UF IFAS Extension
UNIVERSITY of FLORIDA

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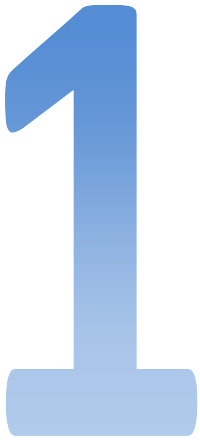


LESSON 1

Aquatic and Marine Ecosystem Connections

LESSON 1: Aquatic and Marine Ecosystem Connections

OBJECTIVES: For youth to:

- Describe and identify Florida's aquatic/marine ecosystems.
- Describe the stages of the hydrologic cycle.
- Discover the effects of abiotic factors on aquatic/marine ecosystems.
- Develop an understanding of energy flow and how food chains function.
- Discover interrelationships between living and nonliving components of aquatic/marine ecosystems.
- Identify stages of aquatic succession.
- Describe ways in which humans value and depend upon aquatic/marine ecosystems.

MATERIALS:
Maps of Florida: 1 per 5-6 youth (a state highway map will work)
Copies of ECOSYSTEMS DEFINED Activity Sheet (1 for each youth)

TIME: 45 minutes to 2 hours (for field trip)

ADVANCED PREPARATION:
Read the BACKGROUND BASICS on Aquatic/Marine Ecosystem Connections. Review activities and choose those appropriate for your group. Obtain the materials described at the start of each activity.

PURPOSE:

To become familiar with and differentiate between basic physical and biological factors common to all aquatic/marine systems.

DO:

Here are some learning activities and suggested ways to implement the activities in Lesson 1.

1.1 Discover and understand Florida's many diverse aquatic/marine ecosystems with WHAT'S AN ECOSYSTEM?

1.2 Learn how one critical factor affects different ecosystem communities using SALT OR NO SALT, WHAT'S THE DIFFERENCE?

1.3 Identify the stages of the hydrologic cycle with WATER BASICS.

1.4 Play ABIOTIC INFLUENCE,

1.5 AQUATIC FOOD CHAINS, and

1.6 FOOD WEBS: STRINGS ATTACHED to discover the relationships and interdependence between the living and non-living parts of ecosystems.

1.7 Discover some different stages of AQUATIC SUCCESSION.

1.8 Complete AQUATIC / MARINE VALUES to identify the many ways aquatic/marine ecosystems are important to humans.

REFLECT After completing each activity in this lesson, help youth reflect on what they have learned with these questions:

- **How many different aquatic/marine ecosystems can you name?**

  Swamps, marshes, bogs, rivers, streams, springs, lakes, ponds, bays, beaches, estuaries, mangroves, gulfs, oceans, coral reefs.

- **What are four stages of the hydrologic cycle?**

  Precipitation, transpiration, evaporation, and condensation.

- **Define "abiotic factor" and list some examples.**

  A nonliving part of an ecosystem. Some examples are water temperature, depth, salinity, wave motion, and sunlight.

- **What is a food chain?**

  The transfer of energy from the sun to primary producers to consumers.

- **What happens if one component of a food chain is removed?**

  The other components may also be affected.

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

- **What human values are associated with aquatic/marine ecosystems?**

  Aquatic/marine ecosystems are important resources for many reasons including; economic values (food and transportation), aesthetic values (beauty and serenity), recreation values (fishing and boating), education values (marine science and botany), and health values (nutrition and drinking water).

- **How does human activity affect these aquatic/marine ecosystems?**

  Marine debris, storm water runoff, pollution, dams, and coastal development are some examples of human impacts on aquatic/marine ecosystems.

- **How can we conserve our aquatic/marine ecosystems?**

  By taking responsibility for our actions on aquatic/marine ecosystems to ensure our continued use and enjoyment, as well as for the survival of all species that depend on these ecosystems.

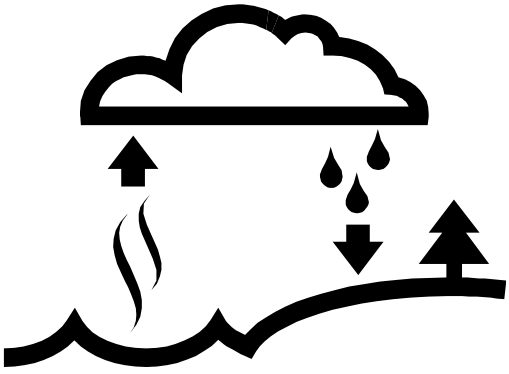
BACKGROUND BASICS

Water . . . Earth's unique and precious resource. Earth is the only planet in our solar system with the necessary atmospheric conditions to allow water to exist as we know it. Water is essential to all life on earth. Plants and animals are composed mostly of water. Human bodies are made up of 95% water. Humans may survive for long periods of time without food, but can survive no longer than a few days without water. We depend on water not only for the physical makeup of our bodies, but also for the environment it provides while moving through its three states. Water is the only substance found on earth that occurs naturally in three forms, solid, liquid, and vapor.

THE WATER CYCLE

The water cycle is a familiar, yet a dynamic mechanism which continually moves throughout all ecosystems. It is a natural process which has no beginning or end. The cycle is driven by energy from the sun that causes the evaporation of water from land and water surfaces and transpiration of water from plants. **Transpiration** occurs when water absorbed by plant roots is drawn through the body of a plant and then evaporates from the surface of leaves and stems. As water vapor rises, it cools, and condenses into clouds. When the water once again falls to the Earth's surface as rain, snow, sleet, and hail, it is called **precipitation**. Once on the surface, the water may immediately evaporate back into the atmosphere or run off into streams, rivers, and other water bodies. Surface water may also infiltrate the ground where it will eventually reenter the cycle through groundwater discharge or transpiration by plants.

In Florida, precipitation falls almost exclusively as rain, with occasional snow and hail. The dry season extends from October through May, and the wet season from June through September. Convective rains or thunderstorms occur in late afternoon in the spring and summer. Tropical low pressure storms from the Atlantic Ocean and the Caribbean Sea occur from late summer into early autumn. Fronts from the North American continent sweep the state during the fall, winter, and early spring. Tropical storms and hurricanes may cause heavy rainfall during the wet season. Seasonal fluctuations in precipitation can greatly affect water resources.

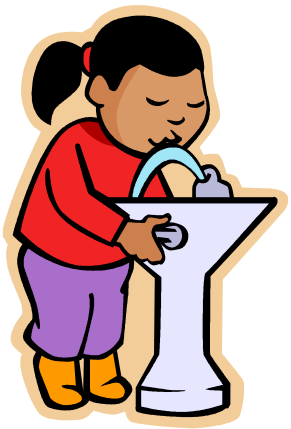


S**urface runoff** is the water which directly flows across the land into streams, rivers, or lakes. As water moves over the land, it may be seen as sheet runoff, or rills and gullies. Sheet runoff can be easily seen on a parking lot, whereas rills and gullies may be best observed on a slope of bare soil. Water that does not run off **infiltrates** (soaks into) the ground. When it travels through the soil, it may be **absorbed** (taken up) by the root systems of plants and used for their physiological processes.

Water not used by plants either adheres to soil particles or continues to move through the soil in all directions. Eventually the water will reach bedrock or a totally saturated zone in the soil. The top of this zone is called the **water table**. Water below the water table is called **groundwater**. Where the water table reaches the ground surface, it may appear as a spring or it may move directly into a flowing stream. This concept is important because without the subsurface movement of water and subsequent recharge of surface water, many streams would not flow between precipitation events. Subsurface drainage may be fast or very slow depending on soil types, depth to bedrock, slope and other climatic and geologic factors.

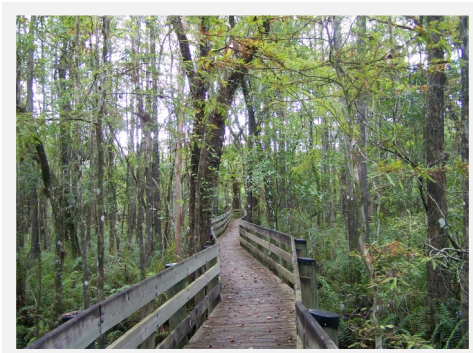
Water that reaches bedrock can move through cracks and fissures in the rock structure. It may move slowly through the rock formation or remain in place for hundreds of thousands of years. A rock formation that holds vast amounts of water is called an **aquifer**, a term derived from the two Latin words "aqua," meaning water, and "ferre," meaning to bear or carry. In Florida, we have the huge and deep Floridan Aquifer and the more shallow Biscayne Aquifer, which together provide nearly 90 percent of the state's drinking water, irrigation water, recreational water, and waste disposal water (Myers and Ewell, 1990).

People withdraw water from groundwater and surface water resources for their daily domestic and economic needs. These uses of water can greatly affect the natural recharge of stream flows and groundwater. Development projects that involve the removal of natural land areas and paving over large soil surface areas may have adverse environmental impacts on soil erosion, stream flow levels, and the natural recharge of groundwater resources. Our utilization of this resource is a necessity, and with careful planning, adverse environmental impacts resulting from our interruption of the natural water cycle can be minimized.



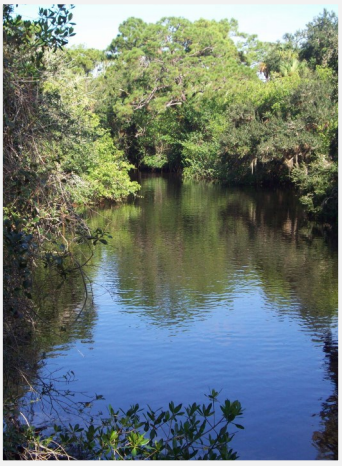
ECOSYSTEMS

All plants and animals require water, but in varying amounts. The amount of water and other nonliving factors in an area determine the types of plants and animals that can exist there. A **community** is all of the living things in a given area. The community and the nonliving environment function together as an **ecosystem**. Ecosystems are made up of both the living, **biotic** component, and the nonliving, **abiotic**, component. The abiotic component of an area largely determines what types of life forms can exist there. Water is one abiotic component, but there are many others such as soil type, elevation, temperature, salinity, etc.



Florida has many very diverse types of ecosystems. One of the reasons for this diversity is that the northern part of the state is situated in the temperate zone and the southern part of Florida extends into the subtropics. Although the State does not have diverse topography, changes in elevation have a significant effect on Florida's ecosystems. In the higher elevations are pine flatwoods, dry prairies, scrub and high pine habitats, and temperate hardwood forests. In south Florida, rockland ecosystems consist of pinelands and tropical hardwood hammocks. In the lower areas are swamps and freshwater marshes. Along the coast, are dunes and maritime forests. Florida has approximately 7700 lakes, more than 1700 rivers, and over 300 artesian springs (Myers and Ewell, 1990). Most of the larger rivers discharge at the oceans, emptying into estuaries, salt marshes, and mangroves. Florida's coastal areas and marine ecosystems are also quite diverse, from the beach dune community to several different offshore reef communities.

Aquatic/Marine Ecosystems



Aquatic/Marine ecosystems are located in areas that are either covered with water for part of the year, or are underwater all of the time. These ecosystems may be divided into four main groups: freshwater wetlands, including swamps, marshes, and bogs; other freshwater ecosystems, including rivers, springs, lakes, and ponds; coastal ecosystems, including estuaries, beaches, mangroves, salt marshes and mud flats; marine

ecosystems, including oceans, coral reefs and sea grass beds (which can be estuarine as well). Each of these ecosystems will be studied in upcoming, individual lessons.

Although the various ecosystems may seem very different and isolated from each other, it is important to realize how they are interrelated. For example, many of the rivers in Florida are brown in color from the tannin released by decaying vegetation that comes from surrounding swamps and forests. Rivers carry detritus (partially decomposed plants and other organisms) downstream, where the nutrients are emptied into estuaries which support the nurseries of the sea. Many forms of wildlife utilize and depend on more than one ecosystem for survival. An osprey may nest in a hardwood swamp, but catch fish for its food in the ocean. Many species of saltwater fish spend most of their adult lives in the ocean but depend on estuaries or rivers for their breeding and spawning grounds.

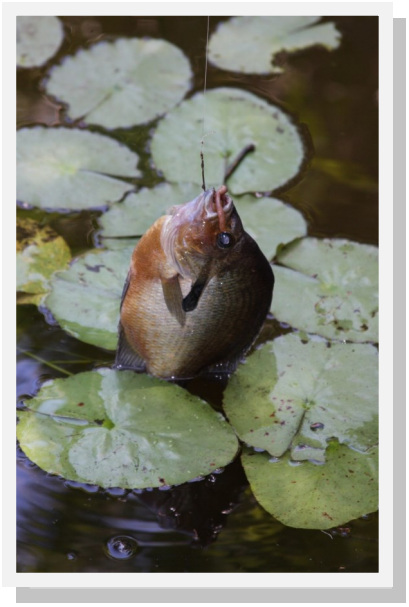
Energy Flow in the Ecosystems

There are complex relationships not only among different ecosystems, but also within each ecosystem. Many of these relationships involve the transfer of energy. The source of energy for ecosystems is the sun. This flow of energy from one organism to the next is known as a **food chain**. A **food web** is the interconnected pattern of separate food chains in a community. Green plants, called **producers,** utilize sunlight to make their own food through the process of photosynthesis. Animals that feed on the producers are called **primary consumers,** also called first order consumers. **Secondary consumers**, also called second order consumers, feed on the primary consumers. Third and fourth order consumers may also exist within an ecosystem.

The last major category is the **decomposers** which consist mainly of bacteria and fungi. These organisms break down organic matter or detritus into nutrients which may be recycled through the ecosystem.

There are a number of factors which influence the amount and types of organisms that a aquatic/marine ecosystem will support. It is important to understand the major factors and to be able to communicate to the youth just how these factors fit together. Vertebrate, invertebrate, and plant populations in an aquatic ecosystem are not only influenced by the size of the area, but by a variety of abiotic factors including soil fertility, water depth, turbidity, temperature, and water quality.

Populations are also affected by the relationships within an ecosystem's food web. For example, various fish populations have different food requirements. A bass would require small fish and large invertebrates such as crayfish. A bluegill would depend on small invertebrates such as aquatic insects, or zooplankton. Therefore, the number of individuals within a population of bass and bluegills that a pond could support directly depends on the amount of food available.



It must be understood that a pond, like other ecosystems, will have a balance between predators and prey, and this balance is necessary to maintain the **homeostatic** (relatively stable state of equilibrium) nature of the ecosystem. It can be said that an ecosystem maintains a state of dynamic equilibrium. Numbers and species of organisms within the system constantly change. Populations increase and decrease, dependent upon food supply and other biotic and abiotic factors. Even with this dynamic system, a state of balance is almost always maintained through a variety of self-regulating factors that include predator/prey relationships, death rates, birth rates, and amount of habitat.

Ecological Succession

Ecological succession is the progressive change in the plants and animals (biotic), and nonliving (abiotic) factors of an ecosystem over time. The new plant and animal community is typically more stable and complex than the previous one. During succession, a community modifies its physical environment so much that it creates conditions which are unsuitable for itself. Subsequently, a different group of species will eventually dominate the community.

The change from one community to another takes place gradually, as the composition of an ecosystem changes. Early stages in certain successional patterns might evolve over a relatively short period of time, sometimes in as few as ten years. Later successional stages may take much longer to evolve into new and unique communities.

Succession occurs in both aquatic and terrestrial ecosystems. In aquatic ecosystems such as ponds and lakes, succession takes place as sediments accumulate. In salt marshes sedimentation rates may vary due to tides and storms, however, succession still occurs. Early marsh plant species trap sand and soil to build land upon which new plant communities may grow. An example of succession in a coastal ecosystem is the change from bare sand dunes to those covered with sea oats. The sea oats may then trap and hold soil and support additional plant life.

Eutrophication is the "aging" of a water body due to the addition of organic matter. Although it is a natural process, human activities can accelerate the eutrophication of a water body. Sewage and agricultural runoff can add nutrients and sediments to the water. Thus, succession may occur much faster than normal. Soil erosion in surrounding areas may contribute to eutrophication as well, by adding soil to the sediment layer.

CONCLUSION

Throughout this curriculum, the focus is on aquatic/ marine ecosystems in Florida. However, many of these ecosystems occur in other locations and most of the concepts explored are universal. Through participation in the activities of this curriculum, an appreciation of the complexity and values of aquatic/marine ecosystems may be developed. The goal is to educate youth concerning these resources to provide them the basis to make informed, intelligent decisions concerning the environment and our future.

Activity 1: What is an Ecosystem?

OBJECTIVES: For youth to:
- Define Florida's aquatic/marine ecosystems.
- Locate examples of ecosystems on a map of Florida.
- Develop an understanding of the interrelatedness of these ecosystems.

LIFE SKILLS
- Acquiring, analyzing and using information.
- Working in groups.

SUNSHINE STATE STANDARDS:
GSS.1.G.1.1: Use physical and political/ cultural maps to locate places in Florida.

SS.1.G.1.5: Locate on maps and globes the student's local community, Florida, the Atlantic Ocean, and Gulf of Mexico.

SC.912.L.17.2: Explain the general distribution of life in aquatic systems as a function of chemistry, geography, light, depth, salinity, and temperature

SC.912.L.17.7: Characterize the biotic and abiotic components that define freshwater systems, marine systems and terrestrial systems.

MATERIALS:
- Maps of Florida - 1 per 5-6 youth (a state highway map will work)
- Copies of ECOSYSTEMS DEFINED Activity Sheet (1 for each youth)

TIME: 30 minutes

SETTING: Comfortable room with tables and chairs or outside with tables.

ADVANCE PREPARATION:
Read background basics. Obtain Florida State Highway map.

Introduction

What is an **ecosystem**? An ecosystem consists of both living and nonliving things (a group of plants and animals and their environment) that function together as a unit in nature. An aquarium is a mini-ecosystem. The fish, plants, and snails are the living parts and the water, light, and heater are the nonliving parts of the environment.

Florida has many different kinds of ecosystems. Some of Florida's ecosystems are called aquatic and marine ecosystems. These ecosystems are located in areas that are either covered with water for part of the year or are completely under water all of the time. There are many types of aquatic/marine ecosystems in Florida. The differences among these ecosystems are in their location, amount of water, the plants and animals that live there, and whether the water is fresh or salt. Ecosystems may be affected by manmade factors in the surrounding area, such as agriculture, forestry, urban development, and pollution runoff. Aquatic and marine ecosystems may also affect each other. For example, a spring may flow into a river, and the river might flow through a swamp and empty into an ocean.

Let's learn about Florida's different "water" ecosystems!

DO

- Divide youth into groups of 5-6.
- Distribute highway maps and copies of ECOSYSTEMS DEFINED Activity Sheet.
- Read and discuss definitions.
- Locate examples of each type of ecosystem on a map. Perhaps use GPS or explain when using internet.
- Locate a river on the map. Identify its source (where it begins) and trace the river's path to where it discharges (ends).

Identify the different aquatic ecosystems associated with this river. For example, the Suwannee River originates in the Okefenokee Swamp. Along its course, the Withlacoochee, Alapaha, and the Santa Fe Rivers join the Suwannee. Many springs, including Manatee Spring, empty into the Suwannee River, which then discharges into the Gulf of Mexico.

REFLECT

- **What are some of the differences among Florida's aquatic/marine ecosystems?**

  Some examples of differences are location, amount of water, kinds of plants and animals, salt or freshwater.

- **Which aquatic/marine ecosystems have trees in them?**

  Some wetland and coastal ecosystems.

- **Which aquatic/marine ecosystems contain saltwater?**

  Coastal and marine ecosystems such as estuaries, oceans, bays and coral reefs.

- **Name the aquatic/marine ecosystems that occur inland, away from the coastline.**

  Wetlands such as swamps and marshes, and other freshwater ecosystems like lakes, rivers, and springs.

- **Why did you look at a map? What other kinds of maps are there? What can you learn by using them?**

  We looked at a map to find the different aquatic/marine ecosystems in Florida. There are road maps, topographic maps, and globes which can be used to learn about roads, elevations, and geography.

APPLY

- **Have youth identify aquatic/marine ecosystems in their area.**
- **Ask youth to discuss aquatic/marine ecosystems they have visited and identify the type of ecosystem.**
- **Discuss how a pollutant introduced in one ecosystem may affect many others.**

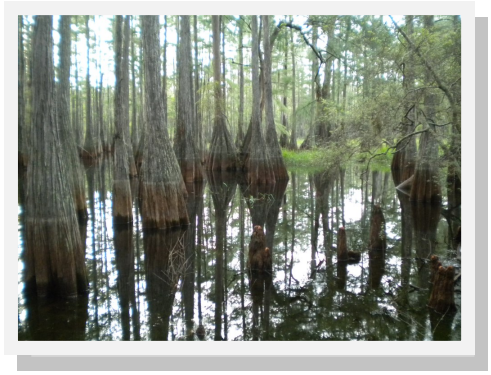
  For example, think about the river traced on the map and how a pollutant entering at the source could make its way through many ecosystems all the way to the river's discharge. Discuss the plants and animals that might be affected along the way.

ECOSYSTEMS

DEFINED

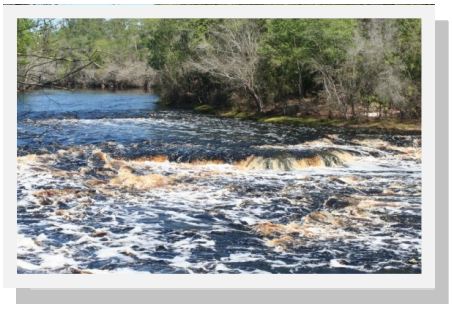
Wetland Ecosystems

Wetlands are areas of land that are covered with water for at least part of the year, for any length of time from a week to the entire twelve months. Some examples of wetlands are swamps, marshes, and wet prairies. Most wetlands contain freshwater, but some, like salt marshes along the coast contain saltwater, too. Wetland plants include: grasses, herbs, shrubs, and/or trees. Wetlands are home to many kinds of fish, frogs, turtles, snakes, birds, and mammals. There are many threatened and endangered species of plants and animals that are dependent on wetlands such as the wood stork, Southern bald eagle, Florida black bear, and the Florida sandhill crane.



Freshwater Ecosystems

Freshwater ecosystems are inland aquatic ecosystems such as rivers, streams, ponds, lakes, and springs. Freshwater ecosystems contain little to no salts in their water. Many kinds of fish, frogs, turtles, and snakes live in freshwater. Birds such as osprey and herons, as well as mammals, like otters, may also live in or near freshwater ecosystems and are dependent on them for food.



ECOSYSTEMS

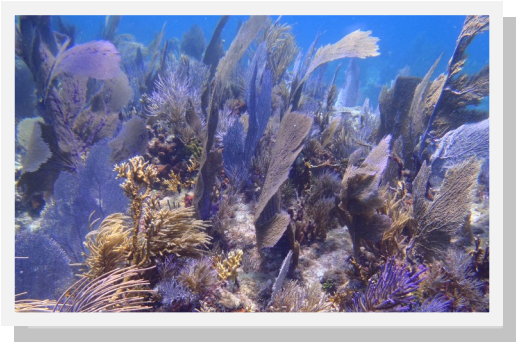
DEFINED

Coastal Ecosystems

Coastal ecosystems are saltwater or brackish ecosystems along the coastlines of Florida such as beaches, estuaries, mangroves, and bays. Brackish water occurs where freshwater and saltwater mix together. An example of a brackish ecosystem can be found where a freshwater river empties into the ocean along the coastline. Many kinds of saltwater fish, turtles, and crabs and shellfish live in coastal ecosystems, and many more animals use these ecosystems as nurseries. Birds like pelicans and seagulls may live in the trees in the mangroves and eat fish from the water in the estuaries and bays. Mammals such as beach mice and bobcats also live in or near coastal ecosystems.

Marine Ecosystems

Marine ecosystems are saltwater ecosystems that are beyond the shoreline, such as oceans, gulfs, and coral reefs. Plants in marine ecosystems consist mainly of algae. In shallow areas, sea grasses may grow as well. Some animals in marine ecosystems include sponges, corals, fish, shellfish, turtles, sharks, dolphins, and whales.



Activity 2: Salt or No Salt: What's the Difference?

OBJECTIVES: For youth to:

- Taste the "ocean."
- Visualize the process of osmosis
- Discover how fish cells respond to fresh and salt water.
- Distinguish the adaptations salt and fresh water fish have made in their environment.

LIFE SKILLS

- Acquiring, analyzing, and using information.

SUNSHINE STATE STANDARDS:
SC.4.N.1.1 (or substitute 5 for 5th grade, 6 for 6th grade): Raise questions about the natural world, use appropriate reference materials that support understanding to obtain information (identifying the source), conduct both individual and team investigations through free exploration and systematic investigations, and generate appropriate explanations based on those explorations.
SC.4.N.1.4: Attempt reasonable answers to scientific questions and cite evidence in support.
SC.4.N.1.6: Keep records that describe observations made, carefully distinguishing actual observations from ideas and inferences about the observations.
SC.5.N.1.4: Identify a control group and explain its importance in an experiment.

MATERIALS:

- Copies of SALT OR NO SALT OBSERVATION Sheet (1 per youth)
- 16 oz. Paper or plastic cups (1 per youth)
- Tap water
- Table salt
- Measuring spoon
- Two shallow bowls for every 2-4 youth
- One small cucumber
- Small knife
- Masking tape
- Marker
- Pencils/pens

TIME: 90 minutes

SETTING: Room with tables and chairs.

ADVANCE PREPARATION: Gather all necessary materials listed above. Check to see is any youth are on salt restricted diets.

Leader Information

Osmosis is the movement of a dissolved substance across a membrane (as in a living cell) from areas of high concentration to lower concentration. In a saltwater environment, water moves out of fish cells into the salty water because there are more salt particles in the water than in the fish cells. Since so much water is moving out of a fish that lives in saltwater, the fish makes up for it by drinking a lot of seawater. The fish gets rid of the extra salt from the water through its gills. The opposite process happens in fish that live in freshwater. Water is absorbed into the fish because the surrounding water is less salty than the cells in the fish. These fish get rid of the extra water through their kidneys. Fresh and salt water fish have special and different ways of dealing with their environments and the results of osmosis.

Introduction

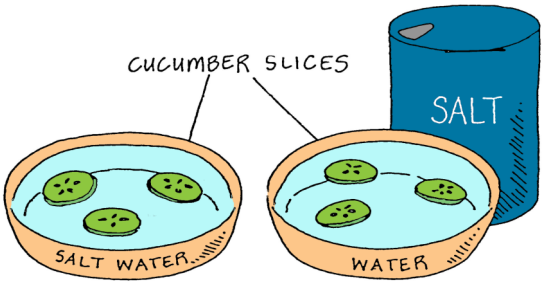
If we stir a teaspoon of salt into a glass of water, where does the salt go? It dissolves in the water. This is similar to the saltwater in marine ecosystems. Salts coming from terrestrial deposits are usually dissolved in water and flow into the seas and oceans. Evaporation then results in further concentrating the salts to a level of approximately 3.5 percent in most open ocean areas.

Some fish live in freshwater and some fish live in saltwater. If the water is different, do you think the fish are different too? Let's conduct an experiment to find out about this. We will use cucumber slices to demonstrate the movement of water from an area with less salt into an area of higher salt concentration. That process is called "osmosis."

Let's taste the "ocean" and then we'll see how fish cells have adapted to fresh and saltwater.

DO

- Fill two bowls each one-half with water.
- Stir one teaspoon of salt into <u>one</u> of the bowls labeling this bowl "saltwater" using the tape and marker.
- Have an adult cut the cucumber into thin slices. Bend the slices back and forth to determine their flexibility and record on the OBSERVATION chart.
- Place three cucumber slices into each bowl.
- Wait 30 minutes.
- While waiting 30 minutes, do the following:
- Have each youth fill a cup (6 oz.) with warm tap water.
- Add a teaspoon of table salt to each cup and stir.



- Have each youth taste their "mini-ocean."
- Answer the first three Reflect questions.
- After the 30 minutes, check the cucumber slices:
- Remove the slices and determine their flexibility by using your fingers to bend them back and forth and record on the OBSERVATION chart.
- Switch the slices by placing the slices that were in the saltwater into the plain water and the slices that were in the plain water into the saltwater.
- Wait 30 minutes.
- After the second 30 minutes, remove the slices and determine their flexibility.
- Complete the OBSERVATION chart.

REFLECT

- **What happened when you stirred the salt into the water? Is it still there?**

  Yes, it's still there - you just can't see it because the salt "dissolved" into the water.

- **Why are oceans salty?**

  Oceans and seas are salty because salts and minerals from rocks have dissolved in these large bodies of water. Since salts and minerals don't evaporate, they stay in the oceans and seas.

- **Does real seawater taste like your "mini-ocean"?**

  Seawater tastes similar, but oceans and seas contain many different kinds of salts in addition to sodium chloride (NaCl), which is table salt.

- **Which cucumber slices are limp?**

  The slices in the saltwater are limp.

- **Why are they different from the slices in freshwater?**

  Water moved out of the cells of the cucumber slice in the saltwater, leaving it limp, like a full water balloon that has lost some of its water. When cells lose some or all of their water, they are dehydrated. Dehydration means without hydration (water).

- **When you eat something salty, like potato chips or popcorn, do you get thirsty? Why?**

  The salt dehydrates some of your cells, and makes you thirsty, just like a saltwater fish that drinks a lot of water.

- **What would happen if a freshwater fish was put in saltwater?**

  Because most freshwater fish do not have the adaptations saltwater fish have, the freshwater fish would dehydrate like the cucumber slice did in the saltwater, and would probably not survive.

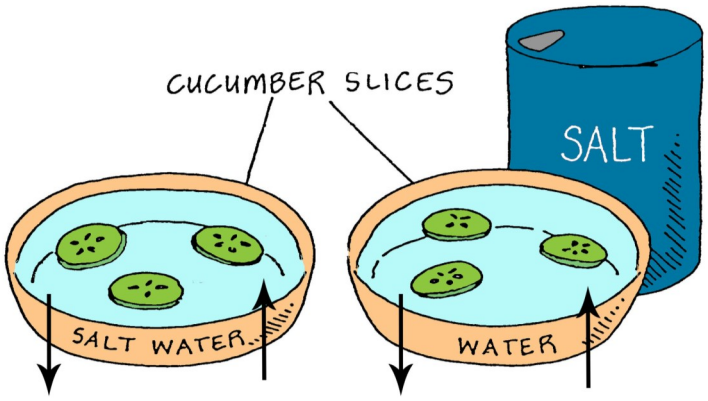
APPLY

- **Leave a saucer full of salt water out for a day or two, until all the water has evaporated away. What is left behind?**

Salt or No Salt Observation Chart

For each box in the table below, indicate the direction water will move in based on the situation given. (Example: "Water will move into cucumber.")

Time	Cucumber Slices in freshwater	Cucumber Slices in saltwater
Before slices go in water		
30 Minutes		
60 Minutes (after switching slices)		



Activity 3: Water Basics

OBJECTIVES: For youth to:

- Name the stages of the hydrologic cycle.
- Describe how water cycles.
- Describe the importance of the hydrologic cycle.
- Identify ways water is used in everyday life.
- Describe ways in which water may be conserved daily.

LIFE SKILLS

- Acquiring, analyzing, and using information.

SUNSHINE STATE STANDARDS:

SC.E.5.7.1: Create a model to explain the parts of the water cycle. Water can be a gas, a liquid, or a solid and can go back and forth from one state to another.

SC.E.5.7.2: Recognize that the ocean is an integral part of the water cycle and is connected to all of Earth's water reservoirs via evaporation and precipitation processes.

MATERIALS:

- Set of WATER CYCLE WORD and PICTURE CARDS (1 for every 4 youth)
- Copies of WATER CYCLE PIRATES activity sheet (1 for each youth)

TIME: 45 minutes

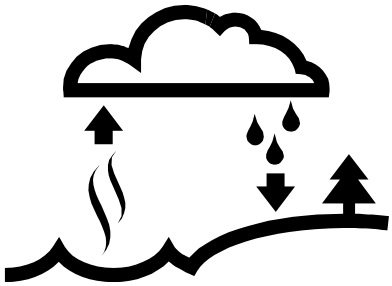
SETTING: Comfortable room with tables and chairs or outdoors.

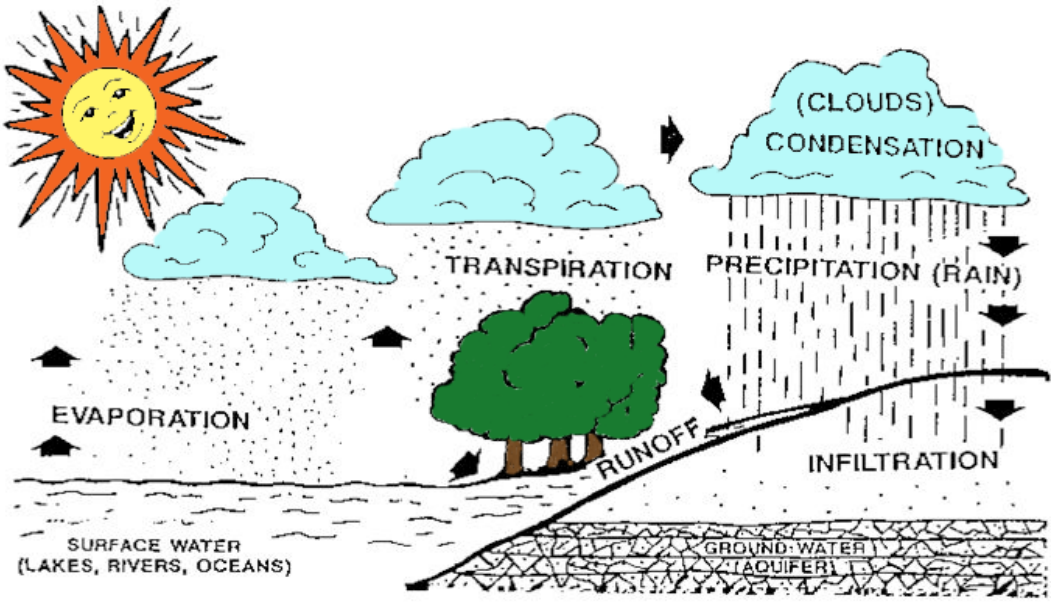
ADVANCE PREPARATION: Read background basics. Copy and cut out WATER CYCLE WORD and PICTURE CARDS and copies of WATER CYCLE PIRATES Activity Sheet. Keep the picture cards separate from the word cards.

Leader Information

The water cycle is a familiar, yet dynamic mechanism which continually moves water throughout the environment. The cycle is driven by energy from the sun that causes the evaporation of water from land and water surfaces. **Evaporation** occurs when water enters the air in the form of a gas called **vapor**. When the vapor cools, **condensation** turns water vapor into drops of liquid that fall to the earth in forms of **precipitation**--rain, snow, sleet or hail. Once on the earth, the water either evaporates immediately, **infiltrates** (soak into) the ground, or runs off. Surface runoff is the water which directly flows across the land into streams, rivers, or lakes. It may be seen as sheet runoff where water moves over the land, or channelization where water is diverted into rills and gullies. Sheet runoff can be easily seen on a parking lot, whereas channelization may be best observed on a slope of bare soil.

Some of the water that infiltrates the ground is absorbed through the root systems of plants. Transpiration occurs when water absorbed by plant roots is drawn through the body of a plant and then evaporates from the surface of leaves and stems. The water that continues to move through the soil is called groundwater. It may enter into underground rock formations that hold vast amounts of water called aquifers. In Florida, we get most of our water from the Floridian Aquifer.





INTRODUCTION

Is the water we use everyday new or recycled? What do you think? The water we use today is the same water that was around when the dinosaurs were alive. Let's look at the stages water goes through as it cycles through the ages.

DO (Part 1)

- Divide youth into teams of four.
- Give each team a set of picture cards showing the parts of the water cycle.
- On a table at the end of the room, set out the cards with the words for the water cycle (one set for each team).
- Have each youth on a team race to their card set and place their picture card next to the word that describes what their card shows.
- Tell each team how many are correct, but do not tell them which cards are correct.
- Allow each team to send one youth to attempt to correct which (if any) cards are wrong.
- Continue until each team has all four cards correct.

REFLECT

- **What do all of the cards together represent?**

  The water cycle.

- **Why does the sun represent evaporation?**

  Because the sun heats the water causing it to evaporate.

- **Besides rain, what are some other forms of precipitation?**

  Snow, sleet, and hail.

- **What forms in the sky when water condenses?**

  Clouds.

- **What is the role of plants in the hydrologic cycle?**

  Plants absorb water through the roots and release it through leaves by the process of transpiration.

DO (Part 2)

- Discuss the water cycle to familiarize youth with the new terms used in the worksheet.
- Distribute WATER CYCLE PIRATES Activity Sheets.
- Allow youth time to work alone and assist where necessary.
- Review the answers to the Activity Sheet.

REFLECT

- **What are some things that could happen to the water once it rains?**

  The water either evaporates immediately, infiltrates the ground, or travels over the surface as runoff and enters streams, rivers, and lakes.

- **Where is the beginning and end of the water cycle?**

  There is no beginning or end because the water cycle is a continuous, ongoing process.

- **What are the two ways water reenters the atmosphere?**

  Evaporation from water and land surfaces and transpiration from plants.

- **Where does the tap water we use everyday come from, and how does it get there in the first place?**

  Precipitation that infiltrates the soil and is not absorbed by plants continues to move through the soil until it reaches the water table and enters the aquifer. The water from our faucets is pumped from the aquifer.

- **What happens if a field is paved?**

  The water from precipitation can not be absorbed into the soil anymore, so it runs off or evaporates back into the atmosphere.

- **What could happen to the our water supply in the aquifer if there was a drought or if too much land was paved?**

  The water supply in the aquifer will be reduced if not enough water was being absorbed into the soil to reach the water table and we kept using up what was already there.

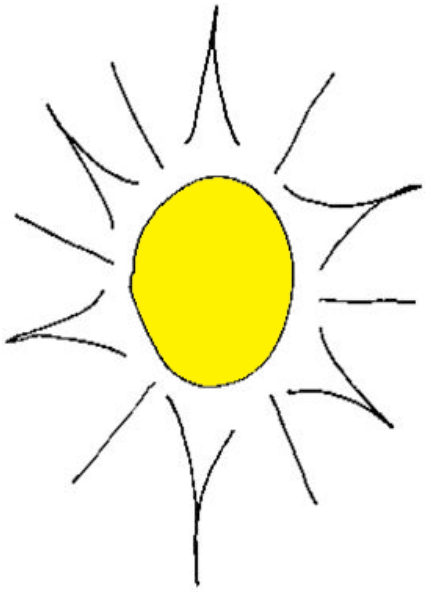
APPLY

- Have youth draw a creative water cycle labeling precipitation, evaporation, transpiration and condensation. (Idea: Draw a picture of your neighborhood or school grounds. How does the water cycle work around your area?)
- Observe the process of transpiration in plants with this simple experiment: place a plastic baggy over a small branch of a plant or tree and tie a string securely around the opening of the bag so that no air can escape. Wait for a few hours and then observe what has happened. Where did the water come from?
- Discuss ways youth can discover how much water they use in everyday activities. For example, putting a stopper in the drain while brushing teeth will illustrate how much water is wasted. Does a shower or a bath use more water? When taking a shower, try putting a stopper in the drain to see how much water fills the tub. Help youth discover ways we can conserve water everyday.

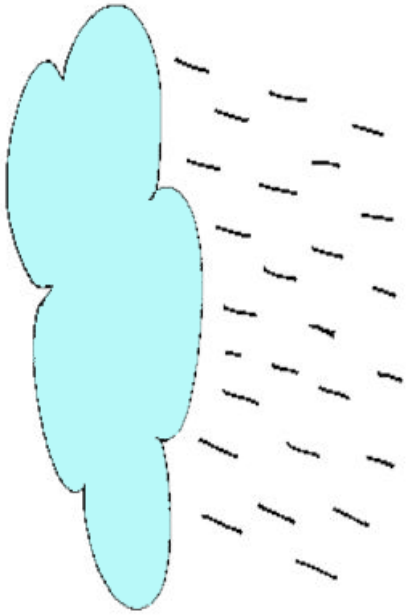
Leader Information and "Water Cycle Pirates" adapted from Instructor's Guide to Water Education Activities, Commonwealth of Pennsylvania, Department of Environmental Protection, Bureau of Dams, Waterways, and Wetlands.

WATER BASICS PICTURE CARDS

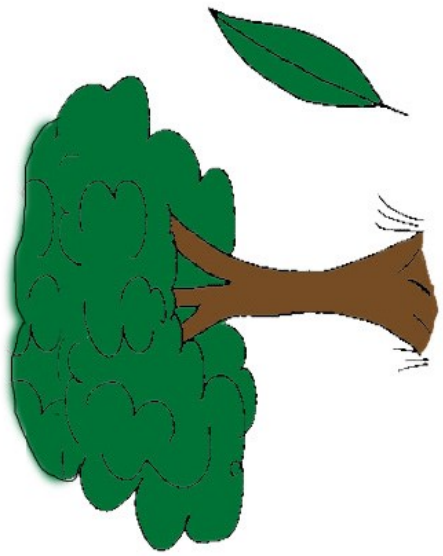
Sun



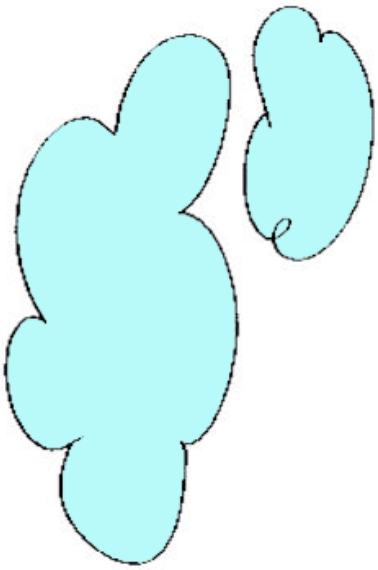
Rain



Plants and Trees



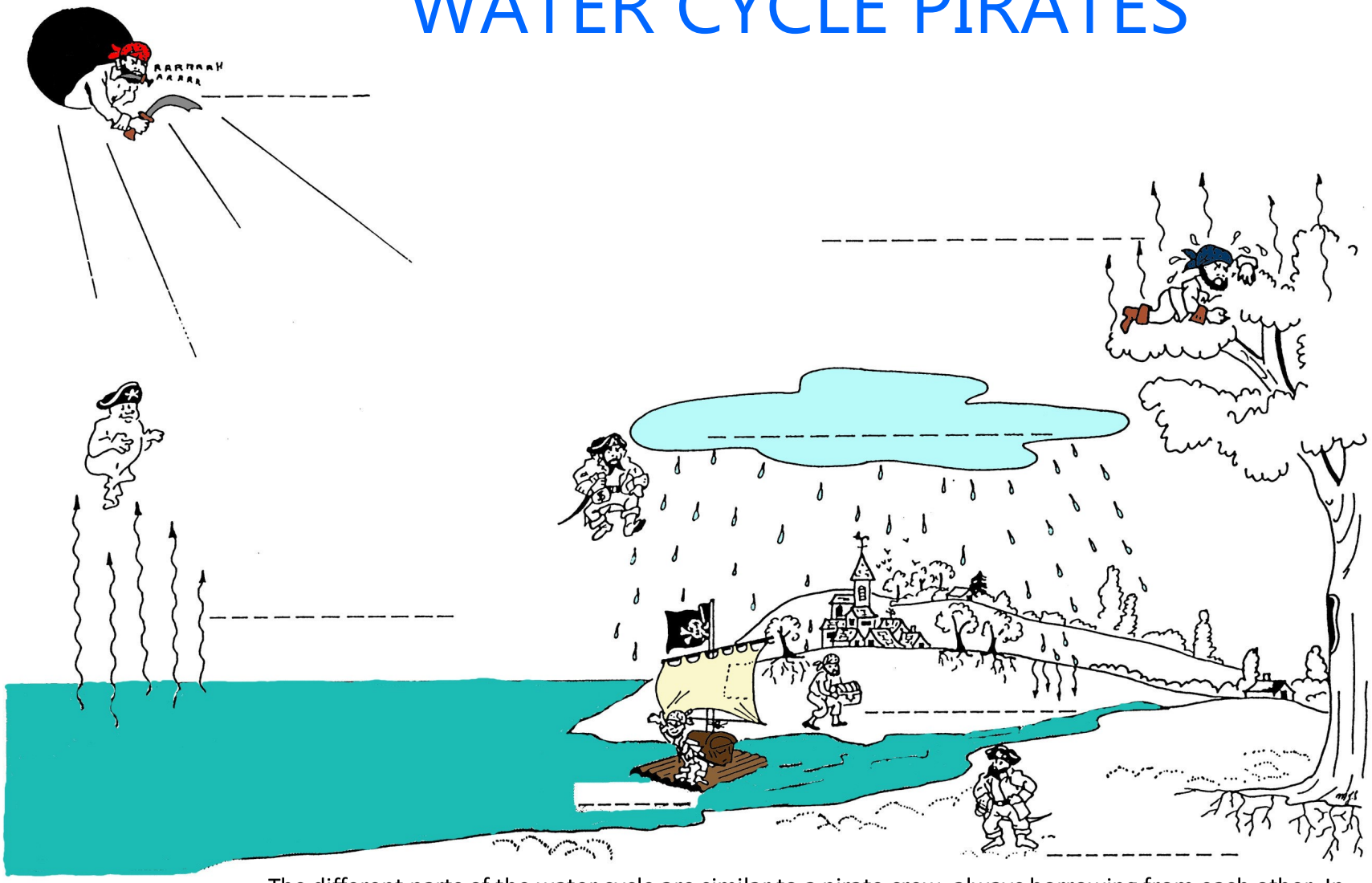
Clouds



WATER BASICS WORD CARDS

PRECIPITATION	CONDENSATION
TRANSPIRATION	EVAPORATION

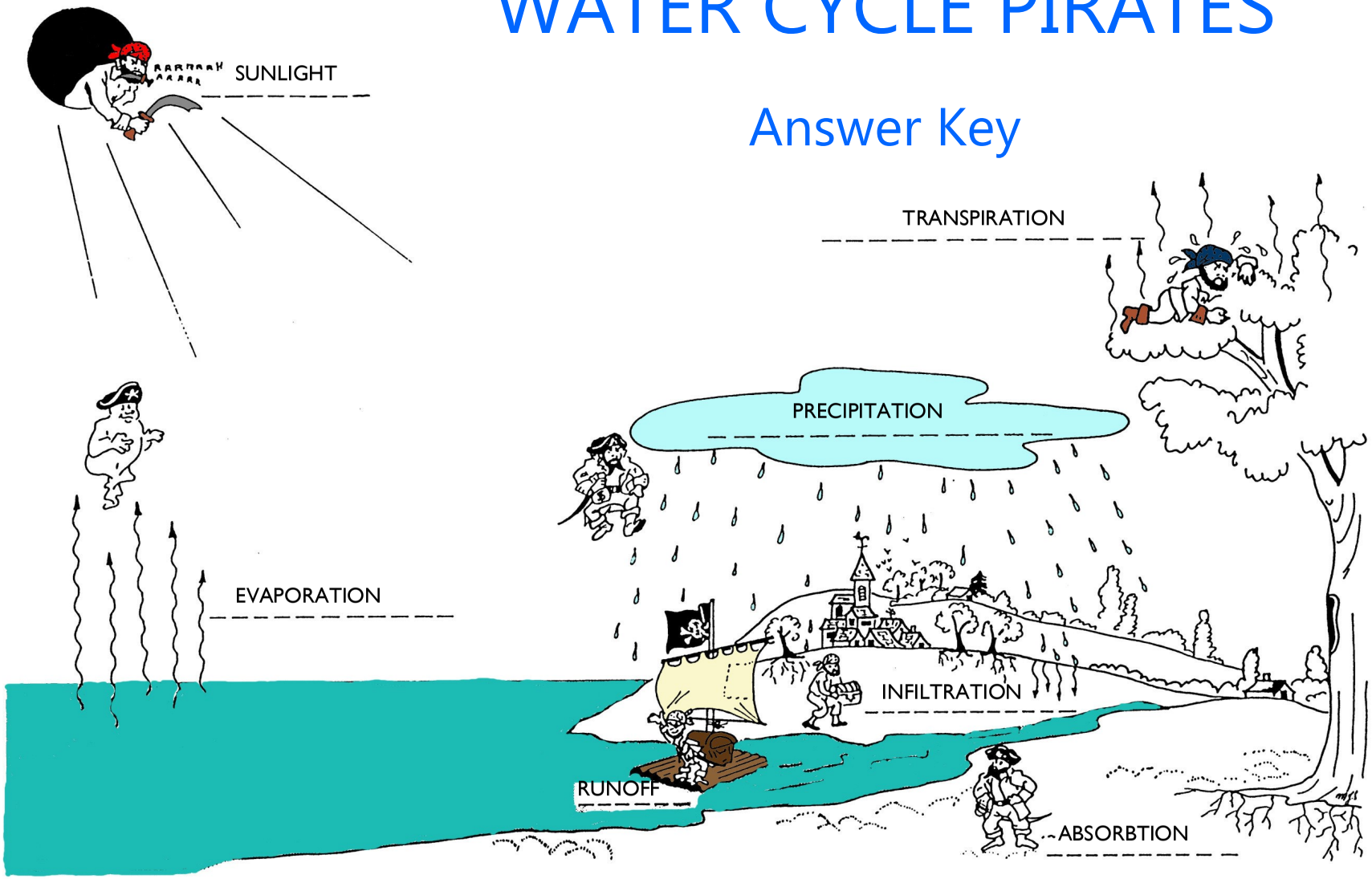
WATER CYCLE PIRATES



The different parts of the water cycle are similar to a pirate crew, always borrowing from each other. In fact, by using the first letter of each part of the cycle illustrates below, you can spell the word PIRATE!

WATER CYCLE PIRATES

Answer Key



Activity 4: Abiotic Influences

OBJECTIVES: For youth to:
- Distinguish between the abiotic (nonliving) and biotic (living) components of an ecosystem
- Identify three to six abiotic variables and explain their importance to lining things.
- Explain how plant and animal are affected by abiotic factors.
- Discover the interrelationship between abiotic factors and the living community.

LIFE SKILLS
- Acquiring, analyzing, and using information.

SUNSHINE STATE STANDARDS:
SC.912.L.17.7: Characterize the biotic and abiotic components that define freshwater systems, marine systems, and terrestrial systems.

MATERIALS:
- One "Hi" and "Low" flag for each of the relevant abiotic factors as determined by the chosen site (temperature, sunlight, elevation, water depth, water salinity, wind/ wave action). If the site is a coastal ecosystem, for example, you will use flags for salinity and wave action.
- Stick, dowels, or rulers for flag stems (1 for each flag used)

TIME: 60 minutes

SETTING: The site may be a marsh, lake, stream, beach or other aquatic environment, according to the location readily available. Whatever site is selected, be sure to investigate it prior to the activity so that you are familiar with the various plants and abiotic factors influencing their growth.

ADVANCE PREPARATION: Read background basics. Preview and select the learning site. Make “High” and “Low” flags by copying activity pages and cutting them in half. Attach each flag to a stick.

Leader Information

An ecosystem can be divided into two basic components, the **biotic** (living community) and **abiotic** (nonliving environment). Many abiotic factors influence living organisms. Some of the primary ones that affect plant growth in and around various aquatic environments are temperature, sunlight, elevation, water depth or moisture, water salinity, and wind/wave action. These factors are all part of the organism’s environment or **habitat** (where the organism lives). The abiotic factors may influence an organism by themselves or in combination. Too much or too little of a particular abiotic factor can prevent an organism from living in a specific environment. Such a resource is called a **limiting factor**. For example, moisture by itself can determine the presence or absence of a plant. Cattails will thrive only in the shallow water around a lake or in wetland areas where there is enough moisture to support the species. The wind and wave action on a beach will determine what plants will live there. This activity will focus on the abiotic component and its influence on plant and animal communities in an aquatic/marine ecosystem.

Introduction

When we think about an ecosystem, we often focus on the plants and animals that live there. The plants and animals are the living, or "biotic" part of an ecosystem. There is another part of the ecosystem that is just as important. It is called the "abiotic," or nonliving part of the ecosystem. What do you think are some of the "abiotic" parts of an ecosystem? Let's find out more about them.

DO

- Guide youth to the learning site. Ask the group to define the term ecosystem. Have the group list the components that make up the ecosystem and divide them into two groups, living and nonliving. Define biotic and abiotic and explain that they will be looking at the effects that abiotic factors have on the plants (and animals to a lesser extent) that live at the site. Introduce the abiotic factors that they will be studying (as determined by the study site, ie., temperature, sunlight, elevation, water depth, water salinity, wind/wave action).
- Define the limits of the study site. Explain that the flags should be placed at that spot within the study site that best exemplifies each flag: the "Low" sunlight flag would be placed in a very shady area, the "Hi" flag in the brightest place. (Make sure that the whole group understands what each flag represents in relation to each abiotic factor.) Distribute all of the flags. Allow youth to double up if necessary. Give everyone 5-10 minutes to distribute the flags. Observe to make sure that the flags are left at the appropriate spots, and when all the flags have been placed, gather the group together.
- Visit each flag with the group. The youth who chose the site should explain the reason why their abiotic factor is found in either high or low amounts. They should also note the types of plants that are found in relationship to specific abiotic conditions. Interrelationships between abiotic factors should be discussed. For example, high sunlight and high temperature are likely to exist at the same site.
- Once all sites have been visited, ask the group to diagram the study area. Use colors to represent the different abiotic factors and shading to show the high/low range of each. Outline the places where certain plants are found and discuss them in relation to the different abiotic conditions. Collect all the flags after the diagram has been completed and discussed.

REFLECT

- **Name six abiotic factors that affect plants in an aquatic ecosystem.**

  Temperature, sunlight, elevation, water depth, water salinity, wind/wave action.

- **Do these abiotic factors change over time?**

  Yes

- **How often do they change?**

  Daily, monthly, seasonally.

- **What things do green plants need to live?**

  Sunlight, air, water, chlorophyll, nutrients and sometimes soil in the right quantity.

- **What happens if a plant does not get enough of a required abiotic factor?**

  It may die or be out competed by other plants.

- **How do abiotic factors affect animals?**

  Animals need water to drink and plants or other animals to eat for energy, so they are dependent on the right abiotic factors to live. For example, alligators could not survive without water and neither could the prey they depend on for food.

- **Can you name a plant that usually requires standing water for survival?**

  Cypress trees, mangrove trees, cattails, sawgrass.

- **Can you name some types of living things that are sensitive to changes in salinity?**

  Coral reefs, salt marsh grasses, fresh water fish.

- **What do we call the place where an organism lives?**

  The place where an organism lives is its habitat.

- **Too much or too little of a particular abiotic factor can prevent an organism from living in a specific environment. What do we call such restrictions?**

  Limiting factors.

- **What are some ways a habitat can be changed?**

  By natural causes like a flood or a fire, or by human activities such as, clearing a forest for farmland, paving a field, or draining a wetland.

- **What happens to organisms that live in a specific habitat if too many abiotic factors are changed or if even just one limiting factor is altered too much?**

  The organisms that lived there may not be able to survive in the new environment.

APPLY

- Look at the diagram of the area you have studied. How would the abiotic factors change if it were a different time of year? Imagine the site six months from now and discuss how the abiotic factors would be different. Would there be more or less sunlight? Would the temperature be higher or lower? How would these changes affect the plant and animal life found there?
- Diagram your backyard, schoolyard or other area; noting the abiotic factors affecting the plants and animals that live there, and the types of plants and animals in the area. How would the abiotic factors change in that location if it were a different time of year?

HIGH SALINITY

LOW SALINITY

HIGH TEMPERATURE

LOW TEMPERATURE

HIGH ELEVATION

LOW ELEVATION

HIGH DEPTH

LOW DEPTH

HIGH SUNLIGHT

LOW SUNLIGHT

HIGH WIND

LOW WIND

Activity 5: Aquatic Food Chains

OBJECTIVES: For youth to:

- Identify at least one aquatic food chain and indicate which members are producers, consumers, or decomposers, and why.
- Identify one predator and one prey species and the importance of that predator to the dynamic balance of the community.
- Describe how energy flows through the system indicating the ultimate energy source and energy utilization by the various organisms.
- Correctly identify at least two invertebrates that were collected in the pond. Youth may use a guide such as Pond Life, a golden guide , the National Audubon Society Nature Guides, Atlantic and Gulf Coasts or Wetlands or the activity sheets in from Lesson 3 Activity 5. See the reference list for a complete citation on these publications.
- Demonstrate a knowledge of proper collecting and release methods while using the equipment provided for this activity.
- Provide several examples of interrelationships existing within the aquatic community observed.

LIFE SKILLS

- Acquiring, analyzing, and using information.

SUNSHINE STATE STANDARDS:

SC.4.L.17.2: Explain that animals, including humans, cannot make their own food and that when animals eat plants or other animals, the energy stored in the food source is passed to them.

SC.4.L.17.3: Trace the flow of energy from the sun as it is transferred along the food chain through the producers to the consumers.

TIME: 60 minutes

Leader Information

This activity can be adapted for use in any aquatic ecosystem. It can be used in conjunction with the food web activities in Lessons 2-5. If the site is an estuary, for example, review the activity "Web of Life" in Lesson 4. This activity will provide additional information on the species found in coastal ecosystems. NOTE: If youth are cannot go to a location and collect the specimens, the educator should collect the specimens beforehand and have youth look at them in tubs for this activity.

This activity is designed to give youth a better idea of the food relationships that exist within an aquatic ecosystem. Many people see the game fish that a pond produces but few take a closer look at the many organisms making up the complex food webs that support the fish populations.

The energy source for all the organisms in the pond is the sun. Various types of green plants utilize sunlight to produce their own food. These green plants or producers can fall into a number of different categories: Submerged plants are rooted in the bottom and do not extend above the water surface. Examples are hydrilla and pond weed. Emergent plants are rooted in the bottom and extend out of the water. Examples are cattail and bullrush. Free floating plants have roots in the water that are not attached to the bottom. Examples are water hyacinth and duckweed. Phytoplankton are microscopic free floating plants found in the water column.

Animals that feed on the producers are called primary (or first order) consumers. Secondary (or second order) consumers feed on the primary consumers. Tertiary and fourth order consumers may also exist within the pond. These organisms form predator/prey relationships. Decomposers form the last major category which consists mostly of bacteria and fungi. These organisms break down dead organic matter or detritus into basic nutrients which may then be recycled by the producers or in some cases by consumers.

SETTING: Any pond that contains vertebrate and invertebrate population.

Materials:
Instructor:

- One large dip net and seine
- One sieve
- Two light colored pans
- 6 to 8 glass jars
- FOOD ENERGY PYRAMID
- AQUATIC FOOD WEB PICTURES

Youth (for each team of two)

- One dip net
- One magnifying glass
- One medium size plastic container (such as a milk jug with the top cut off)
- One set of tweezers
- One pencil
- One data sheet
- One clipboard
- Field guides to identify species
- DATA SHEET (1 for each youth)

ADVANCE PREPARATION: Read background basics. Gather all equipment together before beginning the activity. Make sure the youth have been properly instructed in the use of equipment and field guides. If possible, sample the area ahead of time and identify all unknown species. Make sure all equipment is available and in functional condition. Be prepared to show youth how to use the equipment. Make copies of DATA SHEET (1 for each youth)

The flow of energy from the sun to primary producers to consumers is known as a food chain. A common food chain found in ponds in Florida is: Sun ➔algae ➔snail ➔ ➔shell cracker (red ear sunfish) ➔large mouth bass.

A food web is the interconnected pattern of all separate food chains in a community. Each successive level of producers and consumers in a food chain is called a trophic level. With each transfer of energy (or with each successive trophic level), energy in the form of heat is lost to the environment. This concept of energy loss occurring at each trophic level can be illustrated by an energy pyramid.

INTRODUCTION

We can observe plant and animal life in many different ecosystems. Our observations help us to understand how all living things work together to make up an ecosystem. Oceans, swamps, or rivers may all contain very different living organisms, but they all need energy to live. Energy from the sun is transformed into food energy by plants. Plants are the producers. They need water, air, chlorophyll and energy from the sun to grow the leaves and fruits that are consumed by animals. Animals that eat plants are called primary consumers. Some animals, called secondary and tertiary consumers, eat other animals for food. Within an ecosystem, decomposers might be called the recyclers. These organisms, such as bacteria and fungi, breakdown organic matter into basic nutrients that may be reused by other living things. This flow of energy from one living thing to another is called a food chain. Today, we will visit a pond ecosystem and see how many food chains we can find!

Do

- Take youth to the area to be studied. Ask them to identify the source of energy needed to support the ecosystem. Also, ask them about other factors that might influence plant growth, fish populations, water temperatures, fertility, etc. (such as water clarity, predator/prey numbers, vegetation).
- Use the food chain and food web charts to point out the various organisms that exist within the pond or lake. Explain some of the food relationships that exist among these creatures and emphasize the fact that millions of smaller organisms support a small number of fish because of the loss of energy between trophic levels (e.g., by respiration, movement and waste products). Show youth the FOOD ENERGY PYRAMID Chart so that they can get a better idea of the energy flow and the numbers of smaller organisms required to support a few larger organisms in the higher trophic levels.
- Explain to youth that they are to observe or capture, identify and release organism (plants and animals) that are part of the food chain in the area. Emphasize that the creatures should be place unharmed in the plastic containers so that they can be returned alive at the end of the activity.
- Divide youth into teams of two. Explain that they are working in a "buddy" system and that each youth must assume responsibility for a teammate! Pictures of some possible aquatic animals they may find are provided on the following pages (see Bug Groups).
- Distribute the guides, equipment, data sheets, pencils and clipboards. Demonstrate how to use the collecting equipment (dip nets, seines, tweezers) and how to handle the organisms after capture. Show proper handling of a dip net by gently dragging it slowly through the water. Youth should not try to aggressively attack their specimens with the net. Explain how to use the guide and data sheet to identify -and record all organisms.
- Each team is now prepared to find and identify at least two organisms. Tell the teams to disperse, remain in view of each other, and use caution as they explore. Move from team to team to assist in collecting and identification. Help teams identify producers, consumers. Ask them to note such things as size, color, mouth parts, any special appendages and means of locomotion. Encourage them to determine what function each organism serves. If they find it difficult to identify producers or consumers, refer to the field guide which will give them some help. Make sure the teams are handling specimens and equipment correctly. Do not let them "over collect." One example of each organism will be sufficient.

- Call everyone together after about 30 minutes. Ask several of them to pour the contents of their jars into a light-colored pan. Have youth gather in a circle for a closer examination of the specimens.
- Ask youth to identify some of the specimens in the pans using identification guides. Also have them classify each organism in terms of its position in a food chain (producer, consumer). After the students have identified all specimens they know, look at the FOOD WEB Chart to see what members are missing from the collection (possible algae, zooplankton, and fish). Try to point out these missing organisms. Try to find out why they were not collected.
- Review the concept of the food chain and the energy flow within the chain, pointing out the energy source, producers, primary and secondary consumers.
- Explain the differences between a food chain and a food web. Emphasize the fact that most aquatic systems are actually many interconnecting food relationships that form a dynamically balanced community represented by a food web.

REFLECT

- **For each identified specimen: Where does this organism fit in the food chain? Is it a producer or consumer? If it is a consumer, what does it eat? Is it eaten by any other organisms?**
- **What is the energy source for a producer?**

  The sun.
- **What other components are needed for producers to survive?**

  Water, nutrients, air, and chlorophyll.
- **What is the difference between primary and secondary consumers?**

  Primary consumers eat plants, secondary consumers eat the animals who eat the plants.
- **What are decomposers? What do they do?**

  Bacteria and fungi are decomposers. They feed on organic matter and break it down into basic nutrients.
- **Which organisms were most abundant? Producers, primary consumers, secondary consumers or tertiary consumers? What could be a possible explanation?**
- **How does energy flow through the food chain?**

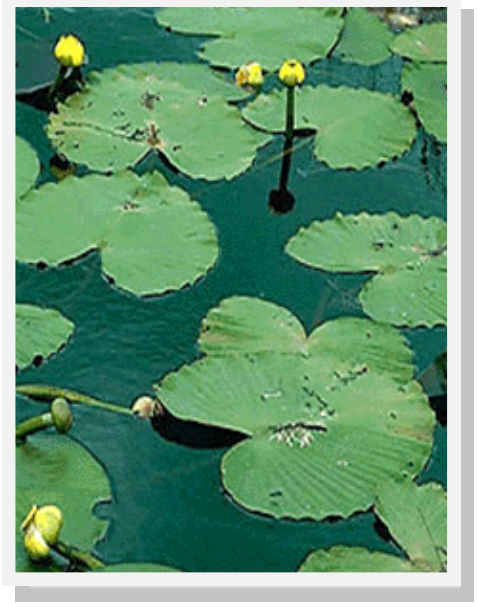
  Sun ~ producer ~ primary consumer ~ secondary consumer. Decomposers may act as the nutrient and energy cyclers when a plant or animal dies at any level of the food chain.

- **What predator/prey relationships can we find among the collected organisms?**
- **How many examples of a food chain can we list using these specimens? Can we connect some of these chains together? How would you describe a food web?**
- **Why was it important to handle the specimens with care and return them to the place from which they were collected?**

When the discussion session has ended or the specimens are no longer needed, have youth release all creatures, preferably in the same areas from which they were taken. Gather all equipment and return to a central location.

APPLY

- Draw pictures of the collected organisms while at the site or later back inside a room. Use the data sheets to label the drawings. Arrange the drawings in a group on a large bulletin board or hang them on the wall. Show the relationships between each organism by using string to connect all possible elements of the food web.
- Write a short essay about your field trip and the things you discovered. If you could be one of the organisms you observed in this environment, would you be a producer, consumer, or a decomposer? Why?



DATA SHEET

Aquatic Food Chains

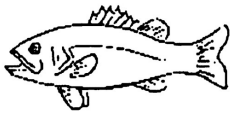
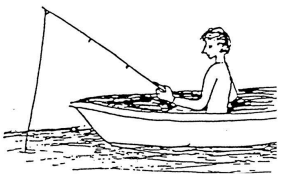
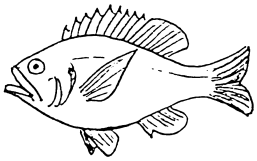
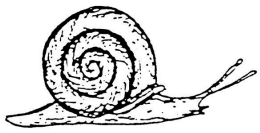
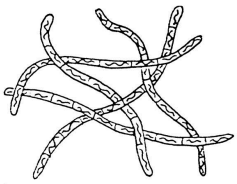
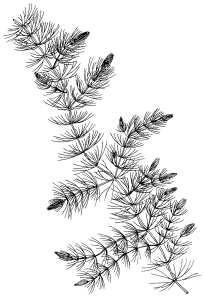
Collectors Names:

_____ _____

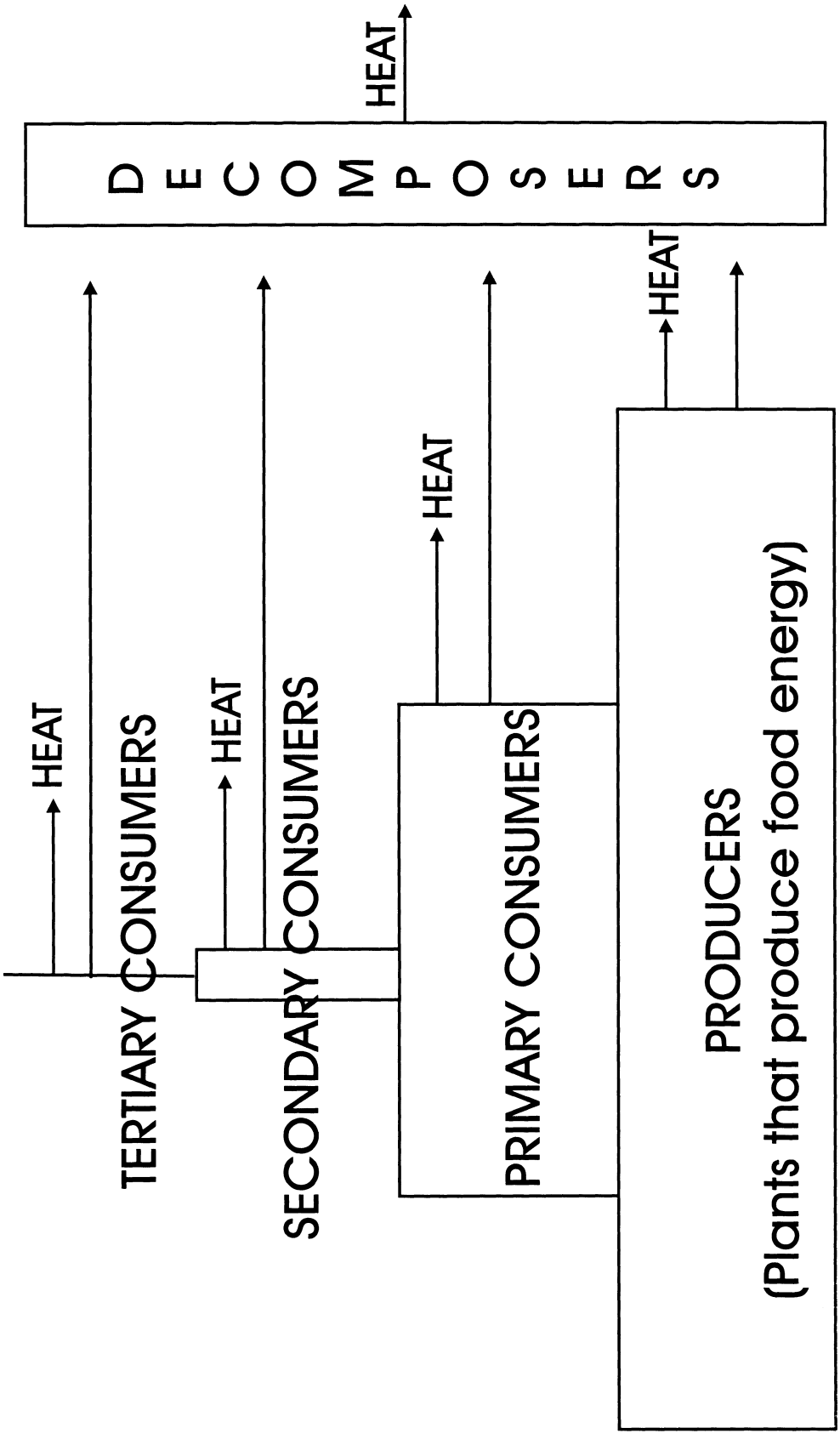
Date: _____ Time: _____

Describe or name each species collected or observed by : color, size, type of locomotion, specialized appendages	Feeding habits: Indicate whether the organism is a producer, consumer or decomposer. Why do you think so?	Habitat Preference

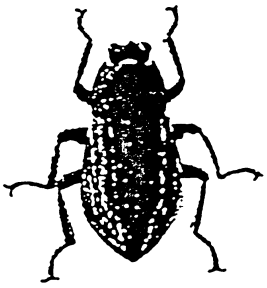
AQUATIC FOOD WEB

TERTIARY CONSUMERS	 LARGE MOUTH BASS	 GREAT BLUE HERON	 HUMAN
SECONDARY CONSUMERS	 SHINER	 SUNFISH	 CATFISH
PRIMARY CONSUMERS	 TADPOLE	 SNAIL	 CRAWFISH
PRODUCERS	 ALGAE	 PONDWEED	 COONTAIL

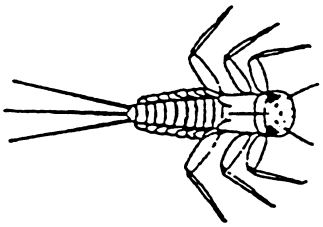
FOOD ENERGY PYRAMID



GROUP 1
"BUGS"

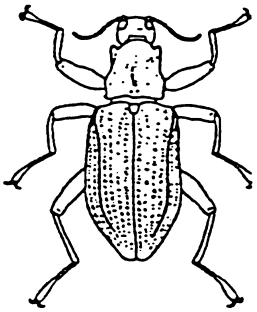


RIFFLE BEETLE
(adult)



MAYFLY
(nymph)

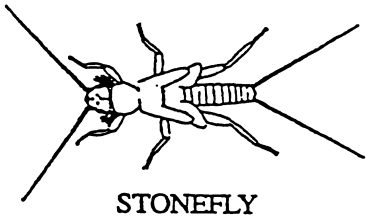
MAYFLY
(nymph)



RIFFLE BEETLE
(adult)

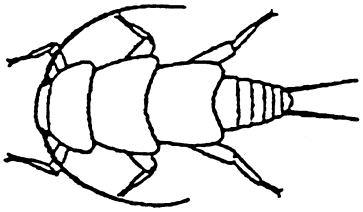
RIFFLE BEETLE
(larva)

MAYFLY
(nymph)



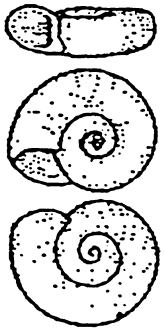
STONEFLY
(nymph)

STONEFLY
(nymph)

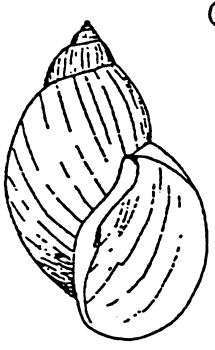


STONEFLY
(nymph)

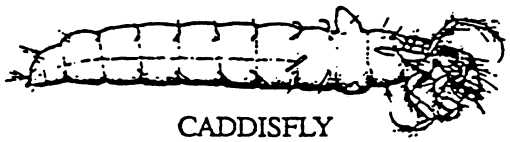
CADDISFLY
(larva)



SNAIL



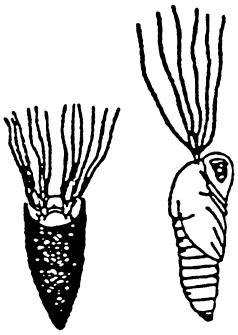
SNAIL
(shell opens to the right)



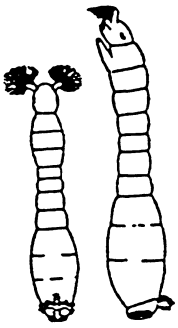
CADDISFLY
(larva)

Reference from - Lesson 3, Activity 3.5: How Many Bugs Do You Have?

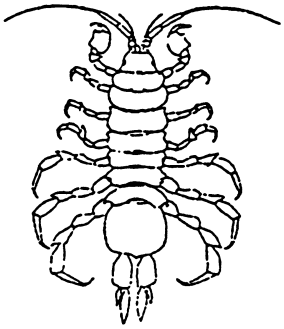
GROUP 2
"BUGS"



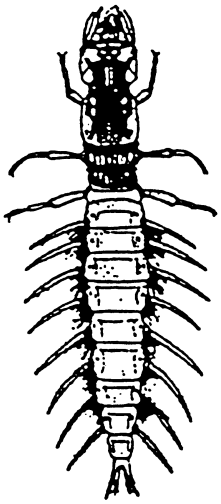
BLACKFLY
(pupa)



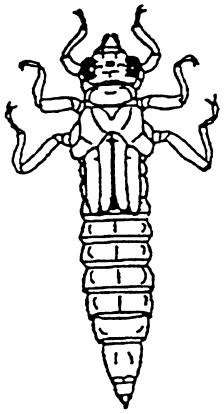
BLACKFLY
(larva)



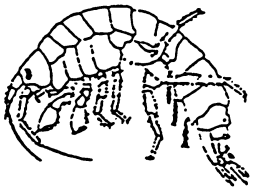
SOWBUG



HELLGRAMMITE
(Dobsonfly)
(larva)



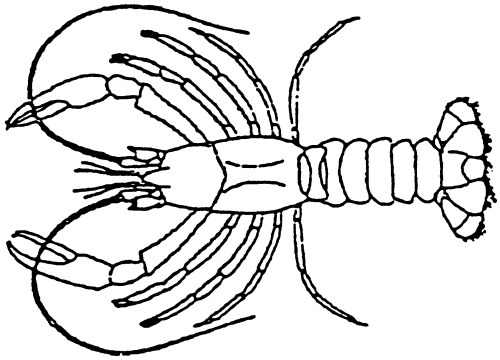
DRAGONFLY
(nymph)



SCUD

SNIPE FLY
(larva)

FILTERING CADDISFLY
(Hydropsychidae)
(larva)

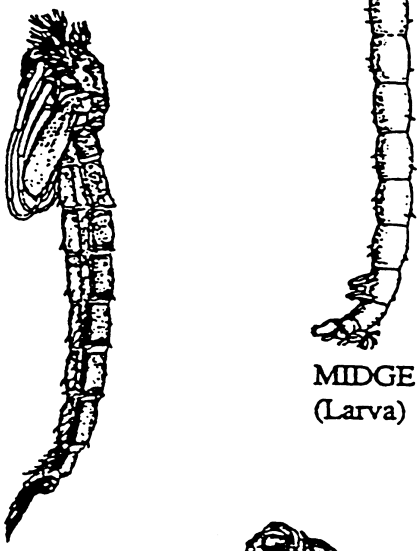


CRAYFISH

Reference from - Lesson 3, Activity 3.5: How Many Bugs Do You Have?

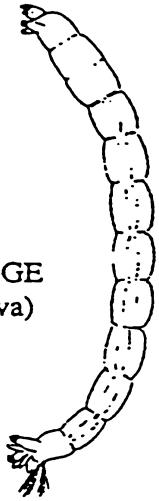
GROUP 3
"BUGS"

MIDGE
(Larva)

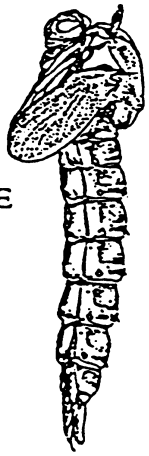


MIDGE
(Pupa)

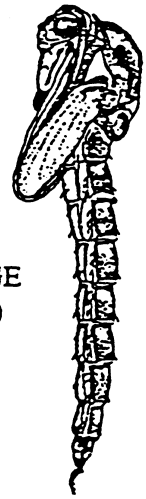
MIDGE
(Larva)



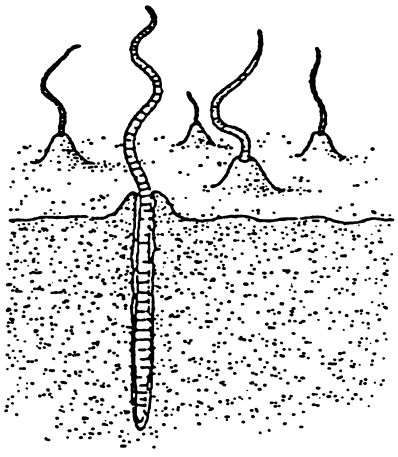
MIDGE
(Larva)



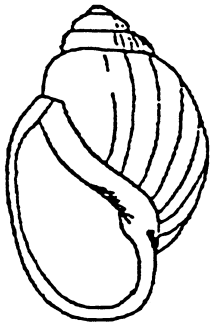
MIDGE
(Pupa)



MIDGE
(Pupa)



AQUATIC WORM



SNAIL
(shell opens to the left)

Reference from - Lesson 3, Activity 3.5: How Many Bugs Do You Have?

Activity 6: Food Webs: Strings Attached

OBJECTIVES: For youth to:

- Discover how living and nonliving components of a aquatic/marine ecosystem are interconnected.
- Differentiate between the living and nonliving parts of a food web.
- Predict the outcome if parts of a food wed are removed.

LIFE SKILLS

- Acquiring, analyzing, and using information.

SUNSHINE STATE STANDARDS:
SC.4.L.17.3: Trace the flow of energy from the Sun as it is transferred along the food chain through the producers to the consumers.

SC.912.L.17.9: Use a food web to identify and distinguish producers, consumers, and decomposers. Explain the pathway of energy transfer through trophic levels and the reduction of available energy at successive trophic levels.

MATERIALS:

- Ball of yarn
- FOOD WEB PICTURE Cards of the plants, animals, and elements found listed below in the food chain examples, one card per youth.
- Roll of masking tape.

TIME: 30 minutes

SETTING: Comfortable room or outside with plenty of room for all youth to sit in a circle.

ADVANCE PREPARATION: Read Background Basics. Copy and cut out plant, animal, and element cards. Make any others you wish to include in your own food web.

Leader Information

Most organisms depend on more than one source of food. A **food web** is a series of interconnecting **food chains**, showing the many possible energy links between living organisms. Food webs also rely on nonliving elements for survival. There are many ways in which the components of an ecosystem are related, and the survival of the ecosystem as a whole depends on the delicate balance of all these relationships. Everything is affected by everything else, either directly or indirectly. The interconnectedness between plants, animals and nonliving elements can be demonstrated with the web of life. Let's look at some examples of food chains found in a typical aquatic environment:

sun →sea grass→blue crab →great blue heron

sun → algae →mullet → osprey

sun →phytoplankton →zooplankton → minnow → bass → bald eagle

sun →plankton →mosquito larva → mosquitofish → kingfisher

sun →algae →apple snail → snail kite

sun →milkweed leaves →monarch butterfly → bullfrog → blue heron

sun → grass → deer →alligator

sun → duckweed → wood duck → man

Introduction

We all need to eat food to get energy to live and grow. What did you have for dinner last night? If you had a hamburger, you know the beef came from a cow. What do you think the cow ate to get energy? Where did the hay get its energy to grow? Why, the sun of course!

When we look at the connections between plants and animals that get energy from each other, we may call the connections a food chain. When many of these food chains overlap or link together, we may call the connections a food web. Today, let's take on new identities and become the parts of an aquatic food web!

Do

- Have youth sit in a circle.
- Tape a food web picture (plant or animal) or an element card to each youth.
- Hand the ball of yarn to one "plant," asking it to name another organism in the circle with which it interacts. Then holding on to the end of the yarn, toss the ball to the youth identified as that organism or element, stating the relationship.

  Examples:I am an osprey and I eat mullet.

  I am a mullet and I eat algae.

  I am algae and I need the sun to make my food.

  I am the sun and all plants need me to live.

  I am zooplankton and minnows eat me.

  I am a minnow and striped bass feed on me.

  I am a striped bass and bald eagles eat me.

  I am a bald eagle and I need pine trees to nest in.

  I am a pine tree and I need water to survive.

- As the ball of yarn is passed, each youth will wrap the yarn around their wrist once before passing it on. The process will continue until all links have been made.
- Now have youth slide back until the yarn becomes taut. Tell them to keep still. If they feel a tug on the yarn, they should tug back in response. When everyone is still, ask one youth to give a small tug. Through this mechanism, vibration will begin to spread quickly through the Web of Life until everyone is tugging and the whole web is shaking.
- Ask students to pick one organism in the system that seems less important than the others, and have it drop out. Ask if any other organisms should drop out because they depended on that organism. Observe what happens to the web, stating the connections that have been affected.
- Variation: cut the yarn connections one by one, stating the connections affected.

REFLECT

- **How is everything connected in the Web of Life?**

  There are many relationships. Plants, animals, and nonliving elements are all connected either directly or indirectly.

- **What happens when one or more of the animals become threatened or endangered?**

  Other species may be affected in some way.

- **What happens when a plant or animal becomes extinct?**

  A gap in the web occurs and others could be affected.

- **What can we say about the complexity of a food web and how stable it is?**

  This depends on several factors. One factor is an animal's diet. For example, the Everglades' Snail Kite relies almost exclusively on apples snails for food. If the snails are eliminated, the Snail Kite would perish. An animal with a varied diet may be able to "shift" to other food sources.

- **Are the plants and animals from our activity found in more than one type of aquatic environment?**

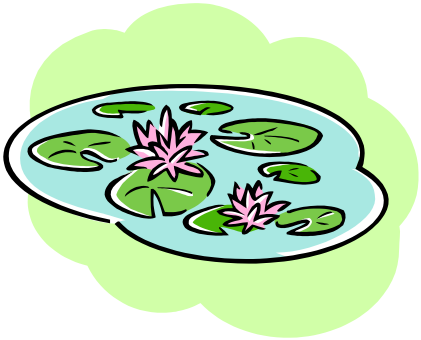
  Yes, the water from one ecosystem often flows into another, and so a species that lives in a river, for example, could also live in a lake, swamp, marsh, or estuary. For instance, a redfish spends part of its life in the ocean, but can be found up rivers and in estuaries at other times.

- **So, if the life in an ecosystem is connected, is that ecosystem connected with other ecosystems?**

  Yes, everything is connected.

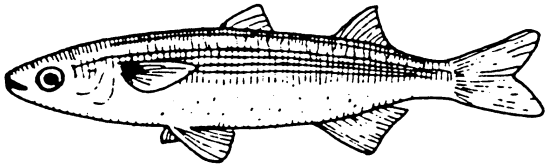
APPLY

- Draw a picture of any aquatic ecosystem and illustrate some members of the food web that might be found there.
- Discuss mankind's role in an aquatic or marine food wed. How much of our food comes from the water? Why might we be called "top predators"?

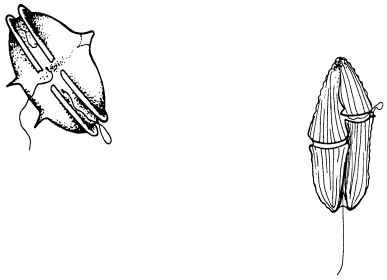


FOOD WEB PICTURES

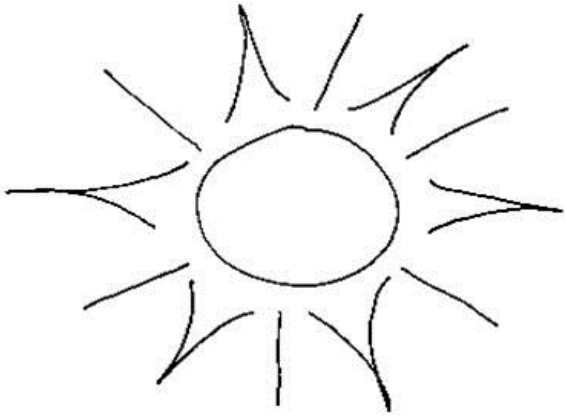
Osprey



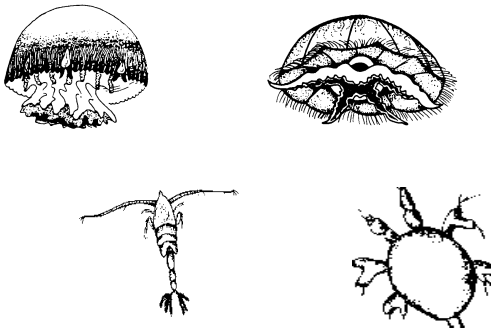
Mullet



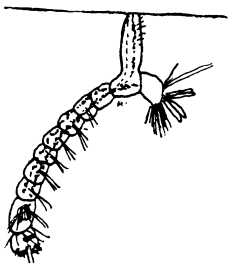
Phytoplankton



Sun

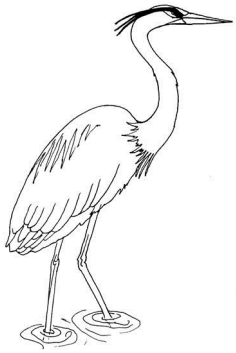


Zooplankton

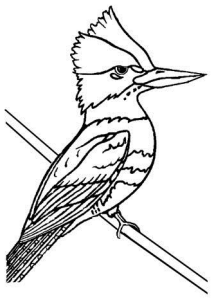


Mosquito Larvae

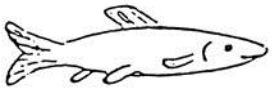
FOOD WEB PICTURES



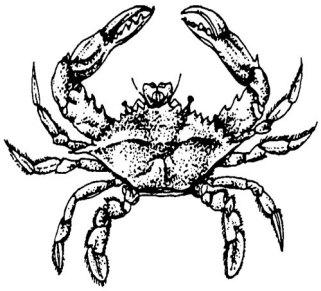
Great Blue Heron



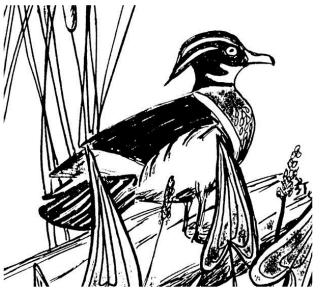
Kingfisher



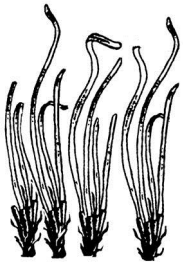
Minnow



Blue Crab

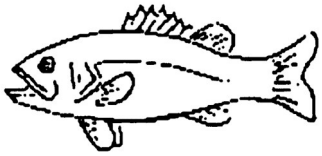


Wood Duck

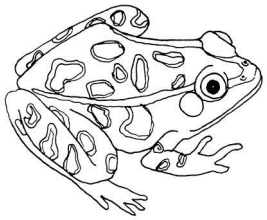


Seagrass

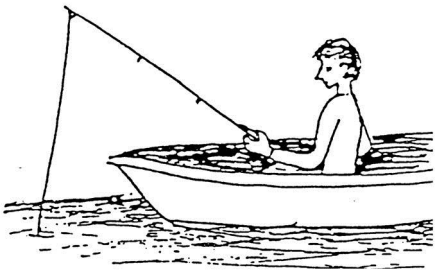
FOOD WEB PICTURES



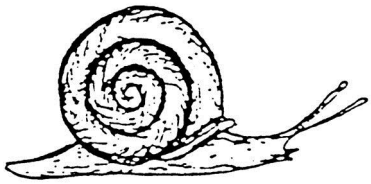
Bass



Frog

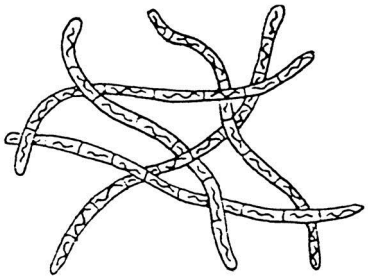


Human



Snail

Bald Eagle



Algae

Activity 7: Aquatic Succession

OBJECTIVES: For youth to:

- Explain the concept of ecological succession.
- Define related terms on DEFINITION Activity Sheet: ecological succession, ecosystem, climax community, equilibrium, detritus, aquatic, terrestrial, and eutrophication.
- Demonstrate application of knowledge related to ecological succession.

LIFE SKILLS

- Acquiring, analyzing, and using information.

SUNSHINE STATE STANDARDS:

SC.912.L.17.4: Describe changes in ecosystems resulting from seasonal variations, climate change and succession.

MATERIALS:

- Copies of DEFINITIONS Activity Sheet (1 for each youth)
- Sets of AQUATIC SUCCESSION Cards (1 set for each group of 3– 4 youth)
- Crayons, markers, etc., for coloring
- Reference book: (see reference list for complete citation) Ecology: An Introduction for Non-Science Majors

TIME: 45-60 minutes

SETTING: Comfortable room with tables and chairs.

ADVANCE PREPARATION: Read Background Basics. Copy DEFINITIONS Activity Sheet (1 per youth). Copy and cut out sets of AQUATIC Succession Cards (1 for each group of 3-4 youth).

Leader Information

Ecological succession is the progressive change in the plants, animals, and nonliving factors of an **ecosystem** over time. It is the gradual and ongoing replacement of one kind of plant and animal community by another. The final stage of succession is called the **climax community**. A climax community maintains a balance with the physical environment.

Succession occurs in both aquatic and terrestrial ecosystems. The study of a pond can reveal several stages in aquatic succession. A new manmade or young pond is devoid of plants and has little or no organic sediment. Eventually insect larvae, plankton, and larger aquatic organisms, which eat the plankton, colonize the pond. Slowly an organic layer of **detritus** (partially decomposed plants and organisms) forms on the pond bottom. Submerged plants can then grow, using the organic layer as a substrate for their roots. Floating plants invade and eventually shade out the submerged plants. The plants provide a habitat for larger organisms like beetles and amphibians. More sediment forms on the pond bottom as the plants and animals die and add to the detritus. As the sediments build up, the water level decreases. Emergent plants like cattails and sedges begin to grow, and as they die, add to the sediment layer. The emergent plant stage of pond succession is known as a marsh.

As the soil builds up, grasses begin to replace the emergent plants. Eventually, the water level is so low that bushes and trees begin to grow, and **terrestrial** succession may now take over. This aging process of a water body is termed eutrophication. Eutrophication can occur naturally as organic matter accumulates. Human activities that add nutrients and sediment to a body of water may increase the rate of eutrophication.

INTRODUCTION

The term **succession** refers to a progression or sequence of events. What is **ecological succession**? Can a pond turn into a forest? Let's look at aquatic succession and see!

DO

- Divide the group into teams of 3 or 4.
- Have teams use reference books or Internet resources to investigate ecological succession and complete the DEFINITIONS Activity Sheet.

REFLECT

- **What is the word for the progressive changes in the structure of an ecosystem over time?**

  Succession.

- **What is the final stage of succession called?**

  Climax community.

- **What is detritus?**

  Partially decomposed plants and animals.

- **What is the difference between aquatic and terrestrial succession?**

  Aquatic succession occurs in water and terrestrial succession occurs on land.

- **What is eutrophication?**

  The aging of a body of water due to the addition of organic matter.

- **How can humans affect the process of eutrophication?**

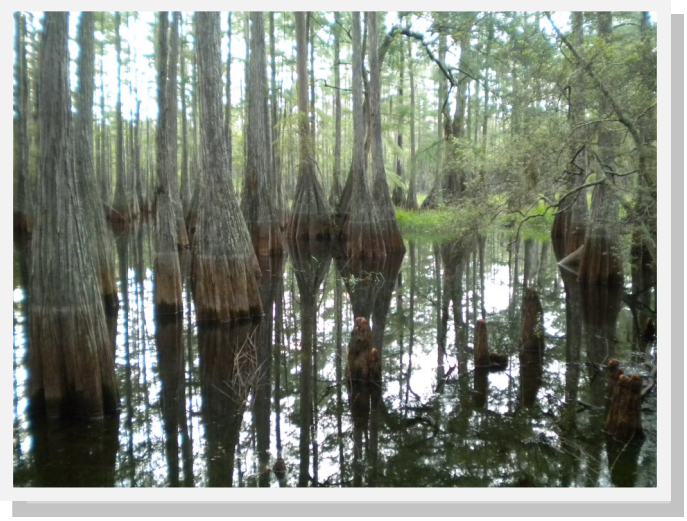
  Humans may increase the rate of "aging," by allowing sewage and other sediments to "runoff" and enter aquatic systems, increasing nutrient levels and bottom sediments.

APPLY

- Distribute a set of four AQUATIC SUCCESSION Cards to each team. Ask each team to arrange the cards in the correct order of aquatic succession. Allow a member from each team to make one change at a time with their cards until all teams have the cards in the correct order.

- Have individuals draw a picture of what the next stage of succession might look like on the back of the definitions activity sheet (i.e., more and larger trees filling in the area where the pond once existed).

- If a cleared pasture was left alone, how do you think succession would proceed?



DEFINITIONS

Activity Sheet

Use reference materials to find the definition of the following words:

Ecological Succession—

Ecosystem—

Climax Community—

Equilibrium—

Detritus—

Aquatic—

Terrestrial—

Eutrophication—

DEFINITIONS

Answer Key

Use reference materials to find the definition of the following words:

Ecological Succession—the profession of plant communities from one to another in a given locality; often begins with a pioneer community progressing through a series of plant communities toward a climax plant community.

Ecosystem—an aggregate of plants and animals which are interdependent plus the abiotic values with which they interact; typically thought of as self-contained in the sense that many of the essentials for life can by cycled and recycled within that system

Climax Community—the stage of succession that results in a relatively stable ecosystem, usually one with a wide array of species and habitats

Equilibrium—a state of balance

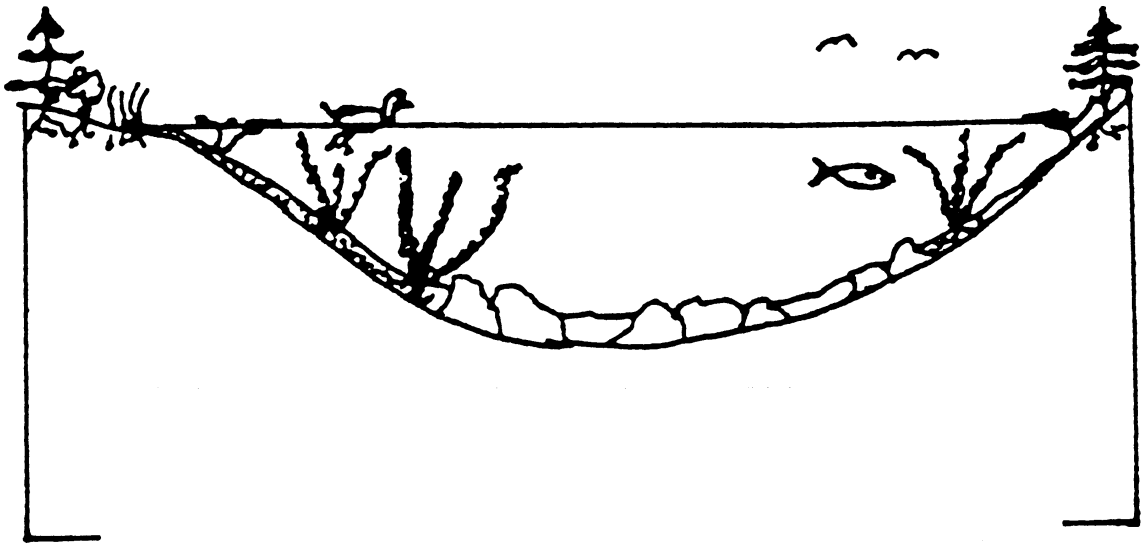
Detritus—partially decomposed plants and animals

Aquatic—taking place in or on water

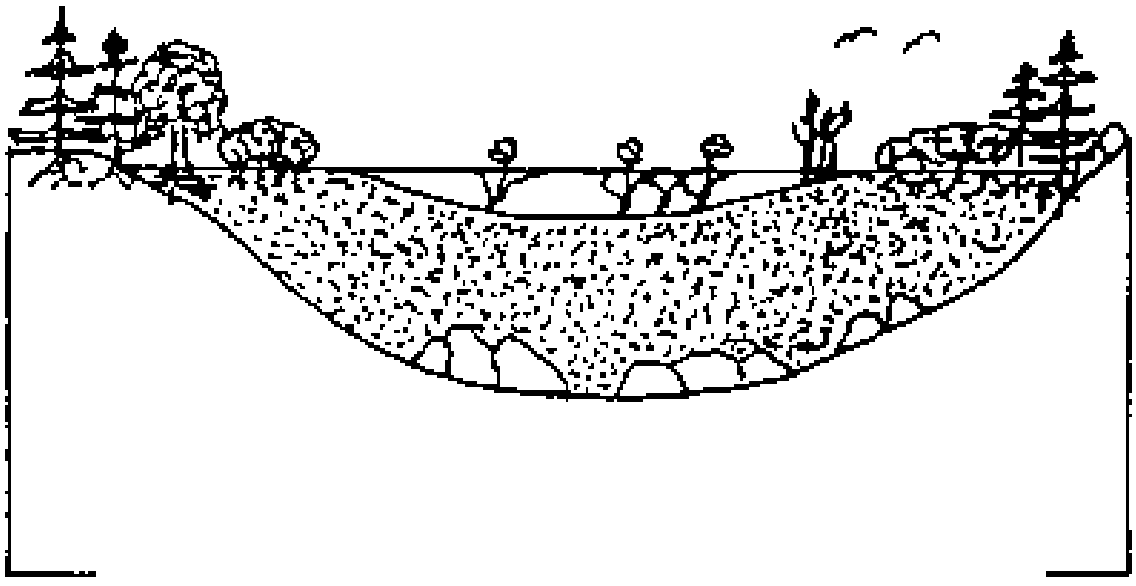
Terrestrial—living on or in or growing from land

Eutrophication—the aging of a body of water due to the addition of organic matter

AQUATIC SUCCESSION CARDS

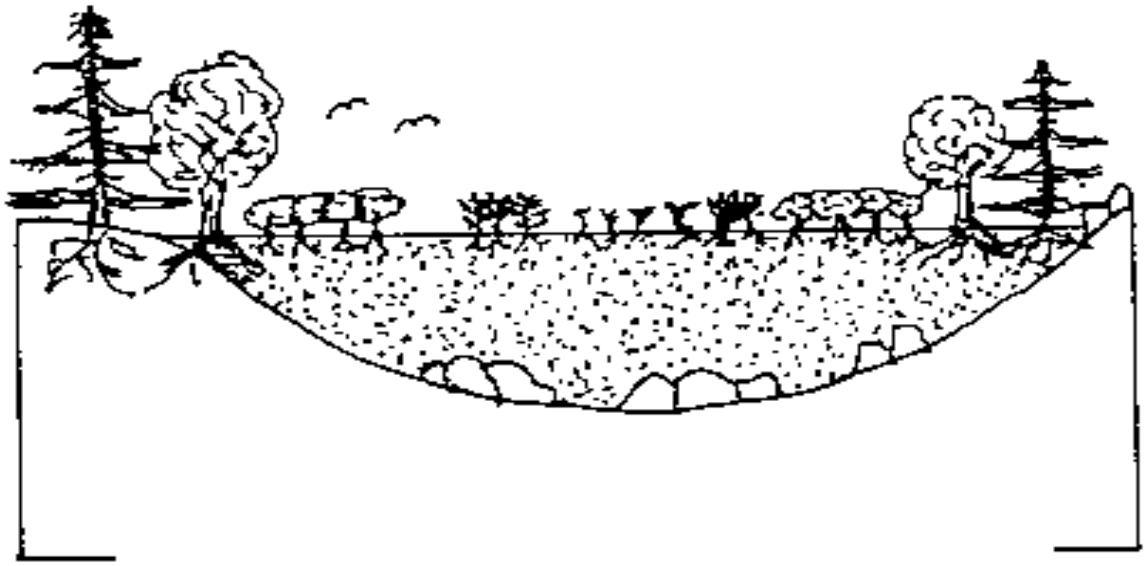


A pond (lake) of medium age. Sedimentation has begun and aquatic succession is in full development. Some sediments are introduced in the ecosystem by erosion and others accumulate as a result of biological processes; growth, death, & decomposition.

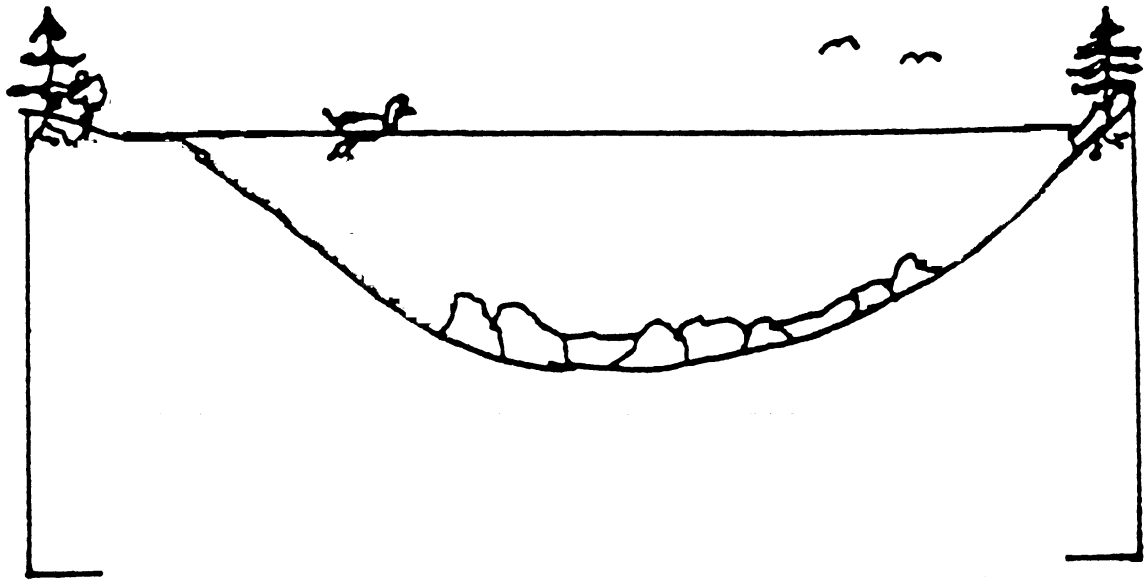


A pond (lake) is in an old age here. Sedimentation has taken place for an extended time and the ecosystem has changed. Terrestrial succession will begin soon.

AQUATIC SUCCESSION CARDS



Terrestrial succession at the original site of the pond (lake). Aquatic succession has ceased and terrestrial succession initiated. In time, a forest will grow here, where ducks once swam and water lilies grew.



A pond (lake) is in early age here.

Activity 8: Aquatic/Marine Values

OBJECTIVES: For youth to:

- List ways in which humans utilize aquatic/marine ecosystems.
- Describe several resources that humans use from the aquatic/ marine ecosystem.
- Associate human values with aquatic/marine ecosystem resources and their uses.

LIFE SKILLS

- Communicating and relating with others.

SUNSHINE STATE STANDARDS: Common Core Standards:

LACC.6.L.3.6; LACC.7.L.3.6; LACC.8.L.3.6; LACC.910.L.3.6: Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases.

MATERIALS:

- Copies of AQUATIC WORLD SEARCH Activity Sheet for each youth.
- Copies of WHAT ARE OUR VALUES? Activity Sheet for each youth.
- Pencils/pens

TIME: 30 minutes

SETTING: Comfortable room with tables and chairs.

ADVANCE PREPARATION: Read Background Basics.

INTRODUCTION

We have learned about the water cycle and some of the ways plants and animals interact with each other in food chains. Humans depend on aquatic and marine ecosystems for many resources. In Florida, the seafood industry alone is valued at 1-2 billion dollars. We also use these systems in less consumptive way such as snorkeling, scuba diving and bird-watching. Let's identify ways that humans use aquatic/marine resources and some of the values associated with their use.

DO (Part 1)

- Give each youth a copy of WHAT ARE OUR VALUES? worksheet. Have youth read the descriptions of each value, then provide examples and discussion to ensure everyone's understanding.
- Ask each youth to place a check in the column for every use of an aquatic/marine resource and then identify the values associated with it. There may be more than one value for a use. An answer is "correct" if it can be defended.

DO (Part 2)

- Give a copy of AQUATIC WORD SEARCH and a pencil or pen to each youth, or make a poster of the word search and conduct a group activity.
- Have youth read instructions and complete word search by circling each listed term.
- Assign each youth a word from the word search list. Ask them to describe some human values associated with this type of resource use.

REFLECT

- **What is an example of resource use and educational values?**

  Bird watching is educational because while looking at the birds you learn what they look like, what sounds they make and their habits.

- **What is an example of resource use and aesthetic values?**

  Snorkeling can be aesthetic because you are appreciating the beauty of the underwater environment through sight, and possibly sound.

- **Name seven ways we use aquatic/marine ecosystems for recreation.**

  Fishing, boating, swimming, birdwatching, scuba diving, snorkeling, and collecting seashells are all ways we use aquatic/marine ecosystems for recreation.

- **What is aquaculture?**

  Aquaculture is the production of animals and plants in a water environment controlled by humans (for example, water temperature and the addition of nutrients).

- **What animals and plants are commonly produced through aquaculture in Florida?**

  Tropical fish, catfish, alligators, American eels, sportfish, baitfish, aquatic plants for aquarium use, shrimp, and oysters are commonly produced through aquaculture in Florida.

- **What types of food are utilized from the aquatic/marine environment in Florida?**

  Crab, lobster, fish, oysters, scallops, and shrimp are taken from Florida waters.

- **What products, other than food, are obtained from aquatic/marine environments?**

  Many products such as sponges and oyster shells are ground into livestock feed, medicines extracted from various marine organisms, shells used as jewelry, and fish and plants for aquariums are obtained from aquatic/marine ecosystems.

APPLY

- **What aquatic/marine ecosystem values can also be associated with terrestrial ecosystems?**

  Trees have economic, aesthetic, educational, health and recreational values.

- **Give three examples of things that are recreational in a forest?**

  Some examples of things that are recreational in a forest are hiking, bird watching, bicycling, etc.

- **What activities do you enjoy or would you enjoy in an aquatic\marine setting? How could you enjoy this activity without having a great impact on the ecosystem?**

- **Think about an aquatic/marine ecosystem near you. How do humans utilize this area? What values do you think are associated with these uses?**

AQUATIC WORD SEARCH

How many of the following words can you find in this puzzle? Circle each word (they may be spelled forwards, backwards, upwards, downwards, or diagonally).

A	S	C	U	B	A	D	I	V	I	N	G	R
G	B	I	R	O	C	P	J	Q	D	S	O	H
K	G	N	I	H	C	T	A	W	D	R	I	B
E	M	N	Q	F	M	I	N	E	R	A	L	S
L	L	F	S	W	I	M	M	I	N	G	D	N
G	I	M	E	P	I	J	K	N	J	N	R	O
N	E	H	A	K	O	G	O	L	F	I	I	R
R	P	D	S	E	A	F	O	O	D	P	L	K
E	M	E	H	D	Q	I	Q	N	E	P	L	E
T	M	C	E	C	U	S	O	R	E	I	I	L
A	B	L	L	P	A	H	A	S	W	H	N	I
W	B	Q	L	Z	C	I	K	T	A	S	G	N
G	R	J	S	W	U	N	X	S	E	U	Y	G
N	V	T	U	V	L	G	T	U	S	I	A	W
I	V	B	O	A	T	I	N	G	H	A	R	S
K	W	X	R	Y	U	X	Q	Y	G	Y	L	P
N	E	Z	Z	L	R	M	X	A	F	N	O	T
I	B	V	K	J	E	C	D	I	W	D	H	C
R	E	T	R	W	A	T	E	O	N	F	E	G
D	E	B	F	T	D	C	G	A	B	U	H	A

AQUACULTURE
BIRDWATCHING
BOATING
DRINKING WATER
FISHING
MINERALS
OIL DRILLING
SALT
SCUBA DIVING
SEAFOOD
SEASHELLS
SEAWEED
SHIPPING
SNORKELING
SWIMMING

AQUATIC WORD SEARCH

Answer Key

How many of the following words can you find in this puzzle? Circle each word (they may be spelled forwards, backwards, upwards, downwards, or diagonally).

A	S	C	U	B	A	D	I	V	I	N	G	R
G	B	I	R	O	C	P	J	Q	D	S	O	H
K	G	N	I	H	C	T	A	W	D	R	I	B
E	M	N	Q	F	M	I	N	E	R	A	L	S
L	L	F	S	W	I	M	M	I	N	G	D	N
G	I	M	E	P	I	J	K	N	J	N	R	O
N	E	H	A	K	O	G	O	L	F	I	I	R
R	P	D	S	E	A	F	O	O	D	P	L	K
E	M	E	H	D	Q	I	Q	N	E	P	L	E
T	M	C	E	C	U	S	O	R	E	I	I	L
A	B	L	L	P	A	H	A	S	W	H	N	I
W	B	Q	L	Z	C	I	K	T	A	S	G	N
G	R	J	S	W	U	N	X	S	E	U	Y	G
N	V	T	U	V	L	G	T	U	S	I	A	W
I	V	B	O	A	T	I	N	G	H	A	R	S
K	W	X	R	Y	U	X	Q	Y	G	Y	L	P
N	E	Z	Z	L	R	M	X	A	F	N	O	T
I	B	V	K	J	E	C	D	I	W	D	H	C
R	E	T	R	W	A	T	E	O	N	F	E	G
D	E	B	F	T	D	C	G	A	B	U	H	A

WHAT ARE OUR VALUES? Answer Key

Read each of the following values associated with aquatic/marine resources. Place a check in the column next to each of the uses. Be able to defend your answer.

AESTHETIC: appreciation of beauty through the human senses (sight, hearing, smell, taste, or touch).

ECONOMIC: the use and exchange of money, materials, and/or services.

EDUCATIONAL: concerning the accumulation, use, and communication of knowledge.

HEALTH: the maintenance of a positive general condition of the human body.

RECREATIONAL: pertaining to human leisure/fun activities.

	AESTHETIC	ECONOMIC	EDUCATION.	HEALTH	RECREATION
FISHING					
SEAFOOD					
SALT					
BIRDWATCHING					
SNORKELING					
SHIPPING					
BOATING					
MINERALS					
AQUACULTURE					
SEAWEED					
OIL DRILLING					
SCUBA DIVING					
SEASHELLS					
SWIMMING					
DRINKING WATER					

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RECREATIONAL: pertaining to human leisure/fun activities.

	AESTHETIC	ECONOMIC	EDUCATION.	HEALTH	RECREATION
FISHING		X			X
SEAFOOD		X			
SALT		X		X	
BIRDWATCHING	X		X		X
SNORKELING	X		X		X
SHIPPING		X			
BOATING					X
MINERALS		X			
AQUACULTURE		X			
SEAWEED		X			
OIL DRILLING		X			
SCUBA DIVING	X	X	X		X
SEASHELLS	X		X		X
SWIMMING				X	X
DRINKING WATER				X	