatened species. An **endangered** species is one that is in immediate danger of extinction. A **threatened** species is one that is likely to become endangered. When a species is listed as endangered or threatened, the plant or animal becomes protected by law and the government will protect the species habitat or otherwise implement protection strategies for the species. The bald eagle is an example of an endangered species that has recovered sufficiently, as a result of protection through the banning of certain pesticides, and has been downgraded to threatened status. Can you name any endangered or threatened species?

Plants and animals that occur naturally in an ecosystem are called **native** species. Native species that are only found in a particular location are called **endemic**. For example, the Okaloosa darter is a small freshwater fish that is only found in a few sand bottomed streams of the western panhandle of Florida.

Some plants and animals have been introduced into ecosystems by humans. These introduced species are called **exotics**. Exotic species sometimes cause problems for the native plants and animals that naturally live there by competition for food and other resources. Water hyacinth is an example of an exotic floating plant that when introduced to a lake ecosystem, will take over large areas of the surface water and severely reduce sunlight penetration for other organisms below.

What kinds of plants and animals do you think you would see if you visited a aquatic ecosystem such as a lake, pond, river, or spring? Let's do a crossword puzzle and find some more!

Do

- Distribute AQUATIC FLORA AND FAUNA Activity Sheet and pencils.
- Have youth complete puzzle.
- Review the plants and animals in the puzzle. Use the field guides to look up species with which the youth are unfamiliar.

Reflect

- **What is a native species? An exotic species?**

  A native species is one that occurs in a ecosystem naturally. An exotic species is one that naturally would not occur in a particular ecosystem, but is introduced into the ecosystem, usually by human activity.

- **Name an exotic aquatic plant species that is causing problems in Florida.**

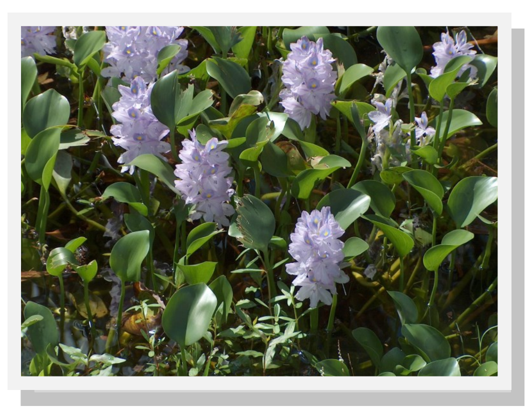
  Water hyacinth and Hydrilla are exotic plants that are causing problems in Florida. Both of these species grow quickly, clog waterways and out compete native plants.

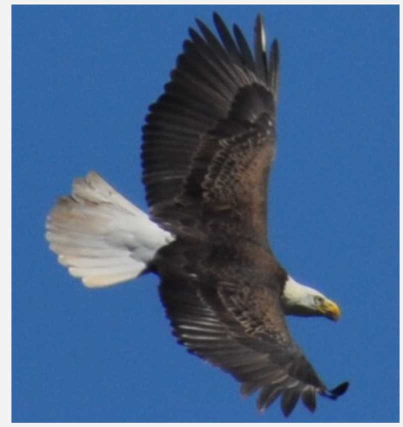
- **What does extinction mean?**

  Extinction is when the last one of a particular species has died and there will never again be any more of that plant or animal.

- **What is the meaning of a "threatened" species ?**

  A threatened species is one that is so low in numbers that is likely to become endangered.





- **Name a bird, a mammal, and a fish from the crossword puzzle that is protected as an endangered or threatened species.**

  The bald eagle, the Florida manatee, and the Gulf sturgeon are all endangered or threatened species.

- **Name two animals that were once threatened with extinction, but with protection are doing better.**

  The American alligator and the bald eagle were both close to extinction, but with protection, are recovering. In fact, the alligator has recovered so well, it is now harvested for hide and meat in some areas of Florida.

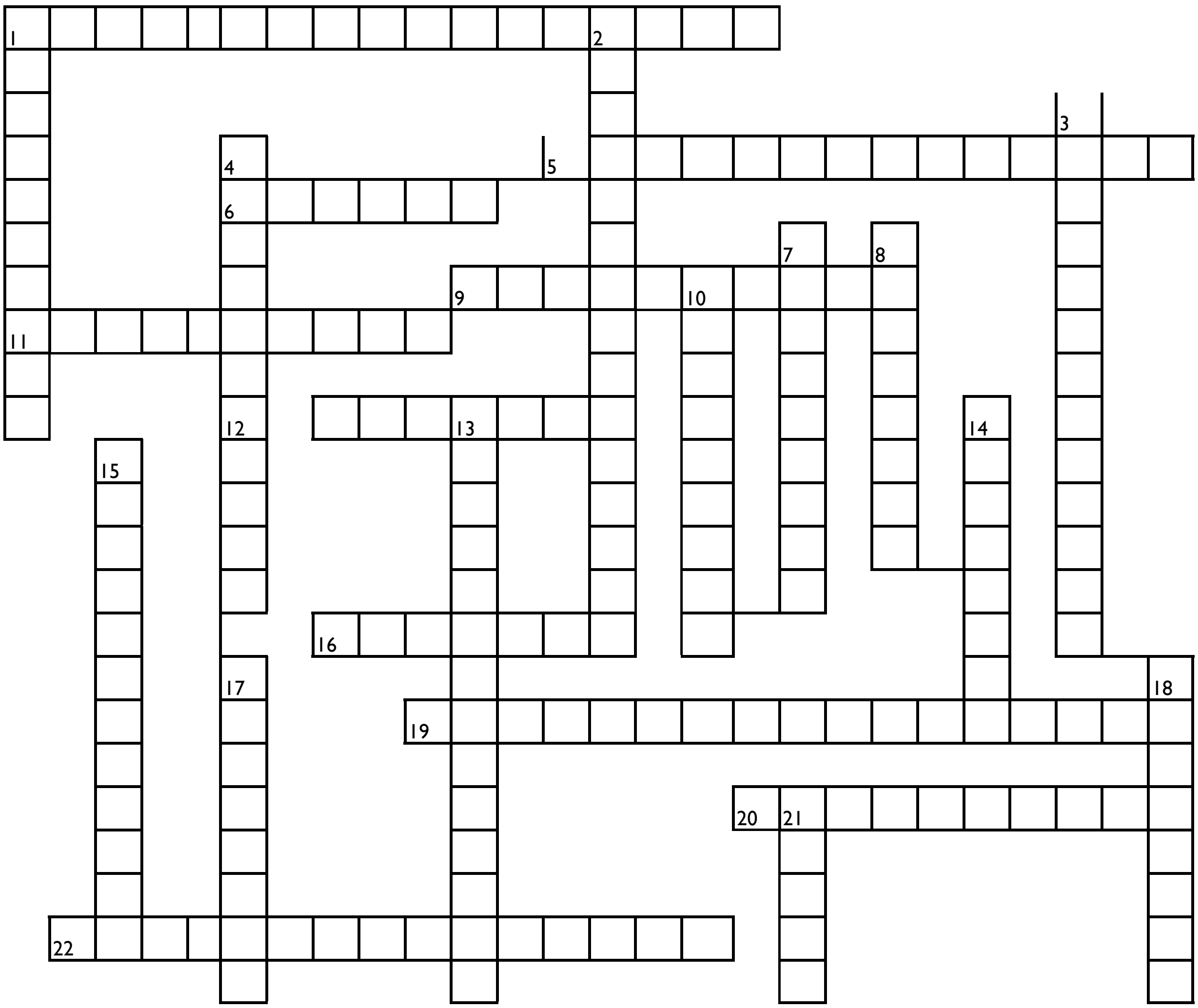
- **When you were doing the crossword puzzle and didn't know an answer right away, how did you figure out the answer?**

  By moving on to other questions, other letters were filled in on the crossword puzzle, which gave clues about where another answer might fit. Also, by answering all the easier questions, names were crossed off the list and the list to choose from became smaller.

APPLY

- Plan a field trip to a nearby pond, river, or stream and make a list of common and endangered plant and animal species seen there. Bring along the Audubon field guides to help in identification.
- Contact the Florida Game and Freshwater Fish Commission for a list of state listed threatened and endangered species.
- Contact local conservation groups such as Audubon to arrange a guest speaker for your group, or to find out about listed species in your area and what you can do to help.

Aquatic Flora & Fauna Crossword Puzzle



ACROSS

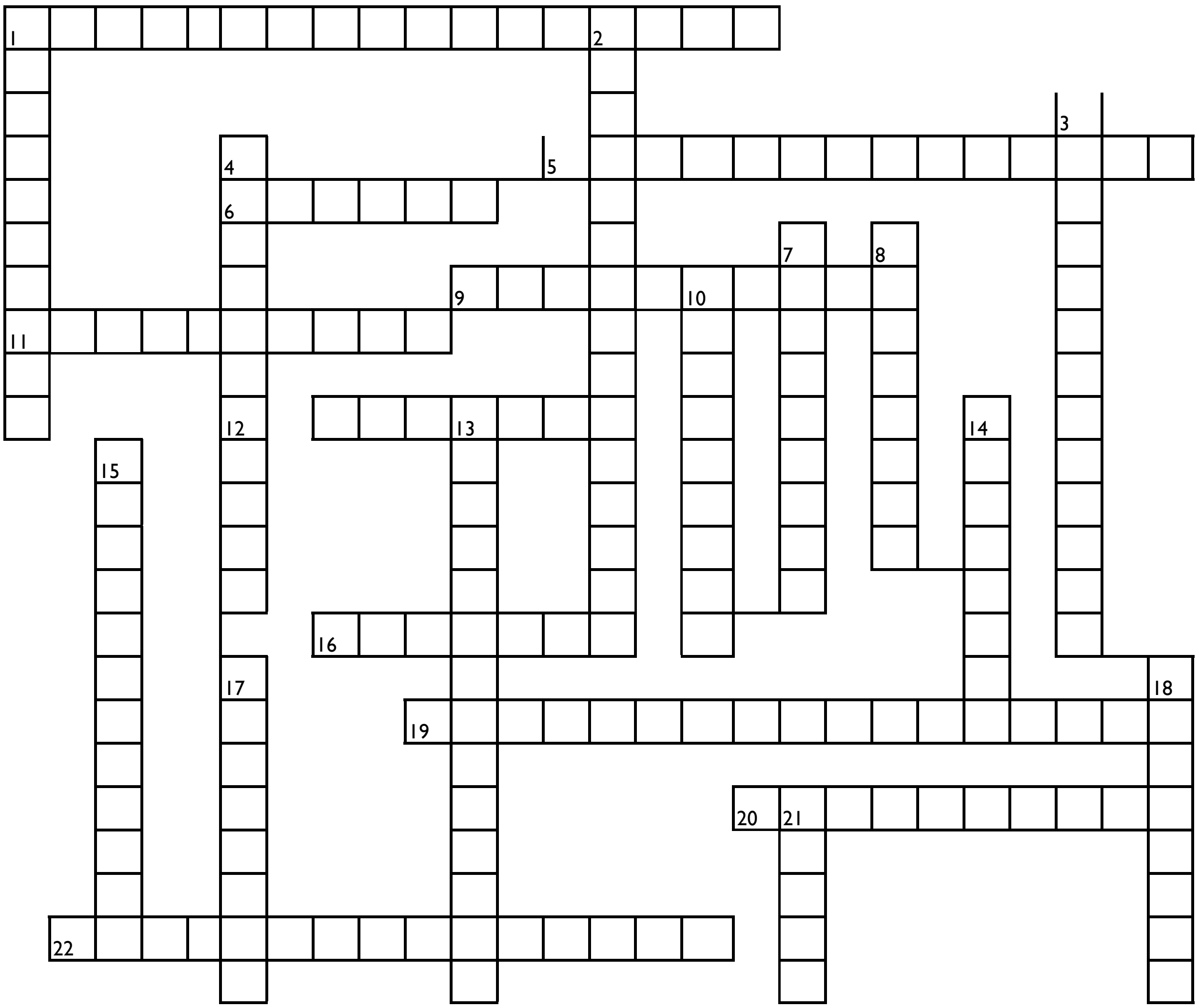
1. This endangered fish could be a doctor if it weren't for the "T"
5. Florida's foremost freshwater sportfish
6. This bird is often called a fish hawk because of its diet
9. This is a favorite food of the snail kite.
11. This playful mammal is fun to watch.
12. It has whiskers, but it is not fury
16. This turtle may often be seen sunning itself on fallen logs and riverbanks
19. This reptile used to be threatened with extinction, but because of good management now thrives in Florida
20. Frogs like to sit on the floating leaves of this beautiful flowering plant
22. This mammal comes to the water's edge to quench its thirst

DOWN

1. This bird looks like the frozen precipitation its named after but would probably hate the cold weather
2. This very large bird wades around in the shallow water to fish for its food
3. This exotic fish has no legs but likes to travel
4. This snake has a soft name, and a very venomous bite
7. This endangered species is our national bird
8. An important game fish for humans and also eaten by largemouth bass
10. This bird loves to eat apple snails
13. This endangered mammal is often hit by motorboats when it comes to the water surface to breathe
14. Some people eat them, but they're not beef, as the name implies
15. This floating exotic plant has pretty flowers, but is a pest because it clogs waterways
17. Ducks like to eat this tiny floating plant
18. A favorite food of the largemouth bass; not a fish even though it's name says so
21. There are many species of this tiny plant. Often is appears as a slippery green carpet on rocks in the water

Aquatic Flora & Fauna Crossword Puzzle

Answer Key



ACROSS

1. SHORTNOSESTURGEON
5. LARGEMOUTHBASS
6. OSPREY
9. APPLESNAIL
11. RIVEROTTER
12. CATFISH
16. SLIDER
19. AMERICANALLIGATOR
20. WATERLILLY
22. WHITETAILEDEER

DOWN

1. SNOWYEGRET
2. GREATBLUEHERON
3. WALKINGCATFISH
4. COTTONMOUTH
7. BALDEAGLE
8. BLUEGILL
10. SNAILKITE
13. FLORIDAMANATEE
14. BULLFROG
15. WATERHYACINTH
17. DUCKWEED
18. CRAYFISH
21. ALGAE