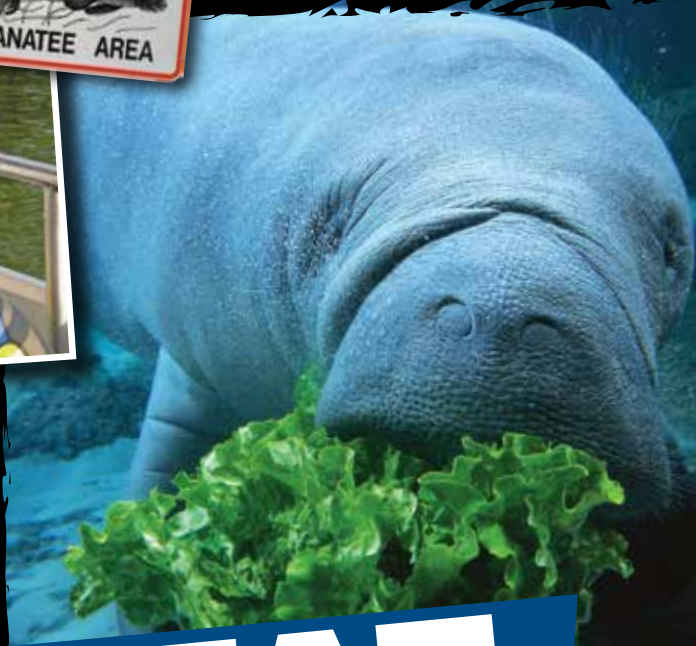


DISCOVERY JOURNAL



HABITAT:

H_2O

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INTRODUCTION

USING YOUR DISCOVERY JOURNAL
SETTING THE SCENE



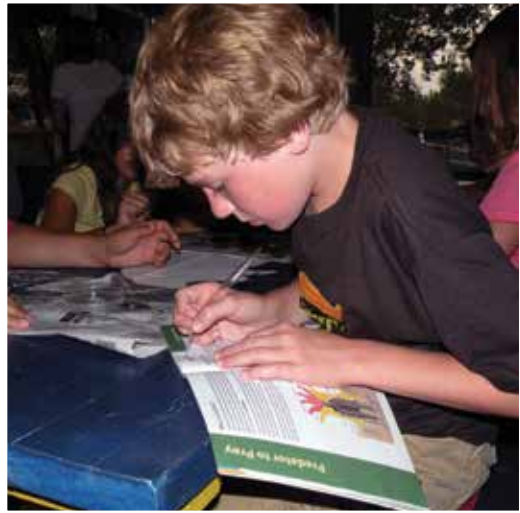
INTRODUCTION

USING YOUR DISCOVERY JOURNAL

General Advice


To make the best use of your Discovery Journal on your WorldStrides program:

- Personalize your journal! This is *your* research, thoughts, and observations. They are unique to you and reflect your individual perspective.
- Write with as much detail as possible. There is plenty of space throughout the journal to take notes or draw sketches. If you run out of space, use the Notes section at the end of the journal.
- Refer to the Eco-pedia, located at the end of the journal, to refresh your memory on concepts you'll learn about during your trip.
- Bring your Discovery Journal with you for every activity in the field.



Tools of the Trade

As an investigator, you should bring the following tools of the trade with you when you embark on an adventure.

TOOL	PURPOSE
<p>Discovery Journal</p>	<p>Keeping a journal is an important part of fieldwork. Scientists use journals to write down observations, thoughts, and ideas. Your Discovery Journal serves as a learning resource and a place to record your thoughts.</p> <p><i>List 5 examples of types of information you will be able to capture in your Discover Journal</i></p> <ol style="list-style-type: none"> 1. _____ 2. _____ 3. _____ 4. _____ 5. _____
<p>Pens, pencils</p>	<p>It's difficult to record your observations without a writing utensil! Be sure to bring writing instruments with you.</p>
<p>Camera</p>  <p>= Lights, Camera, Action!</p>	<p>A digital camera is useful for documenting animals, plants, and landscapes you encounter on your adventures. Note the time, date, location, and subject of your photos for future reference.</p> <p><i>Write 3 tips to help capture great images.</i></p> <ol style="list-style-type: none"> 1. _____ 2. _____ 3. _____ <p><i>Check out the Lights, Camera, ACTION! photo tips throughout your Discovery Journal for photography hints.</i></p>
<p>Teammates</p>	<p>In the field, scientists often collaborate and help each other to accomplish a project. Throughout your program, your Course Leader will divide your group into teams to compete in various challenges. In some challenges, you may be able to earn points to be used toward your "skit kit" for your final project.</p>

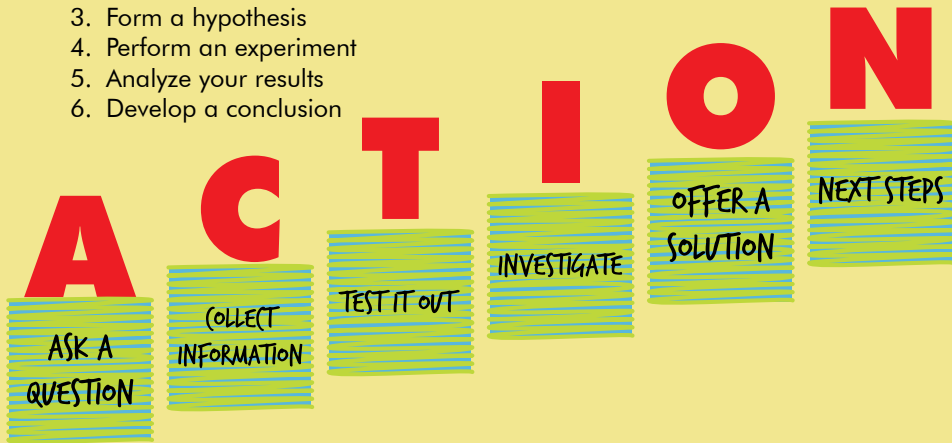
INTRODUCTION

TAKING ACTION

You are probably familiar with the Scientific Method from your science classes. The Scientific Method includes several major steps:

1. Ask a question
2. Conduct research
3. Form a hypothesis
4. Perform an experiment
5. Analyze your results
6. Develop a conclusion

During your WorldStrides Habitat: H₂O trip, the ACTION steps will take you beyond the Scientific Method to transform you into a conservation activist!



ACTION steps are more than just basic scientific questioning. They encourage you to evaluate the ways you interact with the natural world and develop a plan for improving it.

ACTION Figures

Throughout your trip, you'll meet people who practice a variety of exciting careers in the sciences. ACTION Figures highlight some of these careers and appear in the bonus section of your Discovery Journal. Whether it's a profession that you've never heard of or one you've dreamed of pursuing, you can read all about these

careers. You may be inspired to learn even more about these careers when you return home.



Don't let bad weather stop you from being active! The raindrop icon will lead you to rainy-day-friendly activities at each site.

When you meet an ACTION Figure, think up a superhero name for him/her that will help you remember what amazing things he or she does!

Essential Questions

Throughout your trip, you will work with your peers and Course Leaders to answer the following questions:

1. Why do wetlands host such a diversity of wildlife? How have different species adapted to wetlands living?
2. What role does biodiversity play in maintaining the integrity of Florida wildlife? How do organisms rely on each other for survival?
3. What threats do human activities pose to Florida ecosystems?
4. How do conservation efforts contribute to a solution? What are some practical ways that you can help?

THE ECO-PEDIA

Have you become a little rusty on your science concepts or vocabulary? No need to find your textbook! There's a great tool at the back of your Discovery Journal—the Eco-pedia. Go here if you are confused about a term or concept or if you want more information about a topic. Like a dictionary, terms are organized alphabetically.

SETTING THE SCENE



Florida Facts

Nickname: The Sunshine State

State flower: Orange Blossom

State Bird: Mockingbird

State Tree: Sabal Palm

State Beverage: Orange Juice

State Animal: Florida Panther

Florida

You may know Florida for Disney World and dolphins, but did you know it is also a place of pristine natural beauty? Florida boasts 663 miles of beaches, 1,800 miles of coastline, and 11,000 miles of rivers, streams, and waterways. Florida has 163 state parks where you can hike, kayak, camp, and explore.

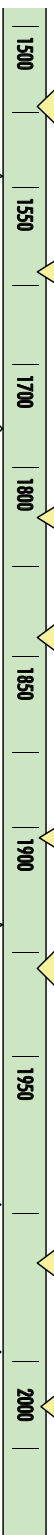
Florida's humid weather yields long summers and mild winters, making it a popular vacation destination. Because it is surrounded by water on three sides, this tropical paradise is more prone to hurricanes than any other state. Hurricane season runs from June 1 to November 30, with an average of 10 named storms during this period each year.

INTRODUCTION



FLORIDA TIMELINE

This timeline will help you piece together things you know with things you are learning!



1513: Spanish explorer Ponce de Leon leads first European expedition into Florida.

1565: Spanish establish St. Augustine, the first European settlement in the New World.

1540: European diseases kill 80% of Florida's native people over the next century (the Timucua, the Apalachee, and the Calusa).

1816: First Seminole War - European Settlers and Creek Natives clash.

1760: Native people from Georgia and Alabama move into Florida, called Seminoles by Spanish (meaning "outsiders" or "runaways").



1845: Florida becomes a state.

1835-1842: Second Seminole War.

1855-1858 Third Seminole War.

1901: Draining of Everglades to create more farmland.

1936: On June 1, Amelia Earhart takes off from Miami on first international leg of her round-the-world flight. She disappears over the Pacific on June 29.



1914-1918: WWI - Florida serves as training ground for soldiers.



1971: Walt Disney World opens in Orlando.

2000: Massive recount of Florida voting ballots delays results of Presidential election for over two months.

1969: Apollo 11 launches from Cape Kennedy and lands first men on the moon.



1992: Hurricane Andrew strikes South Florida, the costliest disaster U.S. has seen up to this point.

LESSONS & ACTIVITIES

TAMPA

FORT DE SOTO

CRYSTAL SPRINGS

TAMPA'S LOWRY PARK ZOO

HOMOSASSA & CRYSTAL RIVER

RAINBOW RIVER

MOTE MARINE LABORATORY

LIDO BEACH

BUSCH GARDENS

BONUS PAGES

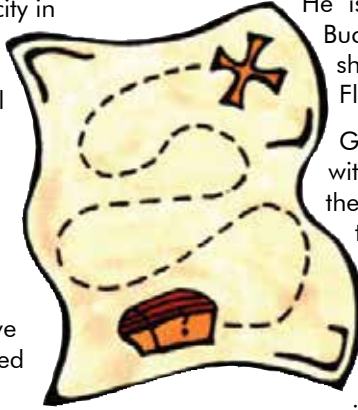


TAMPA

Exploring Tampa Bay

Ahoy! Tampa Bay is the only city in America that celebrates pirates. Each January since 1904, Tampa holds its annual Gasparilla Pirate Fest.

It gets its name from the legendary pirate, Jose Gaspar. Gasparilla, as he called himself, had been serving as a lieutenant for the Royal Spanish Navy for five years when, in 1783, he started a mutiny, seized a ship, and began his life of piracy.



He is often called the last of the Buccaneers, pillaging and burning ships in the coastal waters of West Florida until his death in 1821.

Gasparilla Pirate Fest begins with the Gasparilla Invasion, with the Jose Gasparilla Pirate ship taking over Hillsborough Bay with flying flags and booming cannons. "Pirates" parade down Bayshore Boulevard during the day and return to the streets at night to party like its 1799.

PIRATE GLOSSARY

AHOY! – Hello

AVAST! – Stop and give attention

AYE! – I heartily agree

AYE AYE! – I'll get right to it

ARRR! – Yes, I agree, I'm happy (anything you want it to mean really)

BEAUTY – Used to address a woman, for instance "Me beauty"

BILGE RAT – A rat that lives in the slimy lower levels of the ship; used to playfully insult other pirates

HORNPIPE – A single-reed musical instrument or a spirited dance

LUBBER, LAND LUBBER – A land lover, someone who doesn't go to sea, used as a serious insult to a pirate



SMARTLY – Quickly

Do Pirates Still Exist?

Yes, there are modern day pirates all over the globe. Hundreds of ships are attacked by pirates each year! Cargo ships and tankers are the most common targets and attacks usually occur off the coasts of Indonesia, Somalia, and Bangladesh. Pirates maroon, pillage, assault, and even kill ships' crews.

Today's pirates may wear modern military fatigues and carry machine guns, but they fit the basic definition of piracy:

1. They use private boats to attack other boats for private gain.
2. They operate outside the authority of any government.

MYTH	MAN
	
<p>Captain Jack Sparrow from <i>Pirates of the Caribbean</i></p>	<p>Edward Teach, commonly known as Blackbeard</p>
<p>Pirates in film, like Jack Sparrow, use treasure maps to locate gold, silver, and jewels</p>	<p>Actual pirate plunder usually consisted of everyday items like tobacco, rum, and sugar</p>
<p>Pirates dress and behave like royalty and live extravagant lifestyles</p>	<p>Actual pirates lived difficult lives and survived on diets of spoiled meat, dirty water, and stale crackers</p>
<p>Pirates make their victims "walk the plank"</p>	<p>Actual pirates marooned their victims on islands, sold them as slaves, or killed them. "Walking the plank" is an invention of books and film</p>
<p>Pirates are portrayed as handsome, charming, and noble outlaws</p>	<p>Actual pirates were usually thieves and murderers</p>
<p>Pirates sail in enormous and slow-moving ships</p>	<p>Actual pirates preferred smaller, faster vessels called sloops, schooners, or brigantines</p>
<p>Reference: <i>The National Museum of Crime and Punishment</i></p>	

ORIENTATION ACTIVITIES

Orientation: Pirate!



Divide into groups of four to six students. This will be your band of pirates during your trip. You'll need to name your ship and then design a pirate

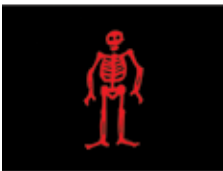
flag. Jolly Rogers (pirate flags) became popular during the height of piracy in the early 1700s. Pirates used their flags to intimidate victims, in the hopes that they would surrender their ships without a fight. This tactic usually worked, and the pirates captured an undamaged ship without wasting any ammunition.

Though Jolly Rogers pictured traditional pirate symbols like skulls, skeletons, daggers, bleeding hearts, crossbones, and hourglasses, your group's Jolly Roger should represent you.

Flag Illustration



Name of your ship: _____



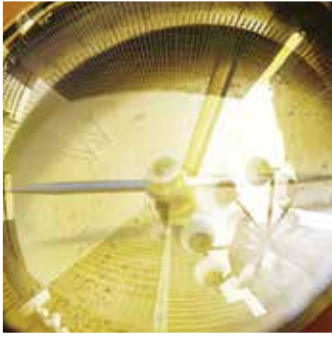
Famous pirate flags from left to right:
Edward Low, Edward England, Blackbeard, and Christopher Condent

Courtesy www.wikipedia.org



Make a Compass!

You'll need a compass to navigate the sea. Follow the instructions below to make a cork compass with your team.



BACKGROUND:

A compass is a navigation device with a magnetized needle that naturally swings towards the north. A magnetic field is the magnetic region surrounding the Earth, with the magnetic poles near the North and South poles.

MATERIALS:

- A clear plastic cup filled with water
- A bar magnet
- A metal sewing needle or small nail
- A cork

INSTRUCTIONS:

1. Rub the end of the magnet alongside the needle about 30 times in the same direction to magnetize it. Test the needle's magnetism by trying to pick up a small pin or needle with it.
2. Press the magnetized needle through the cork until it is centered.
3. Place the cork in the water. When the cork stops bobbing and comes to a rest, the thickest part of the needle will be facing north.

TEAM CHALLENGE: MESSAGE IN A BOTTLE

Your band of pirates found a letter in a bottle that washed onto the shores of Tampa Bay. This shipwreck took place at one of the sites you will visit on this trip. In order to get the reward, you and your group must decide which site the shipwreck took place. Pay close attention to the places that you explore and look for clues in the letter on the next page. Your Course Leader will read "Mystery Shipwreck Hints" throughout the trip, so be sure to record them in your journal.

You may not have the chance to visit every site, but you can use the resources in your journal to solve the mystery. At the end of the trip, you will draw a treasure map leading to the location that the shipwreck took place and the winning pirates will split the booty. Keep in mind, fewer winners means more treasure for each pirate, so keep your guesses between you and your team.

TAMPA

HELP!

THE YEAR IS 1752 AND MY CREW AND I ARE SHIPWRECKED ON A DESERTED ISLAND. WE WERE COMMISSIONED BY THE SPANISH CROWN TO SEARCH FOR GOLD AND SILVER IN FLORIDA. A STORM BLEW US OFF COURSE AND OUR BATTERED SHIP WAS STRANDED ON THE BEACH ON THIS TINY ISLAND. WE CAN SEE OTHER SMALL ISLANDS NEARBY, AND SOME OF OUR MEN SWAM OVER TO EXPLORE THEM, ONLY TO FIND THAT THEY, TOO, WERE UNINHABITED. OUR NAVIGATION TOOLS WERE SOAKED AND BROKEN DURING THE STORM SO THAT WE COULDN'T EVEN FIND OUR WAY WITH A WORKING SHIP.



BY MY COUNT, WE HAVE BEEN HERE FOR 44 DAYS. THE HEAT IS ALMOST UNBEARABLE AND MY MEN HAVE SUFFERED MANY SLEEPLESS NIGHTS BEING DEVoured BY BLOOD-SUCKING INSECTS. THE BITES LEAVE ITCHY RED BUMPS THAT COVER OUR BODIES. EVEN SOME OF THE PLANTS CAN DRAW BLOOD! THERE IS ONE HERE THAT RESEMBLES A PRICKLY GREEN DISK AND HAS NEEDLES ON ITS SURFACE.

WE HAVE SEEN SOME OF THE MOST BIZARRE SPECIES HERE! WHEN I WAS SEARCHING FOR FOOD IN OUR FIRST DAYS, AN ARMORED ANIMAL WITH MEAN EYES AND NUBS COVERED IN BARNACLES FOR ARMS CRAWLED OUT OF ITS BURROW. IT WAS ONLY ABOUT TWO-HANDS LONG AND QUITE SLOW, BUT I WAS TOO AFRAID TO APPROACH IT. I'VE MADE SEVERAL ATTEMPTS SINCE BUT THE ANIMAL DISAPPEARS INTO ITS ARMOR. A MASKED ANIMAL WITH A STRIPED TAIL RAIDS OUR CAMPSITE AT NIGHT AND HAS STOLEN MOST OF OUR FOOD STORES. CREATURES WITH TEN EYES SCUTTLE OVER THE SHORES AT NIGHT AND ARE VERY DIFFICULT TO CATCH, BUT MAKE FOR A TASTY MEAL. THERE IS A MAJESTIC, LARGE WHITE BIRD WITH A GRACEFUL LONG NECK AND BLACK LEGS THAT ACT AS STILTS WHEN IT WADES IN THE POND. IT HAS A LONG POINTY YELLOW BILL AND ITS NECK FORMS AN S-SHAPED CURVE WHEN IT FLIES.

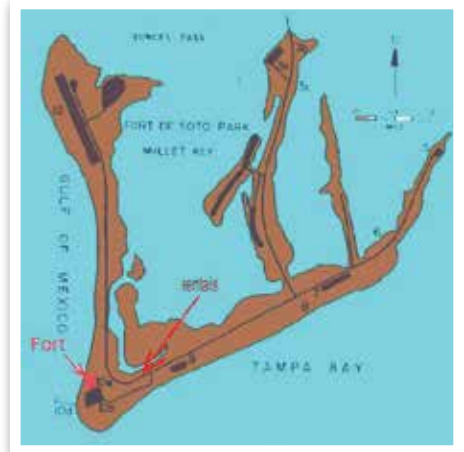
WE ARE NOT IN WANT OF FOOD AND WATER; THERE ARE MILES OF MARSHES AND CHANNELS FOR FISHING, AS WELL AS PLENTY OF FRESHWATER INLAND. WE GATHER OYSTERS, CONCHS, AND CLAMS TO EAT WHEN THE FISHING IS NOT GOOD. WE'VE DISCOVERED THAT THERE ARE TREES HERE THAT SERVE AS BOUNDARIES BETWEEN SALTWATER AND FRESHWATER WITH ROOTS SO MASSIVE THAT THEY SEEM TO STAND ON THE SURFACE OF THE WATER. THERE IS MUCH TO BE LEARNED ABOUT THIS WILD LAND.

I AM PUTTING THIS MESSAGE IN A BOTTLE AND THROWING IT OUT TO SEA WITH HOPES THAT SOMEONE WILL FIND IT AND RESCUE US. WE WILL PAY YOU IN GOLD!

BARRIER ISLANDS

Fort De Soto

Fort De Soto was named after Hernando De Soto, a Spanish explorer in the 1500s. De Soto arrived at Tampa Bay on May 30, 1539, with 10 ships and over 600 soldiers, explorers, and priests. He and his large expedition trekked through the swampy regions of Florida and southeastern North America looking for gold and silver and engaging in brutal conflicts with the natives. De Soto died in 1542 and was buried on the banks of the Mississippi River. Fort De Soto, named in his honor, wasn't constructed until 1898, over 300 years after his death. The map shows De Soto's daring passage through unfamiliar terrain.



Think of yourself as an explorer of Florida's still-wild lands. Many of the places you will visit have been preserved in their natural state through limited human interaction.

FORT DE SOTO: TRUE OR FALSE?

- _____ THE FORT HAS THE ONLY TWO GUNS LEFT FROM THE YEAR 1898 IN THE UNITED STATES.
- _____ IT WAS ONE OF THE NAVAL FORTRESSES CREATED TO PROTECT TAMPA BAY DURING THE SPANISH AMERICAN WAR.
- _____ MULLET ISLAND WAS NOT DISCOVERED UNTIL THE 1700S.
- _____ IT WAS ADDED TO THE NATIONAL REGISTER OF HISTORIC PLACES IN 1977 BECAUSE OF ITS ROLE IN THE DEVELOPMENT OF MODERN WEAPONRY.
- _____ IT WAS THE SITE OF MANY MAJOR BATTLES.
- _____ IT WAS USED BY UNION TROOPS DURING THE CIVIL WAR.
- _____ DURING WWII, THE ISLAND WAS USED FOR BOMBING PRACTICE BY THE PILOT WHO DROPPED THE BOMB ON HIROSHIMA.

FORT DE SOTO

Not Your Ordinary Island

There is more to a barrier island than you might think!

What is a barrier island and how are they formed?

Why are barrier islands so important? What would happen if they suddenly disappeared?

Barrier islands typically contain four zones. Complete the chart below as you learn the characteristics of each zone.

ZONE	PLANTS FOUND HERE	ANIMALS FOUND HERE	THREATS
Beach			
Dune			
Barrier Flat			
Salt Marsh			

If one zone is damaged—by pollution, extreme weather, etc.—can the others survive? Explain the relationship between the zones.

Do exotic species impact barrier islands? In what ways?



Exotic Species

De Soto introduced exotic (nonnative) species to North America. Draw a line from each animal that De Soto brought to America and its effect on Florida.

- | | |
|----------------|---|
| 1. HORSES | A. Reduced vegetation, uprooted seedlings, less forest diversity, but comes with a delicious meat source. |
| 2. BLOODHOUNDS | B. Typhus and bubonic plague |
| 3. PIGS | C. Swift travel, communication, and military conquest |
| 4. MULES | D. Contaminated food, particularly grain and seed |
| 5. RATS | E. Hunters found their best friend |
| 6. MICE | F. Pastures and easier farming |

Although introducing new species can have profound and sometimes disastrous effects on ecosystems, it is an unavoidable result of exploration, colonization, and even modern travel. How have these species changed America?

SHARKS



Dissection: Teaching Life or Teaching Death?

Dissection was introduced in the classroom in the 1920s as a method for studying anatomy and biology. Dissection causes a lot of disagreement among scientists, environmentalists, and educators. The issue is respect for life. Animal rights activists argue that dissecting an animal devalues its life and promotes the torturing and killing of innocent creatures. Alternatively, some educators have noted that dissection teaches students to understand the inner workings of life and therefore gain a deeper appreciation and understanding of the natural world.

The debate is even more complicated when discussing the dissection of mammals versus other species. Most arguments against dissection center around mammals like mice, rabbits, and pigs, but people seem to be less squeamish about dissecting other species like squid, sea stars, or worms.

Why do you think this is? _____

Controversial topics like dissection cause a lot of arguments. As you prepare to dissect the spiny dogfish, what are your arguments for and against dissection?

FOR	AGAINST

The truth about sharks

Many people think that sharks are murderous eating machines. But as a matter of fact, some species of sharks only eat two percent of their body weight each day, which is less than what the average human consumes.

The popularity of beach tourism has caused sharks and humans to come into contact more than ever. Humans are guests to the ocean's ecosystem and need to be aware that sharks can mistake humans for prey. Most shark attacks are hit-and-run incidents resulting in only cuts and bruises, because the shark retreats after realizing that the human is not its usual diet.

While shark attacks result in only five to 15 human fatalities each year around the world, 20 to 100 million sharks die each year due to fishing. Shark fin soup is an Asian delicacy which involves cutting off a shark's dorsal fin and then throwing the shark back into the ocean to die.

Conservation

Sharks are particularly vulnerable to over-fishing because they have long lives, take years to mature, and they give birth to very few young at a time. Sharks are also threatened by pollution, oil spills, and toxic waste. It can take decades for shark populations to recover. Shark conservation groups support research, education, implement Fishery Management Plans, and pursue international and domestic conservation agreements.

Shark conservation groups include:

- Ocean Conservancy
- IUCN Shark Specialist Group
- NOAA Fisheries: Sharks
- National Coalition for Marine Conservation
- World Wildlife Fund: Ocean Rescue
- Marine Fish Conservation Network



SHARK ANATOMY

Spiny Dogfish

Spiny Dogfish, *Squalis acanthias*, are some of the most abundant sharks in the world, which is why they are the most studied. They are called dogfish because they travel in packs of



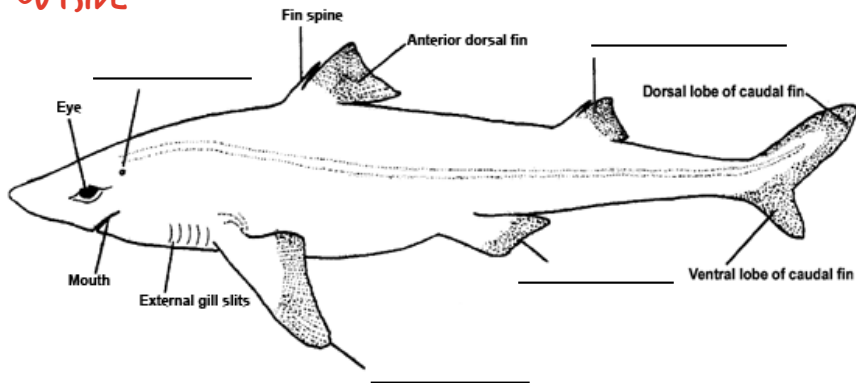
hundreds or thousands. The most distinctive external features of the spiny dogfish are a row of small white dots along its sides and a sharp spine that some scientists believe releases a mild poison to ward off predators. As a member of the Chondrichthyes class, the dogfish has jaws, paired fins, paired nostrils, scales, a three-chambered heart, and a skeleton made up of cartilage instead of bone.

Fill out this chart to explain how form fits function within a shark's internal organs.

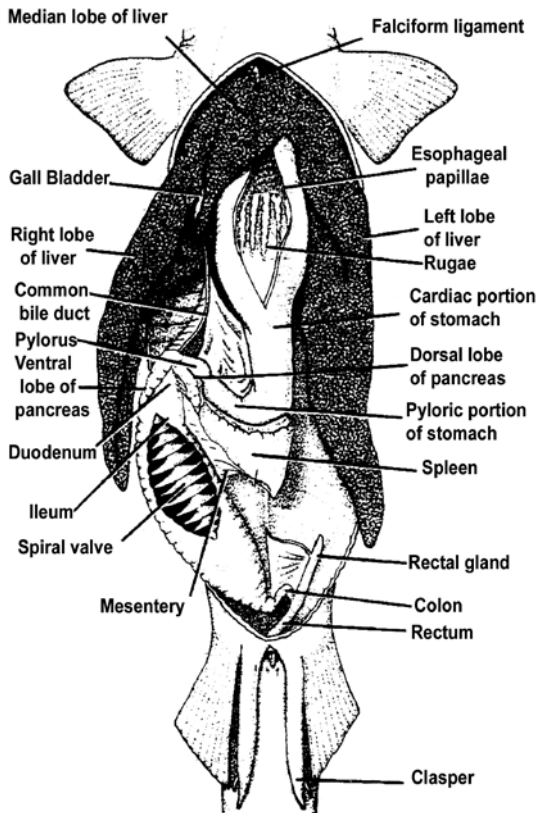
FORM	FUNCTION
Spiral valve in the intestines	
Hair-like projections called papillae in the esophagus	
Deep folds (rugae) in the stomach	
Large, oily liver	

THE SPINY DOGFISH

OUTSIDE



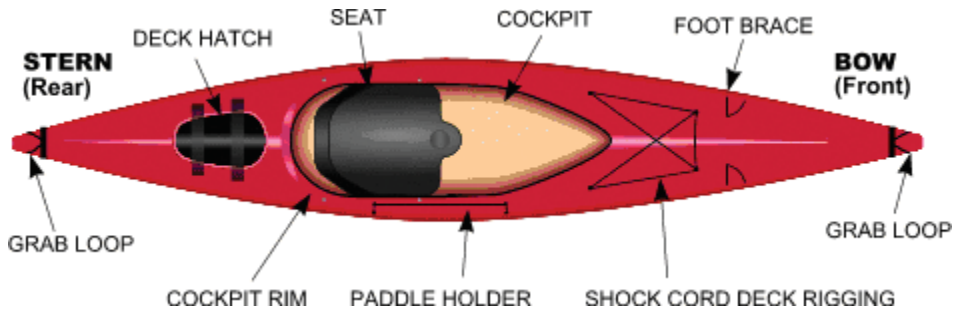
INSIDE



KAYAKING 101

Are you a first-time kayaker? Don't worry. Review the diagram for a quick tutorial on kayaking terms and you'll be talking like a pro in no time. Kayaking is an easy skill to pick up and a very peaceful and relaxing activity that you can enjoy for the rest of your life. Paddle at your own pace and enjoy your leisurely exploration into this watery habitat. If you're a solitary type, use the time to meditate on the world around you and

enjoy the silence. If you like a little company, it's a great time to play "I spy" with a fellow kayaker. Either way, you're toning your arms and getting your heart rate up. As with any athletic activity, it's important to stay hydrated and rest when you need. And don't forget the sunscreen- sunlight reflected off the surface of the water can be very damaging to your skin. Use waterproof sunscreen and reapply!



KAYAKING ETIQUETTE

- KEEP YOUR DISTANCE AT BIRD AND ANIMAL NESTING SITES - THEY DO NOT LIKE TO BE DISTURBED.
- DO NOT CHASE, TEASE, OR TAUNT ANY ANIMALS OR BIRDS.
- DO NOT TRY TO TIP YOUR FRIEND'S KAYAK. YOU MAY THINK IT'S FUNNY, BUT EVERYONE HAS DIFFERENT LEVELS OF COMFORT ON THE WATER.
- LEAVE NO TRACE - BE SURE TO BAG ANY TRASH AND TAKE IT WITH YOU WHEN YOU'RE FINISHED.

WATER SOURCES

Crystal Springs

Crystal Springs is one of the 600 natural springs in the state fed by the Floridian Aquifer. It's the largest magnitude 2 spring in South Central Florida. Crystal Springs provides a great window into an aquifer.

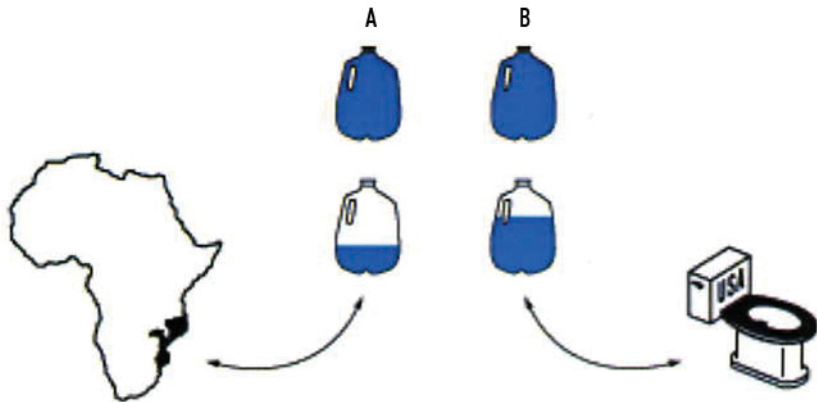
Aquifers are areas where groundwater is stored in porous rock that transmits water to wells and springs. Imagine digging a hole in the sand at the beach: as soon as you reach the surface of the water, the water rushes up to fill the hole. The more sand you remove, the more space is provided for the water to fill in the gaps. Similarly, the movement of water in an aquifer depends on the ability of substances to move freely through its surrounding rock. Groundwater moves very slowly through clay, but very quickly through the Swiss-cheese-like structure of limestone (which makes up most of Florida's aquifers). The permeability of the rock and precipitation affect the recharge rate of the aquifer and the speed at which the groundwater is pushed up into springs.



Reducing Consumption

Nestlé Waters North America is a business partner with the private owners of Crystal Springs Preserve. They use eco-friendly practices to ensure that the natural balance of the spring is maintained, including monitoring water sources, following green building practices, and reducing consumption by using less plastic in their bottles.

How do we as consumers use these natural freshwater resources without depleting them?



A: 1.3 Gallons = Average daily water use in Mozambique per person
B: 1.6 Gallons = Flushing a low-flow toilet in the U.S.

CRYSTAL SPRINGS

PHYSICAL OBSERVATION

Study the biodiversity of the spring by writing down your observations about the water, soil, and atmosphere:

Atmosphere

Air temperature: _____

Was there precipitation in the last 24 hours? Yes No

Weather conditions: Sunny Partly cloudy Overcast Rainy

Wind direction: _____

Humidity: None Low Medium High

Soil

Soil color: Light brown Yellow/orange Green/gray Light gray Dark gray

Soil texture: Mostly clay Mostly sand Mixtures of clay and sand

Soil moisture: Soggy Moist Dry

Erosion

- Bare soil without plants
- Exposed plant roots
- Cuts, ditches, or steep banks where soil is being washed away
- Trees, shrubs, or grasses preserved

Water

Moving water: Stream River Other: _____

Standing water: Pond Lake Reservoir Bay Ditch Other: _____

Is water bottom visible? Yes No Describe the bottom: _____

Describe what the bank of the water looks like:

- Boulders or stones around and in the water
- Riffle areas (streams only)
- Fallen logs or branches in the water
- Pools (streams only)
- Sand bars or gravel bars
- Other: _____
- Man-made structures

Aquatic Organisms

Fish Amphibians Birds Other: _____

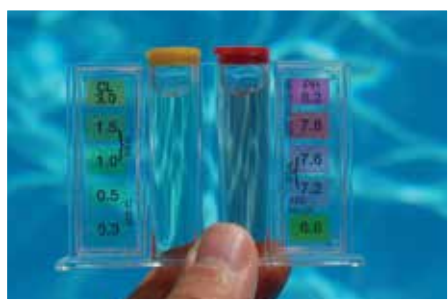
Human Influences

Drainage pipes Dams Litter Trails/bridges
 Swimming Boating Other: _____

Water Quality

There are several characteristics we can test to assess water quality. Using the water samples or locations you are given, complete the chart below to help you record the values for each of the following measures.

What?	Why?	Value				
Water Temperature	Species tolerate temperatures differently.					
pH	The acidity of the water must be between 5.6-8.5 for aquatic organisms to survive.					
Nitrates	Nutrient needed by plants. Animals eat plants and die, decomposing and producing nitrates.					
Dissolved Oxygen (DO)	Amount of oxygen in the water from aquatic plants undergoing photosynthesis during the daylight.					
Salinity	Concentration of salt in the water.					
Phosphate	Found naturally in rocks but also produced by human sources including fertilizers, pesticides, and detergents.					
Turbidity	The clarity of the water determines the amount of light that can penetrate to the aquatic plants beneath the surface.					



Test Site 1:	Test Site 2:	Test Site 3:	Test Site 4:	Test Site 5:
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CRITTER ROUNDUP

The presence of biological indicators, such as macroinvertebrates, can tell us a lot about the health of an ecosystem. Regular monitoring of these organisms' population, function, and physical characteristics will alert scientists if any changes have occurred in pollutants or other changes that may foreshadow problems for the entire ecosystem.

Use dip nets to gather specimens from the spring. Look for:

Macroinvertebrates – Benthic, freshwater organisms that lack a spinal column. They fall under three different phyla:

1. **Arthropoda** (crustaceans/crabs, insects, spiders)
2. **Annelida** (segmented worms)
3. **Mollusca** (mollusks, like snails)

Examine your specimens under a microscope and try to identify them. Here are some examples of organisms that you might find:



DOBSONFLY LARVA



STONEFLY LARVA



RIFFLE BEETLE LARVA



DAMSELFLY NYMPH



NEMATODE



MIDGE LARVA

Because different macroinvertebrates are tolerant to different levels of oxygen, their presence can indicate water quality.

Clean Water/ High Oxygen	Tolerant Oxygen Level	Dirty Water/ Low Oxygen
<input type="checkbox"/> case-building caddisfly larvae <input type="checkbox"/> hellgrammite <input type="checkbox"/> mayfly larvae <input type="checkbox"/> riffle beetle adult <input type="checkbox"/> stonefly nymph <input type="checkbox"/> water penny larvae <input type="checkbox"/> dobsonfly larvae	<input type="checkbox"/> blackfly larvae <input type="checkbox"/> riffle beetle larvae <input type="checkbox"/> clam <input type="checkbox"/> crane fly larvae <input type="checkbox"/> crayfish <input type="checkbox"/> damselfly nymph <input type="checkbox"/> dragonfly nymph <input type="checkbox"/> scud <input type="checkbox"/> aquatic sowbug <input type="checkbox"/> alderfly larvae <input type="checkbox"/> net-spinning caddisfly larvae <input type="checkbox"/> watersnipe larvae <i>Pollution-sensitive organisms for ponds:</i> <input type="checkbox"/> water boatmen and giant water bug <input type="checkbox"/> diving beetle	<input type="checkbox"/> segmented worm <input type="checkbox"/> leech <input type="checkbox"/> midge larvae <input type="checkbox"/> lunged/pouch snail <input type="checkbox"/> mosquito larvae <input type="checkbox"/> rat-tailed maggot <input type="checkbox"/> tubifex worm <input type="checkbox"/> planaria <input type="checkbox"/> horsehair worm <input type="checkbox"/> threadworm/nematode <input type="checkbox"/> pyralid moth/caterpillar
Boxes checked x 3 = _____ index value	Boxes checked x 2 = _____ index value	Boxes checked x 1 = _____ index value

Total Index Value (add up the three index values): _____

Based on your point total, what is the quality of the water?

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

Based on the results of your diversity study, would you drink the water from this source? Why or why not?

SPOTLIGHT ON CONSERVATION

Turning Ocean Water into Drinking Water

According to the United Nations, 1.1 billion people still do not have access to a clean, reliable supply of drinking water. Eighty percent of disease and deaths in developing countries are caused by unsanitary drinking water. In the western U.S., stream volumes are expected to fall 20% by mid century, a harsh blow to agricultural production.

Saltwater, however, makes up 97.5% of water resources on the planet and 60% of the world's population lives within 65 miles of a seacoast. Global warming will only bring sea levels higher; the level of the Pacific Ocean at the Golden Gate Bridge has risen eight inches in the past century.

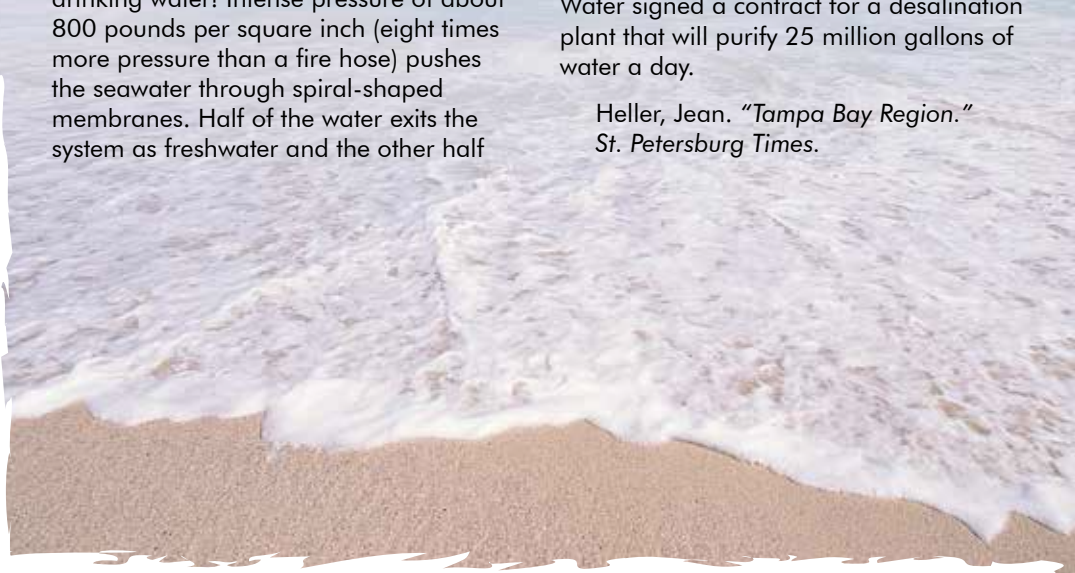
Due to the discovery of reverse osmosis (RO), salt can actually be removed from seawater, turning ocean water into drinking water! Intense pressure of about 800 pounds per square inch (eight times more pressure than a fire hose) pushes the seawater through spiral-shaped membranes. Half of the water exits the system as freshwater and the other half

becomes twice as concentrated with salt and is dumped back into the sea.

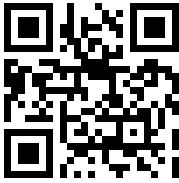
Many Middle Eastern and Asian countries already depend on desalination for their drinking water. It has had a slower start in the U.S., but has recently attracted the interest of large corporations like General Electric. The global market for desalination is estimated to increase in value 10 times by 2015, reaching \$126 billion.

The Tampa Bay area has a rising demand for desalinated water because in times of drought, the aquifer cannot recharge as fast as water is drawn out for drinking, cooking, cleaning, and irrigation. The water problem has caused neighboring communities to feud, cypress trees to die, wells to dry up, and houses to collapse on the porous empty ground. Tampa Bay Water signed a contract for a desalination plant that will purify 25 million gallons of water a day.

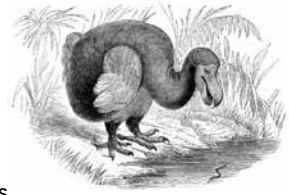
Heller, Jean. "Tampa Bay Region."
St. Petersburg Times.



(CHECK OUT THE IUCN!)



Why are these animals living at the zoo instead of in their native habitats? Human interaction has threatened wildlife around the globe.



Scientists estimate that today's rate of extinction is about 1,000 times higher than it was before humans

appeared on Earth. Pollution, climate change, and land development are the main causes of habitat destruction. The high extinction rate is also the result of hunting, the introduction of non-native species, and the spread of disease.

The International Union for the Conservation of Nature and Natural Resources (IUCN) Red List is a standard for monitoring the populations of species by rating the severity of threats to their survival. The scale ranks the species which are the least threatened (in green) to those which are now extinct (in black).

The IUCN Red List

Status	Definition	Examples
EXTINCT	Last remaining individual of the species has died	Dinosaurs, dodo bird, passenger pigeon, Japanese sea lion, Tasmanian tiger
EXTINCT IN THE WILD	Only survives in captivity, reintroduced populations, or outside its native habitat	Wyoming toad, Hawaiian crow, black soft-shell turtle, Socorro dove
CRITICALLY ENDANGERED	Faces an extremely high risk of extinction in the wild	Red wolf, Chinese alligator, angel shark, black rhinoceros, California condor
ENDANGERED	Faces a very high risk of extinction in the wild	Giant panda, orangutan, Grevy's zebra, gorilla, blue whale, brown kiwi
VULNERABLE	Faces a high risk of extinction in the wild	African lion, giant anteater, polar bear, hippopotamus, American crocodile
NEAR THREATENED	Does not face a high risk of extinction, but is likely to be threatened in the near future	Emperor penguin, jaguar, Gila monster, leopard, box turtle
LEAST CONCERN	Species is thriving, widespread, and abundant	Grey seal, naked mole-rat, American beaver, giraffe, bald eagle

What Florida species are on the IUCN Red List? _____

What are some ways endangered species can be restored to sustainable populations?
When should humans intervene?

ANIMAL ADAPTATIONS

Florida Boardwalk

Discover the answers to the following questions by searching for clues along Tampa's Lowry Park Zoo's Florida Boardwalk. Look, listen, and read the posted information along the way. GOOD LUCK!



1. What elusive bird of the Florida's forest and flatlands is surprisingly a good flier and swimmer?

2. Which animal derived its name from the early Spanish explorers who named it "el largato," the lizard? _____
3. To what Family does the River Otter belong? _____
4. One example of a native Florida tree important to wetlands is: _____
Name two ways these trees help wetlands:
 - _____
 - _____
5. How many Florida Panthers are estimated to survive today? _____
Why are there so few?

6. What animal has the Great Horned Owl as its only predator? _____
7. How many manatees are patients in the Manatee Hospital? _____
Give one injury or reason a manatee is in the hospital?

8. What animal was hunted to near extinction in the early 1900s for its beautiful pink feathers, but since then has made a remarkable comeback in population?

9. Which mammal leaves scratch marks on trees to identify territorial boundaries?

10. Name one mammal that was once found in Florida but is now considered extinct in this state.

ADAPTATION SCAVENGER HUNT

Find an animal at the park with each body part listed below and complete the chart.

ANIMAL	BODY PART	HOW IT IS ADAPTED FOR SURVIVAL	HABITAT
	Hooves		
	Paws with claws		
	Webbed feet		
	Scales		
	Thick fur		
	Spots		
	Stripes		
	Feathers		
	Long tail		
	Long, sharp teeth		
	Flat teeth		
	Eyes on top of the head		

STINGRAYS

Not only can you meet live stingrays at Tampa's Lowry Park Zoo, but you will even get a chance to pet these surprisingly friendly creatures. Be prepared to get splashed!

Use your senses to discover more about stingrays. Record the observations you make about the rays' behavior and physical characteristics.

	SOUTHERN STINGRAY	COWNOSE STINGRAY	OTHER? (Use this column to describe any other creatures that may be visiting the touchtank)
Habitat	Bays and estuaries from New Jersey to Brazil. Migrates to the Caribbean in the winter.	Coastal waters from southern New England to northern Florida and throughout the Gulf of Mexico. Migrates to Trinidad, Venezuela, and Brazil.	
Size	Adult wingspan can measure up to 6 feet across. Adults can weigh up to 150 pounds. Females are larger than males.	Adult wingspan can measure up to 3 feet across. Adults can weigh up to 50 pounds.	
Interesting facts	The dried spines from this family of rays were once used as spear tips by native tribes.	These rays may travel in large schools of up to 10,000 and occasionally jump out of the water, likely as a territorial display.	

BEHAVIOR	PHYSICAL CHARACTERISTICS

MANATEES

Tampa's Lowry Park Zoo's Florida Manatee and Aquatic Center



At Tampa's Lowry Park Zoo's Florida Manatee and Aquatic Center, the only nonprofit manatee hospital in North America, you will observe the manatees and see how the zoo staff cares for them. Manatees are shy, reclusive animals that spend most of their time eating, resting, and traveling slowly. They are freshwater mammals inhabiting the southeastern U.S., the Caribbean islands, and parts of Central and South America. They have been in Florida for over one million years.

Manatees have no natural enemies and no mechanisms for defense, making them particularly vulnerable to predators. Humans are responsible for 30% of

manatee deaths. One of the largest threats to manatees is collisions with watercraft; propellers and hulls can inflict serious and often deadly wounds. Many manatees have scars on their backs or tails from these collisions. Another threat is the loss of their warm water habitats through the degradation and destruction of coastal and freshwater ecosystems. Manatees have drowned or been crushed to death by flood-control gates. Finally, manatees are threatened by red tide (toxic algae blooms in the Gulf of Mexico) caused by runoff in developed areas.

Protecting manatees is a very important issue for Florida residents. Manatees are protected by endangered species acts and the state has established wildlife sanctuaries and boating speed limits in manatee habitats. In 2005, "Save the Manatee" license plates were the fifth most popular custom plate in Florida. The funds from the license plates go towards the state's manatee conservation and environmental education efforts.



SCAR IDENTIFICATION

Manatees have unique physical features that allow scientists to distinguish one manatee from another in the field. Unfortunately, the features used for identification are usually scars resulting from collisions with boats. The ability to identify individual manatees allows scientists to study and track the endangered animals. The Manatee Individual Photo-identification System (MIPS) is a computerized photo database that contains information for more than 1,400 wild manatees.

KEY TO MANATEE IDENTIFICATION DRAWINGS

Flipper drawn to show damage
or to show relation of a scar
to the flipper

SCARS

White



Visible but
healed grey
(sometimes deep)



Cut



Section missing
from tail



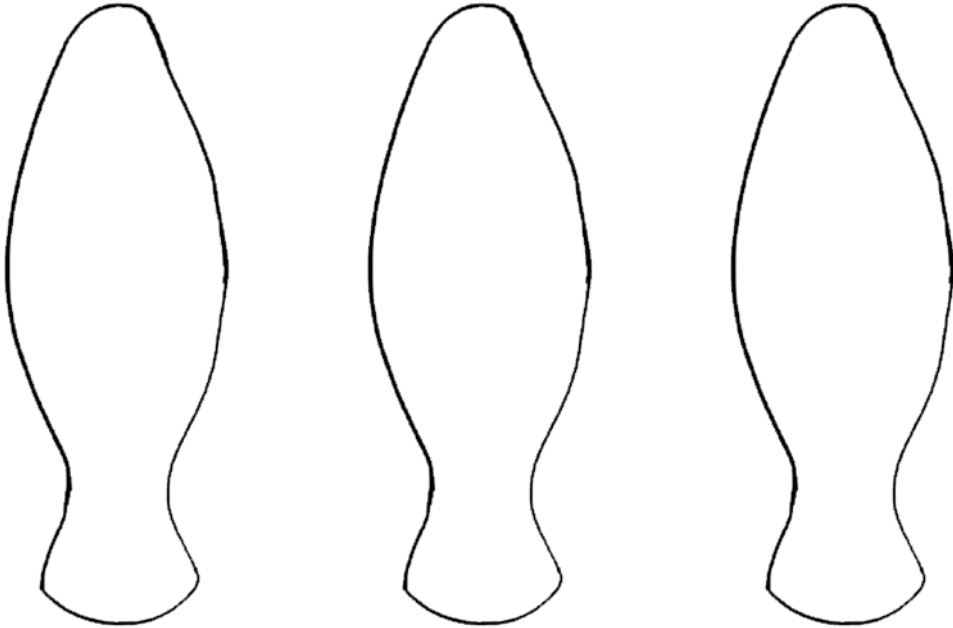
Name _____

PHOEBE

MANATEE TRIVIA

- MANATEES CAN HOLD THEIR BREATH UNDERWATER FOR UP TO 20 MINUTES
- MANATEES ARE THE ONLY MARINE MAMMALS THAT EAT VEGETATION AND ARE THE SEA'S LARGEST VEGETARIAN
- A MOTHER MANATEE CAN HEAR HER CALF SQUEAL FROM OVER 200 YARDS AWAY
- MANATEES' CLOSEST RELATIVES ARE ELEPHANTS AND AARDVARKS

Sketch the scars of three manatees at the manatee hospital using the key to identification drawings.



Why do scientists identify and track manatees using their scars? Do you think this is a good system? Why or Why not?



Take Action to Save Manatees!

WHEN BOATING:

- Obey speed zone signs.
- Wear polarized sunglasses for better visibility.
- Be alert for signs of manatees. Their tails cause swirls in the water and their snouts break the surface when they come up to breath every 20 minutes.

TELL THE U.S. FISH AND WILDLIFE SERVICES NOT TO DOWNLIST MANATEES

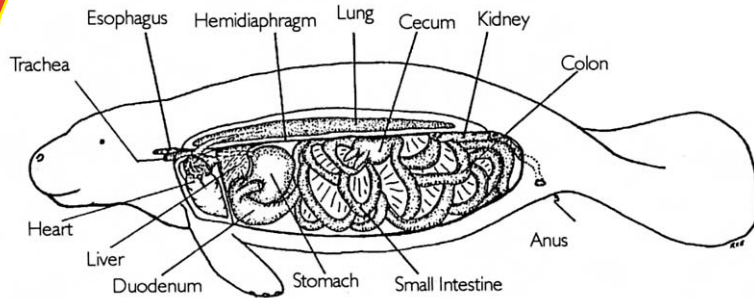
- After a five-year review, the IUCN status of the manatee has been downlisted from “endangered” to “threatened.” The change is not finalized yet. Many people feel that threats are increasing. Email comments to: manatee@fws.gov.

SUPPORT MANATEE CONSERVATION

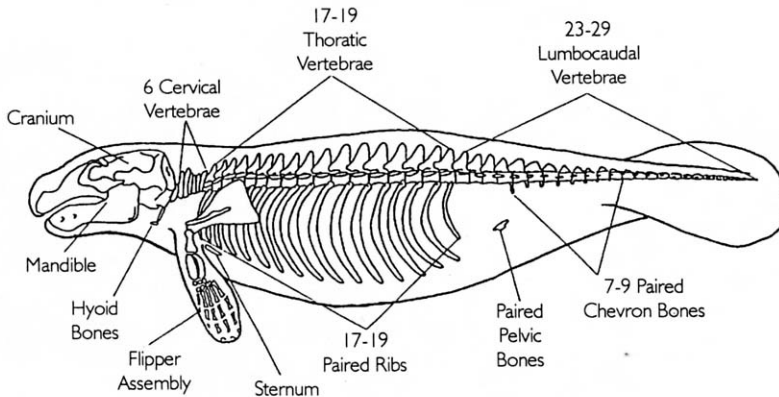
- Adopt a manatee. For \$25, you get a photo of your manatee, an adoption certificate, your manatee’s biography, and four letters each year giving you updates about your manatee.
- Buy t-shirts, bumper stickers, and books from organizations whose profits go towards protecting manatees.
- Join an organization and fight for manatee rights!
 - World Wildlife Fund
 - Wildlife Advocacy Project
 - Sirenian International
 - Wildlife Trust’s Belize Manatee Conservation Program

SPREAD THE WORD! TELL YOUR FAMILY, FRIENDS, FELLOW STUDENTS, TEACHERS, COACHES, AND TEAMMATES ABOUT THE WAYS YOU ARE SAVING MANATEES AND WHAT THEY CAN DO TO HELP.

FUN-ATOMY



- The manatee's lungs are long and thin. The lungs stretch along the backbone (instead of along the ribcage like most mammals) and provide more buoyancy.
- Manatees don't have eyelashes; like the aperture of a camera, their eye muscles close in a circular motion. A lid-like membrane closes over their eyes for protection when they go under water.
- Manatees can hear very well even though they don't have external earlobes.
- A manatee's heart beats 50-60 times a minute, but slows down to 30 times a minute when they are under water for long periods.
- Manatees' teeth are all molars because they are only used for grinding the plants they eat.
- Manatees cannot turn their head sideways because they only have six vertebrae, while most other mammals have seven.
- The jointed finger bones in the manatee's flipper are similar to a human hand. They enable the manatee to grasp objects like food and propel itself forward in water.



SNORKELING 101

Snorkeling equipment: a diving mask, a snorkel, and swim fins. In cooler waters, you may also wear a wet suit.

Snorkeling along the surface of the water allows you to observe underwater life for long periods of time without surfacing for air. Snorkeling is possible in almost any body of water, but snorkelers are most likely to be found in locations where there is warm, shallow water with minimal waves and where there is something interesting to see. Snorkeling requires no special training—only the ability to swim and to breathe through the snorkel.

The less you splash and talk, the greater your chances of having a manatee come up to you. Now this is when the fun really starts. If a manatee approaches you and initiates contact, you will get the chance to touch these gentle giants. Sometimes they even roll over for a belly rub!



TIPS FOR SNORKELING WITH MANATEES

- Never approach a feeding or resting manatee. Keep your distance.
- Do not dive down to be with a manatee. Stay at the surface of the water.
- Never separate a mother from her calf. The calf is dependent on its mother for protection and survival.
- Keep out of posted manatee sanctuaries.
- Never poke, chase, or ride manatees. Harassing the manatees can make them leave their safe habitats, and it is also illegal!
- Always snorkel with a buddy.

IS IT A BOY OR A GIRL?

All manatees have three holes on the underside of their body. There is the belly button and the anus. If it is a male, the third hole appears close to the belly button. If it is a female, the third hole appears closer to the anus. How many male manatees and how many female manatees did you encounter during your snorkel?

HOMOSASSA & CRYSTAL RIVER STATE PARKS

ANIMALS



This endangered black bear cub was rescued and brought to Homosassa Springs Wildlife State Park. There are now less than 1,500 black bears in the state of Florida. A bear population needs 400,000 acres to flourish in the wild, and human development destroys 20 acres of habitat every hour. The black bear's diet is about 80% vegetarian. On average, adult females weigh around 150 lbs. and adult males weigh 350 lbs.



Alligators are found throughout the southeastern U.S. in freshwater swamps and marshes, as well as rivers, lakes, and smaller bodies of water. They can tolerate saltwater even though they lack the salt-secreting glands that crocodiles have. They have broad snouts and overlapping upper teeth.



Bobcats are about two feet tall and weigh around 20 pounds; bigger than a house cat but smaller than a lion. They get their name from their short tails, averaging three to seven inches in length. They have more in common with a household cat than you may think: they are nocturnal; they hunt rodents, birds, and squirrels; they have retractable claws; and they mark their territory with urine. But you probably don't want to pet these wild kitties- they are very strong and can run up to 30 mph!



North American River Otters are 18 to 24 inches in length but males can grow up to 48 inches. They have smooth, brown, waterproof coats and streamlined bodies and like to play and swim. Their short legs and webbed toes help them swim up three to four mph underwater and six mph at the surface. They eat fish, shellfish, and insects. Their closest relative is the weasel.



You can't leave Florida without seeing a flamingo! The American Flamingo lives in salt flats and lagoons throughout the West Indies, Yucatan, Galapagos Islands, and Florida coasts. It is one of six species of flamingo. Their pinkish color comes from the algae, diatoms, and crustaceans that they eat. They can grow up to four and a half feet tall and weigh as much as nine pounds. Flamingos have to hold their breath when they eat because they feed with their heads upside down underwater. Flamingos spend 15 to 30% of the day preening, using their bills to spread the oil from their tails to their feathers. They have few natural predators and live an average of 20 to 30 years.

WETLANDS

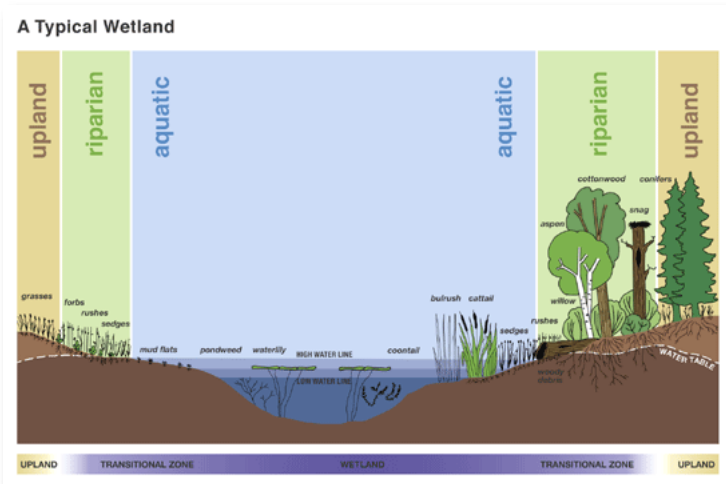
Homosassa Springs State Wildlife Park

Homosassa Springs are the headwaters of the Homosassa River. The spring maintains a temperate 72 degrees year-round and provides a great natural environment for native animals that cannot survive on their own in the wild. The park includes spring-fed streams and wetlands that support a wide variety of species.

Wetlands

A wetland is an area where the water meets the land and acts as a watershed, an area at land level through which water can move and flow. Wetlands are some of the most productive ecosystems on Earth because of the fertile “wet and dry” habitats they provide. They act like sponges, absorbing water during wet periods and releasing it during dry periods. Wetlands also filter the water from precipitation, runoff, rivers, streams, and lakes. The plants and soils in the wetland absorb nutrients, sediment, chemicals, and impurities. Wetlands have three parts:

1. **Upland:** dry land surrounding a wetland; supports trees and grasses.
2. **Riparian:** heavily vegetated strip of land between higher upland and shallow wet areas.
3. **Aquatic:** wet areas, with varying depths.



WETLANDS ARE BENEFICIAL

- CONSTANTLY RECHARGE THE GROUNDWATER SUPPLY
- LESSEN THE CONSEQUENCES OF A DROUGHT
- REDUCE FLOODING

HOMOSASSA & CRYSTAL RIVER STATE PARKS

If you were an animal living in the wetlands, which adaptation would you like to have most of all? Why?

Create Your Own Wetlands Creature!



Choose five body parts from the adaptation chart to make your own well-adapted wetlands creature.

Draw a picture of your fictional wetlands creature using those body parts.

What does your creature eat? _____

Which animals are its predators? _____

Where does it live? Example: on land, in marshes, in streams. _____

UNDERWATER ADVENTURING

Rainbow River

This majestic river has attracted humans for nearly 10,000 years with its abundance of fish, vegetation, and crystal clear waters. It became a large tourist attraction in the 1920s, but was closed in the mid-1970s when tourists were lured away by Florida's theme parks. In 1972, Rainbow Springs became a National Natural Landmark, and was reopened as a state park in the mid 1990s.



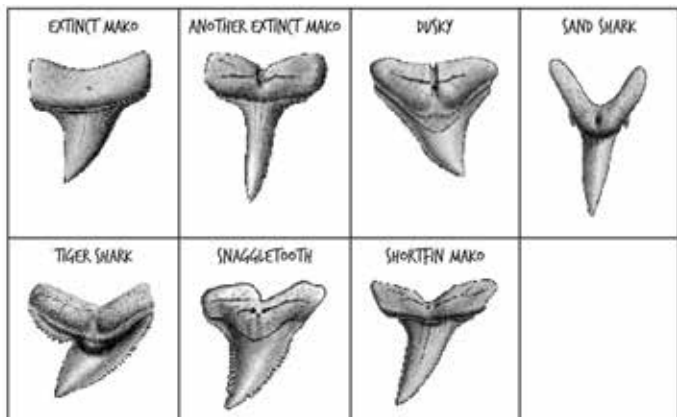
ANIMALS TO LOOK FOR:

- OTTERS
- BLUE HERONS
- BASS
- FLORIDA GARS
- BLUE GILLS
- TURTLES
- HAWKS
- SUN FISH
- BALD EAGLES
- CORMORANTS
- CRAWFISH
- EGRETS
- CATFISH
- ALLIGATORS
- OSPREYS
- SWALLOW-TAIL KITES
- ENDANGERED GOPHER TORTOISES
- FLORIDA PINE SNAKES

Diving for Shark Teeth

As you snorkel in Rainbow River, look for fossilized shark teeth buried in the sand. When sharks die, they sink to the bottom of the ocean floor, where they are covered by layers of sand. Wind and water erosion bring the ancient shark teeth to the surface of the sand. The fossils range in size from 1/8 of an inch to 3 inches.

Here are some of the types of shark teeth you might find:

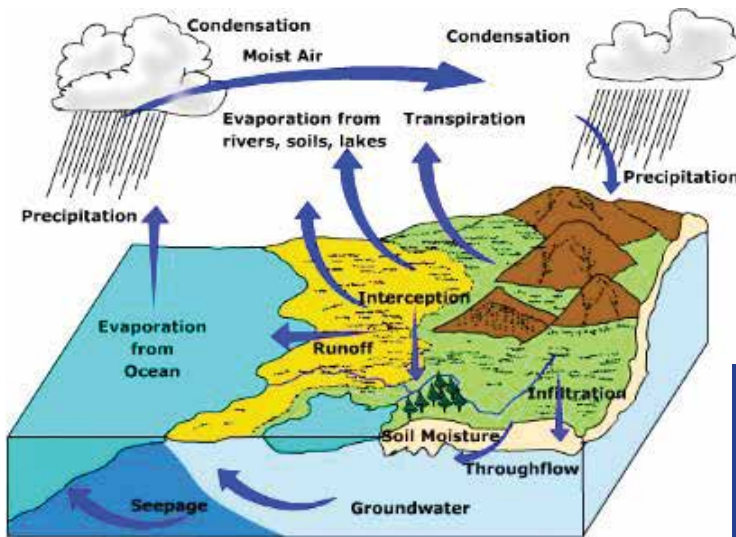


RAINBOW RIVER

CAVES

Formation of Caves

The limestone caverns in Rainbow River were formed through a process called **speleogenesis**. When it rains, water moves through the soil into tiny cracks underground. During the process of infiltration, carbonic acid forms in the water from exposure to carbon dioxide and dying vegetation. When this acidic water is pushed from aquifer to spring through the porous structure of limestone, the holes in the limestone grow larger and larger to eventually form underwater caverns. See the diagram of the water cycle below:

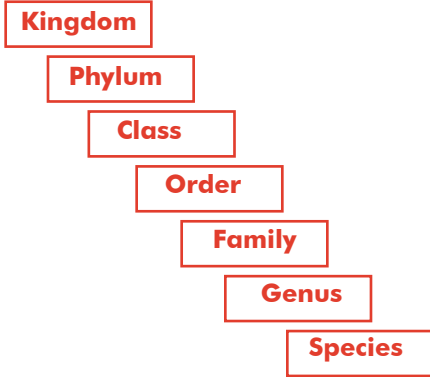


DID YOU KNOW? Florida and Mexico are the two most popular underwater cave-diving destinations in the world.

DRAW A PICTURE ILLUSTRATING THE PROCESS OF LIMESTONE CAVERN FORMATION:

SPINELESS CRITTERS

Biologists use a simple family tree to categorize living things. This taxonomic hierarchy provides structure, keeping classifications organized.

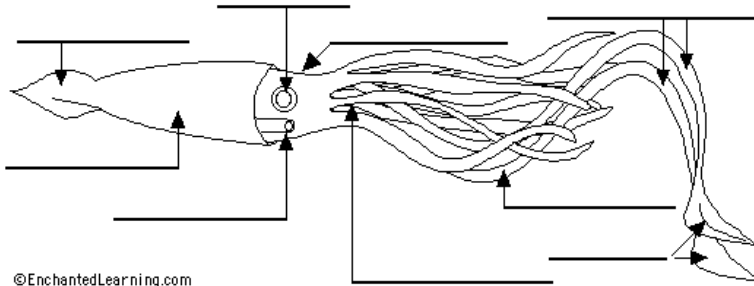


Complete the following chart with characteristics of each phylum and examples of species belonging to each phylum.

	Arthropoda	Porifera	Mollusca	Echinodermata	Cnidarias
Characteristics					
Examples					

What are some threats to these organisms?

During the squid dissection, label the parts on the diagram below.



©EnchantedLearning.com

Arms: eight short limbs, each of which has two rows of suction cups on the lower side; the arms hold the food while the squid bites it into digestible pieces.

Beak and mouth: the parrot-like beak on the mouth is used for biting food into small pieces. The beak and mouth are surrounded by the bases of the arms and tentacles.

Clubs: the ends of the tentacles, which have toothed suckers.

Eyes: squid have two very large eyes (they are large in proportion to the size of the body).

Feeding tentacles: the two long tentacles are used for obtaining prey; they have toothed suckers only near the tip.

Fins: two flaps on the mantle that are used to stabilize the squid during swimming.

Head: the small part of the body between the mantle and the arms; the head contains the eyes, the brain, and the muscular buccal mass, which crushes the food.

Mantle: the large part of the squid in front of the head; the stomach, gills, ink sac, pen, reproductive organs, and many digestive organs are inside the mantle.

Siphon: a tube-like organ on the lower side of the head that expels water forcefully, enabling the squid to propel itself through the sea.

FAST FACTS ABOUT SQUID

- THE SQUID IS A MEMBER OF THE CLASS CEPHALOPODA, MEANING "HEAD-FOOT." THE FOOT OF ANIMALS IN THIS GROUP IS ATTACHED TO THE HEAD, AND IS DIVIDED INTO ARMS. (CEPHALOPODS INCLUDE SQUID, OCTOPUS, CUTTLERFISH, AND NAUTILUS).
- THE MAIN DEFENSE MECHANISM OF THE SQUID IS ITS INK SAC. A SQUIRT OF INK FROM THE SAC (CREATES A CLOUD WHICH DISORIENTS PREDATORS).
- A CURVED BEAK WITH A TOOTH-LIKE STRUCTURE ALLOWS THIS CARNIVORE TO CONSUME ITS DIET OF FISH, BITING OFF AND SWALLOWING (HUNKS AT A TIME).

SQUID DISSECTION

1. Observe the body of the squid. What seems to be missing that most other mollusks have?
2. The long part of the squid's body is called the mantle. It is covered with specialized cells called chromatophores, which contain colored pigment. How do you think squid use these cells?
3. Find the fins at the end of the mantle. How do squid use these fins?
4. Find the ventral side (less spots) of the squid to find the tube-shaped siphon (also known as the funnel) near the head. How does the siphon work in conjunction with the fins?
5. Find the large eyes. Why might a squid need these to survive?
6. Count the number of appendages (arms and tentacles) on the squid. Are they all the same size? Explain.

SQUID DISSECTION, (CONTINUED)

7. How do the arms and the tentacles differ in function?

8. Separate all of the appendages to find the beak. Draw the shape of the beak.

How do the tentacles, arms, and beak work together?

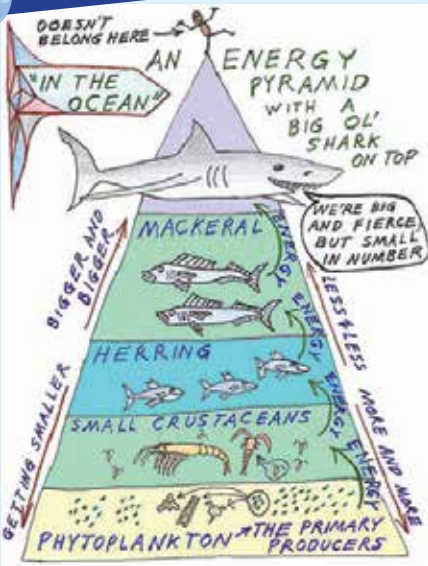
9. Lift up the dorsal side of the mantle to remove the pen. On the end of the mantle, positioned near the head, use your tweezers to remove some of the skin. Then gently pull on the pen. To what part of the human body is the pen similar in function?

10. Use your scissors to cut open the ventral portion of the mantle. Begin cutting at the siphon and continue until you reach the fins. Find the gills, stomach, and ink sac.

11. Use your tweezers to open a small section of the ink sac. Dip the end of the squid pen in the ink and write your initials on this paper.

FOOD CHAINS

Energy Pyramid



The energy pyramid illustrates how energy is transferred in an oceanic food chain. The base of the pyramid starts with organisms that produce energy through photosynthesis and ends with the big fish like sharks that have no real predators. The pyramid shows that there is less energy available as you move up the food chain.

What happens to the energy after the sharks use it?

WHERE DO WE FIT IN?

Humans may be guests to the ocean, but we are serious players in the marine food chain. The man in the diagram is balancing on the top of the pyramid, because he doesn't really belong in this food chain. Our large brains have earned us a spot on the top.

Humans are "engineer omnivores," meaning we eat both plants and animals, and we have developed ways for a small proportion of people to supply the majority of the human population.

ENERGY FLOW

Sun > Primary Producers/Plants > Primary Consumers/Herbivores > Secondary Consumers/Carnivores > Decomposers/Bacteria/Fungus

PRIMARY PRODUCERS/PLANTS

They use energy from the sun to make sugar molecules (like glucose) which are forms of potential energy. Other living organisms eat these primary producers and use their chemical energy. Examples: green plants, bacteria, algae.

MOTE MARINE LABORATORY

PRIMARY CONSUMERS/HERBIVORES

The vegetarians of the animal world. They digest the plants they eat and use or burn the energy stored in the plant cells. Examples: rabbits, deer, and cows.

SECONDARY CONSUMERS/CONSUMERS

These are the meat-eaters and called predators and scavengers. They eat herbivores and sometimes other carnivores. Without herbivores, they would starve! Examples: spiders, crocodiles, cats, and dogs.

DECOMPOSERS/BACTERIA/FUNGUS

They get their energy from the dead plant and animal matter that they consume. They are nature's recyclers, turning mounds of waste into useful energy. Examples: mostly bacteria and fungus, but also maggots, dung beetles, and earth worms.



Oceanic Pyramid

Make your own oceanic energy pyramid in the space provided.

THE OCEANIC FOOD CHAIN AND IMMERSION CINEMA

Use your experience playing Predator/Prey to identify examples of each link in the oceanic food chain.

Primary Producer

Primary Consumer

Secondary Consumer

Tertiary Consumer

Decomposer

Scavenger

FOOD FOR THOUGHT: Think about the message at the end of the film. Is the shark truly the top of the food chain? Is there any creature that has more power than the shark?

FOOD CHAIN CHALLENGE

As you explore the aquarium, see how many different food chains you can find. Find at least two food chains for each of these habitats: wetland, beach, ocean, coral reef. Write your food chains in this format:

Sun>Primary Producers>Primary Consumers>Secondary Consumers>Decomposers

WETLAND FOOD CHAINS:



BEACH FOOD CHAINS:



OCEAN FOOD CHAINS:



CORAL REEF FOOD CHAINS:



OTHER FOOD CHAINS:



LIDO BEACH: SAND AND SEASHELLS

Where does sand come from?

This question has plagued beach bums since the beginning of time. The answer you've probably heard is that it's made up of rocks and minerals that have been eroded, which is true in the case of geologic beaches. But there are also types of beaches that are labeled biological because they are made up of once-living materials like eroded shells and coral reefs.

On a biological beach, there's a good chance that the sand you're stepping in is fish poop. Parrotfish poop to be exact.

Parrotfish have large fused teeth to chew the coral skeletons which they eat for the nutritional algae inside. Jaws inside the parrotfish's throat grind the coral into sand which the fish...ahem...expels. One large parrotfish can produce a ton of sand a year!

What kind of beach do you think Lido Beach is, biological or geological? Why?



WHAT IS A SEASHELL?

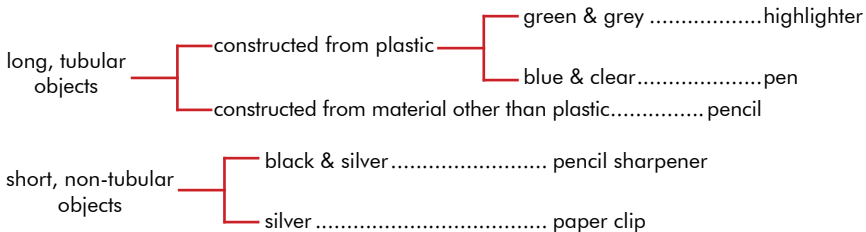
Seashells are hard, protective, outer coverings for marine animals, mostly mollusks like clams, mussels, and oysters. They are made out of calcium carbonate which the animal's body secretes. The shell remains after the animal dies, and is carried by ocean currents until it reaches the shore.

SEASHELL CLASSIFICATION

1. Divide into small groups and collect seashells of various shapes, colors, and sizes. Try to find at least 25 to 30 seashells.
2. Find all of the seashells that look similar and place them in groups.
3. Come up with your own scientific names to classify each group following the guidelines below. Be as creative as you'd like!
4. Each group should create their own classification key. A dichotomous key consists of a series of two choices ("dichotomous" means "divided into two-parts") that leads its user to the name of the organism. The key should contain characteristics of the organism that are quantitative (numbers) and qualitative (descriptive words).

GUIDELINES:

1. SCIENTIFIC NAMES MUST HAVE TWO PARTS.
2. THE FIRST PART IS THE ORGANISM'S GENUS, WHICH SHOULD ALWAYS BE CAPITALIZED.
3. THE SECOND PART IS THE SPECIES NAME, AND SHOULD ALWAYS BE LOWERCASE.
4. SCIENTIFIC NAMES USE GREEK OR LATIN ROOT WORDS. ADD AN -US OR AN -IS TO THE END OF THE NAME YOU CREATE TO MAKE IT SOUND MORE SCIENTIFIC.
5. THE SCIENTIFIC NAME SHOULD REVEAL SOMETHING ABOUT THE ORGANISM .
6. EXAMPLE: SHELLUS SPIRILICUS.



The same information outlined in the spider key above, presented in a traditional dichotomous key format, would appear as follows:

1. a. long, tubular objects go to #2
b. short, non-tubular objects..... go to #4
2. a. constructed from plastic..... go to #3
b. constructed from material other than plastic..... pencil
3. a. green & grey..... highlighter
b. blue & clear..... pen
4. a. black & silver pencil sharpener
b. silver paper clip



Dichotomous Key

Make your own dichotomous key (whichever form you prefer) in the space below:

A large, light blue rectangular area with a torn-paper edge effect, intended for students to create their own dichotomous key.

Final Thoughts:

Why do scientists all over the world use a universal classification scheme?

Eight horizontal lines provided for students to write their final thoughts.

THE SERENGETI PLAINS AT BUSCH GARDENS

“Serengeti” is derived from the Maasaai Maa word ‘serengit’, meaning ‘endless plains’. Stretching from Tanzania in the south to Kenya in the north, the African Serengeti plains has the largest concentration of wildlife in the world and is home to about 70 distinct types of large mammals and 500 unique bird species. At Busch Gardens, the Serengeti Plain is home to more than 25 different African species. This type of habitat is classified as a savanna.



WHAT IS A SAVANNA?

A savanna is a type of tropical grassland filled with coarse grasses and scattered trees. Savannas have warm temperatures year round. There are three different types of Savanna.

TYPE OF SAVANNA	CHARACTERISTICS	EXAMPLES
Temperate	Devoid of trees, except around streams and rivers.	American prairie, Asian steppes, South African veldts
Tropical and Subtropical	Receive three to five feet of rain per year.	Serengeti Plains
Flooded	High amounts of water, from either rain or other sources.	Florida Everglades

The Serengeti is a Tropical Savanna. There are two extreme and very different seasons in a savanna: a very long dry season, and a very wet season.

EXTREME WEATHER

The plains in Africa have an average temperature of 77°F; however, the weather there is extreme! Monsoons with heavy rains and harsh winds can last for days at a time and it becomes more hot and humid throughout the rainy season. Reversely,



during the dry season, it typically does not ever rain. The animals in this region have adapted both physically and behaviorally to live in these harsh climates. The great herbivore yearly migration is a perfect example of a behavioral adaptation. Come the

drought of the dry season in May or June, the grasses that wildebeest, zebra and some antelope depend on in Tanzania become scarce, watering holes dry up, and the migration begins. The animals go where the water is, and end up migrating a clock-wise 1800 mile round trip route every year!

As you walk around the Edge of Africa, critically observe the animals to determine their water usage levels. Record your findings on the chart below.

LEVEL 1-Little to no water use - drink water infrequently, if at all; can go long periods without water.

LEVEL 2-Moderate water use - drink water regularly, but can go without it for short periods; do not swim or spend time in the water.

LEVEL 3-Considerable water use - drink large amounts of water each day; use water regularly for feeding, swimming, bathing, etc.

LEVEL 4-Maximum water use - live in water or spend a majority of time in the water each day; water is vital to their every day survival.

ANIMAL	LEVEL OF WATER USAGE	HOW DO THEY USE WATER?
1.		
2.		
3.		
4.		
5.		
6.		

BONUS!

BONUS PAGES!



ACTION FIGURE:

STEVE IRWIN, WILDLIFE EXPERT AND CONSERVATIONIST



Steve Irwin's show "Crocodile Hunter" has reached audiences of over 200 million. Irwin dedicated his life to educating the public about crocodiles, snakes, and other creatures that are popularly perceived as dangerous instead of what they truly are: endangered. He was also a committed conservationist, running the Australian Zoo and buying tracts of land for natural habitat.

Irwin died on September 4, 2006, when he was pierced in the heart by the spine of a stingray on the Great Barrier Reef. While filming for a series called "Ocean's Deadliest" Irwin picked up the stingray and the tail came up and spiked him in the chest. Though stingrays do not aggressively attack, they will use their tails as a form of defense if threatened. Irwin died within minutes of pulling the barb out of his chest. He died from a loss of blood, not from the barb.

Some people in Irwin's line of work feel that this incident is the result of him taking too many risks with wild animals. Although the Queensland Police determined that Irwin did nothing to provoke the animal, many animal experts feel that the tragedy is the result of Irwin intruding on the stingray's personal space. Regardless of which side you take, there are a lot of reasons that animals can act aggressively and nature can be unpredictable. It is unfair to demonize an animal that is acting on its natural instinct. In the weeks following Irwin's death, dead stingrays washed onto the shores of Queensland, Australia, with their tails cut off. These barbaric acts of revenge only bring more tragedy to the Steve Irwin story.

Do you think it's necessary to take risks like Steve Irwin did in order to better educate the public?

MARINE ADAPTATIONS

Aquatic animals must adapt to their habitat's particular salinity, temperature, and light.

Salinity: In saltwater, water pressure increases 15 pounds per square inch every 30 feet deep. Marine creatures which are adapted to withstand the pressure at extreme depths may explode if they reach the ocean's surface. Aquatic animals also control the interaction of fresh water and saltwater in their bodies using their skin, gills, or lungs to absorb oxygen through the water and release carbon dioxide into the water as waste.

Temperature: Temperatures vary according to the depth of the water. Many aquatic mammals have blubber to

insulate them from cold temperatures. Some fish even have a substance similar to antifreeze that keep their blood flowing.

Light: Surface waters are more exposed to light, and therefore have better visibility, warmer temperatures, and higher nutrient levels. Creatures that live in the depths of the ocean are adapted to low temperatures and little or no visibility. The giant squid lives at such extreme depths that in order to sense objects it has eyeballs that measure 10 inches in diameter!



A giant squid attacks a bait squid off the Ogasawara Islands south of Tokyo. Photo courtesy of Tsunemi Kubodera of the National Science Museum of Japan.

TREASURE MAP

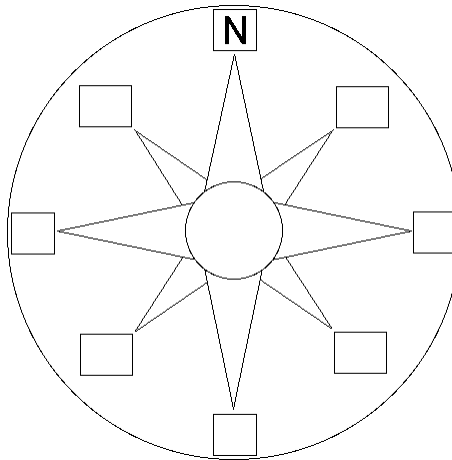
By now, you should at least have a guess as to which island was the site of the mystery ship wreck. With your team of fellow pirates, decide on your answer.

SITE OF SHIPWRECK: _____

Draw a treasure map showing the route from where you are now to the site of the wreck. Include geographical landmarks like streams, springs, beaches, and bodies of water. Be sure to include:

Key: a table explaining the symbols you use on your map.

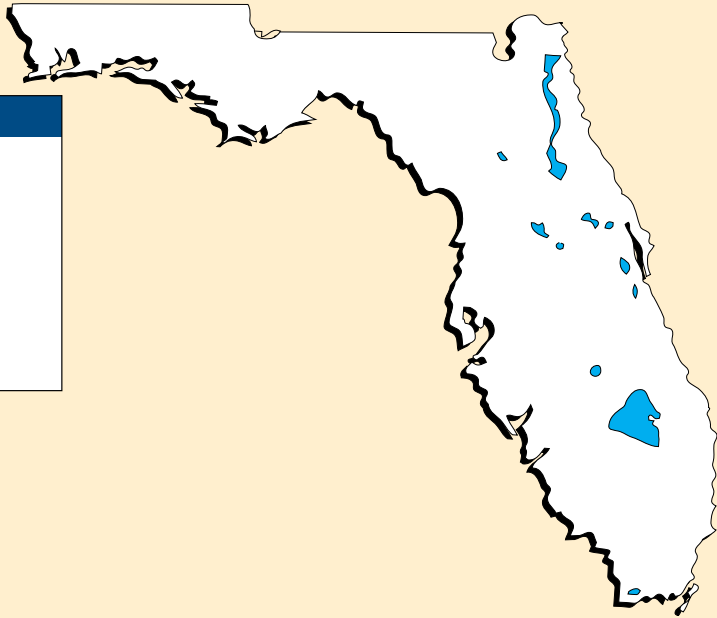
Compass rose: a symbol on a map that shows the directions north, south, east, west, northeast, northwest, southeast, and southwest. An easy way to remember the directions on a compass rose (starting at the top and moving clockwise): Never Eat Soggy Waffles. With this, it's easy to find northeast, northwest, etc.



1. Before drawing your map of Tampa Bay, circle the Tampa Bay area on the Florida map on the next page. Then, draw a new map of that circled area in the space provided.
2. Draw a line to map your route around Tampa, drawing in symbols for geographical landmarks along the way.
3. Finally, write a key and draw your own compass rose.

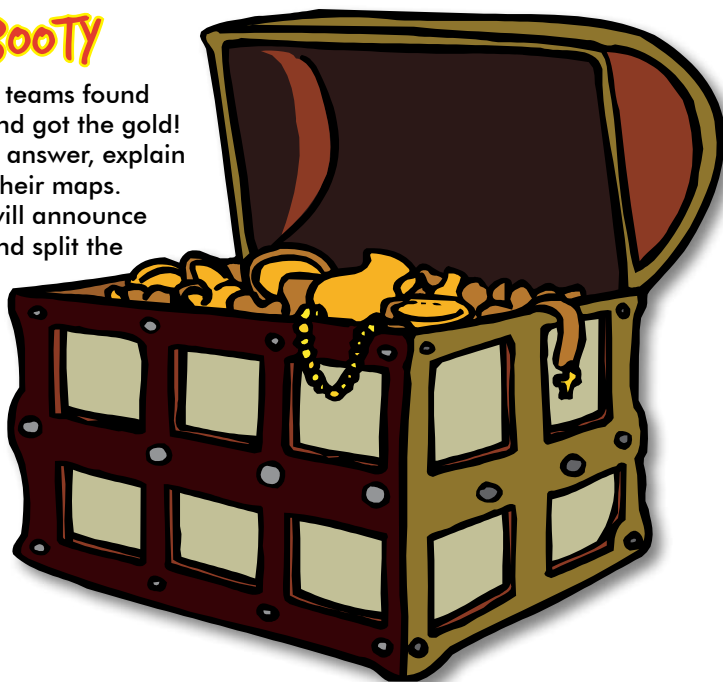
TREASURE MAP

MAP KEY



SPLITTING THE BOOTY

Now it's time to see which teams found the site of the shipwreck and got the gold! Each team will reveal their answer, explain their rationale, and show their maps. Then, the Course Leader will announce the site of the shipwreck and split the booty among the winners.



ACTION FIGURE:

JANISSE RAY, NATURE WRITER



Nature writers carefully observe and record their environments. They study the natural world as closely as scientists do, but they emphasize their personal reactions and relationships with what they study rather than analyzing. Nature writing is about the connections between humans and our environment. It is about coexisting with nature through our respect, understanding, and awe of its beauty. While nature writers recognize the tragedies that sometimes result from human interaction with their landscape, their overall tone is optimistic and hopeful.

Janisse Ray is a nature writer and environmental activist from Georgia. Her essays, poems, books, and lectures focus on protecting and restoring pine forests in the Southeastern United States. Themes in her work include nature, community, and sustainability. She once served as a scholar-in-residence at Florida Gulf Coast University, and has written extensively about Florida's wild landscapes. Her book, *Ecology of a Cracker Childhood*, won four book awards and was a *New York Times* Notable Book.

Read the excerpt from her essay, "On the Bosom of this Grave and Wasted Land I Will Lay My Head" (*Onion Magazine*, Summer 2002):

*ON THE WAY BACK TO SOUTH GEORGIA, traveling on a mountainous road between North and South Carolina, I see a sign announcing an overlook, next to a line of boulders that have been spray-painted with Jesus slogans. I pull over, because it is early, and the world, after all, is still gorgeous. I expect the typical outlook, a concrete slab bolted to a guard rail, not this granite **outcropping** as big as a church that rises out of the Great Smoky Mountains. I walk out across it. Partyers have left beer cans and food wrappers about, and broken their bottles against the rock. There is more spray-painting: Jody was here. Brent loves Kim. Repent. I move slowly to the uneven edge of the overlook.*

Instead of a cliff, the rock rolls away and away, like a scroll, and beyond it, rising out of the mists, is a dream world, a land remembered.

The mountains spin away, ridge upon tree-covered ridge in bands of color, deep blue-green fading toward gray, the **undulating** crust of the Earth softened by forests of hickory and beech. Then, as if in some heavenly **alchemy**, the ridges disappear into the smokelike mists of an **impenetrable** forever.

“My God,” I gasp. My one wish has been granted. I have stumbled upon the world as it was. My legs fold and I squat on the rock, mesmerized. For a few minutes I can see the Earth unchanged. Then I get back in the car and reenter the **industrialized**, road-netted, heavily-used land that makes up most of the eastern United States, full of clear-cuts, pine plantations, development, and signs that say, “LARGE LOG TRUCKS ENTERING AND EXITING HIGHWAY.”

My lovely heartland is being replaced by **vainglorious** nonessentials that lead us to forget what it means to be human in a trembling world.

GLOSSARY

ALCHEMY – magically changing a common substance into a substance of great value. Derived from a philosophy during the Renaissance and Middle Ages that metals could be transformed into gold by finding a universal solvent and elixir of life.

IMPENETRABLE – something you cannot comprehend.

INDUSTRIALIZED – characterized by the ideals, methods, and aims of large-scale industries, as opposed to agrarian or agricultural life.

OUTCROPPING – an exposed portion of the earth.

UNDULATING – softly moving in a wavy pattern.

VAINGLORIOUS – exhibiting boastful pride.

ADVENTURE PHOTOGRAPHY

Materials: (Disposable) underwater camera or camera with waterproof casing

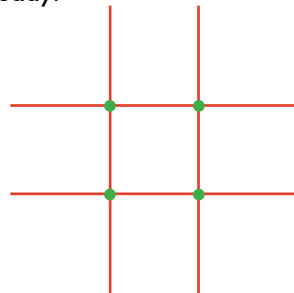
As you float down the river in your snorkeling gear, use an underwater camera to document your journey. Be creative with the pictures you take. Try to create a narrative with your pictures that will help you document the experience. Before you gear up to go, check out these photography tips:

Keep it steady

A perfect picture can be ruined if you accidentally move the camera at the time that you take the picture. To keep your images sharp, hold your camera steady!

Composition

One of the most basic rules about taking strong photographs is “the rule of thirds,” or the “tic-tac-toe rule.” Mentally divide your viewfinder or LCD screen into nine equal-size squares, like a tic-tac-toe grid. Compose your picture with your subject (what you are photographing) centered on one of the four intersecting points. This will help you compose more professional portraits.



Underwater Photography

Light behaves very differently when you’re underwater. The flash of your camera can cause something called “backscatter,” the bright specs of light that appear in a photograph the camera’s flash reflects off of suspended sediment in the water and back into your lens. To avoid this, try to remain steady. Also try to get as close to your subject as possible, to maximize the amount of light on your subject.



LIGHTS, CAMERA, ACTION!

How to be an adventure photographer

Being an adventure photographer is all about telling a story, and as an adventurer you have a front row seat to the ACTION! Taking a great picture requires both photographic technique and getting close to your subject. Consider using a hip pack or shoulder strap so that your camera is always easily accessible if an opportunity strikes. But remember, no photo is worth risking your safety!

If you’re using a digital camera, keep in mind that saltwater is more corrosive than freshwater; you’ll need to carefully clean your camera every day. It’s a good idea to keep your camera sealed in a plastic bag.

When shooting the surface of the water, use the reflections of the sun to your creative advantage, particularly when calm water comes between you and the brightest part of the sky during sunrise and sunset. Look for natural frames like mountains or arches formed by trees.



ACTION FIGURE:

NATURE DOCUMENTARY FILMMAKER

The camera crews that filmed the hit documentary series *Planet Earth* went to extreme lengths to show audiences the immense beauty of the natural world and the importance of preserving it. *Planet Earth* was filmed over the course of five years in more than 200 locations in 62 countries by about 70 cameramen and women. The crew had to endure some of the most extreme environments on the globe, from the frigid Antarctic tundra to Africa's sweltering Danakil Desert.

Being a nature photographer is both physically and mentally challenging and requires a great deal of patience and creativity. One of *Planet Earth's* aerial cameramen, Mark Kelem (who previously did camera work in the movies *Mission: Impossible III* and *Black Hawk Down*), had to learn to operate a camera controlled by a joystick attached to the bottom of a helicopter. One of the best ways to work towards becoming a nature photographer is to take lots and lots of photos or film footage. Look through books or online galleries of other photographers' different perspectives.



CROSSWORD PUZZLE CLUES

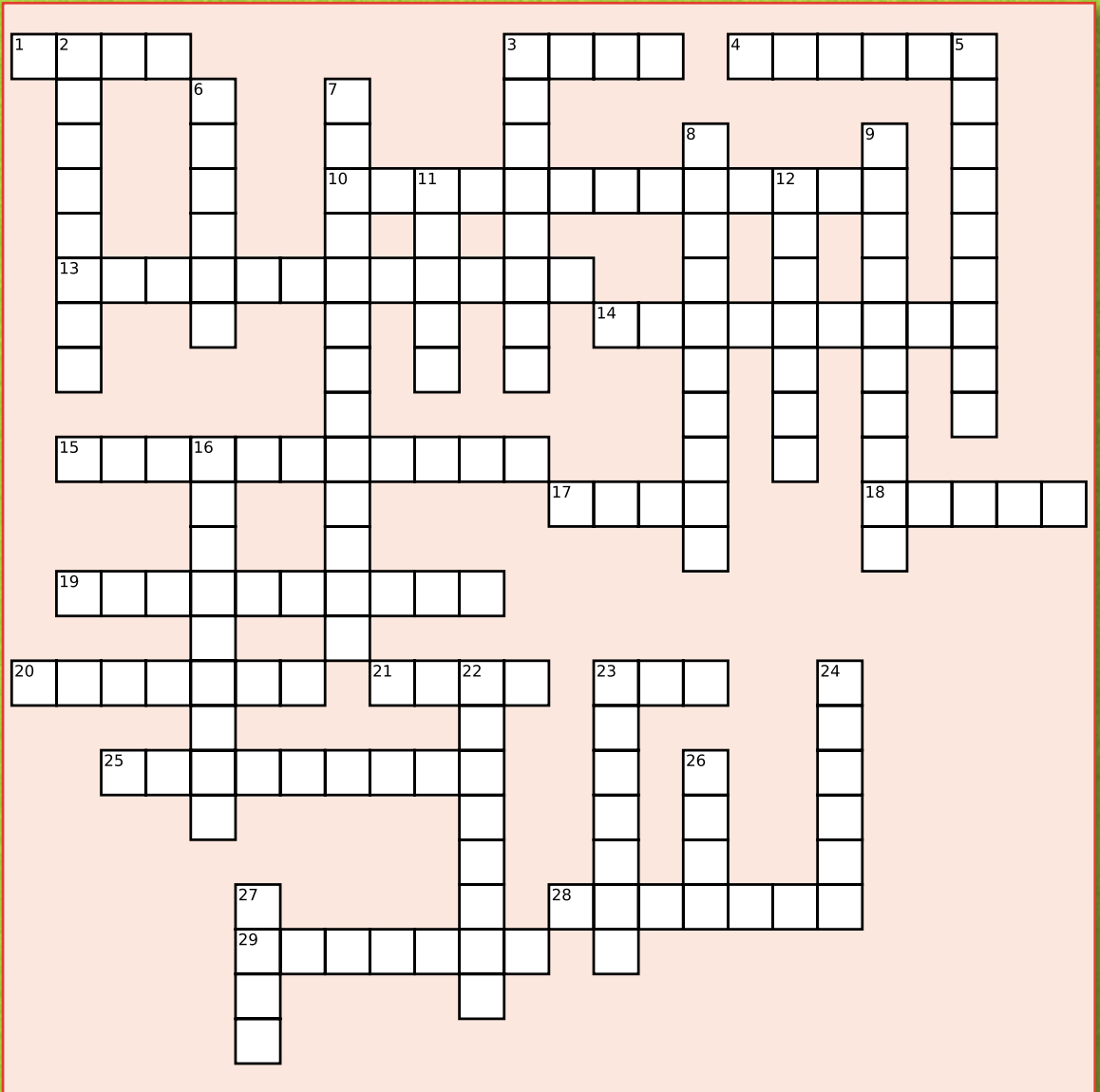
ACROSS

1. Predator's victim.
3. State tree.
4. Species not native to the area.
10. Spiny skin and radial symmetry.
13. An animal without a backbone.
14. Animal who eats meat.
15. Animal plankton.
17. Any substance that has a pH level below 7.
18. A mollusk with a pen.
19. Type of beach where sand is composed of weathered and eroded shells and coral reefs.
20. A marine mammal in the order Sirenia.
21. Predator of aphids.
25. Make their own food.
28. Order to which the manatee belongs.
29. Species native to a region.

DOWN

2. Type of wetland bordering rivers and streams.
3. One who cannot swim against a current.
5. Eat animals who make their own food.
6. Fish hawk.
7. The formation of caves.
8. Jointed legs and hard exoskeleton.
9. Produces sand as waste.
11. Great blue.
12. A storage area for water.
16. Any human caused change in the environment that creates an undesirable effect on living and non-living things.
22. Genus of southern stingray.
23. Pertaining to bottom of a body of water.
24. Largest Florida state park.
26. How many senses do you have?
27. Clown fish.

CROSSWORD PUZZLE



BEACH LIFE



Squid Dissection

You will have the chance to dissect a squid in the Mote Marine Invertebrate Lab. Let's return to our discussion of dissection ethics. Complete the chart with your arguments for and against dissecting the squid:

FOR	AGAINST

Does this chart differ from the one you made before the shark dissection? Why or why not? _____

ECO-PEDIA

Adaptation: an adjustment or change in the physiology, structure, or behavior of an organism to become more suited to its environment.

Amphibian: an endothermic vertebrate that spends its early development in water and its adulthood on land, only returning to the water to reproduce.

Aquifers: groundwater stored in porous rock that transmits water to wells and springs. The permeability of the rock and precipitation affect the recharge rate of the aquifer and the speed at which the groundwater is pushed up into springs.

WHY ARE SPRINGS, AQUIFERS, AND WETLANDS IMPORTANT?

- FLOOD CONTROL
- EROSION CONTROL
- WATER PURIFICATION
- TRAPPING SEDIMENT
- CHEMICAL AND ORGANIC WASTE PROCESSING
- NUTRIENT REMOVAL
- HABITATS FOR WILDLIFE AND FISH

Benthic ecology: the study of bottom-dwelling organisms in marine ecosystems. Important for recycling nutrients and decomposition.

Biodiversity: a wide range of organisms coexisting within a particular habitat, or in the world as a whole.

Buccal: oral, usually referring to the cheek or side of the mouth.

Buoyancy: an object's flotation based on its weight and the amount of water it displaces.

- **Negatively buoyant**—an object sinks because it displaces less water than it weighs. Ex: a steel nail.
- **Positively buoyant**—an object floats because it displaces more water than it weighs. Ex: a basketball.
- **Neutrally buoyant**—an object is weightless because the amount of water displaced is equal to its weight. Ex: Divers use weight belts to make themselves neutrally buoyant to explore the ocean floor without floating to the top or sinking to the bottom and damaging coral or other marine life on the ocean floor.

Condensation: water droplets form clouds when humid air reaches high altitudes.

Conservation: the responsible use of resources to sustain the environment.

Dichotomous key: a classification tool used in the biological sciences to identify organisms based on quantitative (values or numbers of) and qualitative (physical descriptions of) characteristics.

Ecological niches: microhabitats to which organisms adapt, usually referring to how they acquire food.

Ecosystem: dynamic relationship between all living and nonliving things. L.A.W.S.: Light, Atmosphere, Water, Soil.

Ectotherm: an animal whose body temperature changes according to environment, like reptiles and amphibians.

Endangered species: species like the manatee that are threatened with extinction. The “Endangered Species Act” requires the U.S. federal government to identify and help to protect the species and their habitat.

Endotherm: an animal whose body temperature is regulated through controlled internal heat, like mammals.

Estuarine: sheltered areas on coast where fresh and salt water meet (mangroves).

Evaporation: water from lakes, rivers, and oceans turned into water vapor by the heat of the sun, and then humid air is drawn upward through convection.

Extinction: the permanent loss of a species. Largest threats in Florida: habitat destruction through air and water pollution, draining of wetlands, the clearing of forests for human developments.

Floridian aquifer: drinkable water deposited underground through rainfall.

Groundwater: drinkable water stored underground in aquifers.

Habitat: the natural home of an organism where the species is as adaptive as possible to its environment.

Invertebrates: animals that have no spinal columns and use other means of support, such as shells or exoskeletons. 98% of species on Earth are

invertebrates, some of the most common are sponges, mollusks (soft body and hard shell: snails, clams, slugs), and arthropods (exoskeleton, segmented body with appendages on every segment: crustaceans like crabs, lobsters, shrimp).

Lacustrine: borders lakes.

Magnetic field: the magnetic region surrounding the Earth, with the magnetic poles near the North and South poles.

Mammal: an endothermic vertebrate that has a four-chambered heart, fur or hair covering its skin, and young that are milk-fed from their mothers’ bodies.

Mangrove forests: tropical coastal trees or shrubs adapted to live in saline and estuarine environments with above-ground root systems that look like stilts. They trap sediments, nutrients, and pollutants running off the land and protect the shore from erosion and storm damage. They also provide nursery grounds for reef, shore birds, and ocean fish.

Marine: shorelines, shallows, and sea beds.

Palustrine: forested (swamps and marshes).

Parallax: half of the angle formed by a star in an imaginary triangle with lines connecting the star’s position on one side of the Earth’s orbit and its position on the opposite side of the orbit. It is used to calculate a star’s distance from the Earth.

Distance[in cm] = [Earth-Sun distance in cm]/[parallax in radians]

Percolation/infiltration: water travels underground through tiny cracks in the soil and fills holes in the limestone, refreshing groundwater supply which flows out through springs.

Phytoplankton: single-celled algae. At the bottom of food chain, provide nourishment and regulate carbon levels. Two main species: Diatom (silica skeleton, pillbox shape, single or in chains) and Dinoflagellates (flagella for mobility).

Plate tectonics: the theory that Earth's outer shell is made up a series of oceanic and continental plates about 50 miles thick, called the lithosphere, which move in response to convection currents within the mantle. The interaction between plates at their boundaries form islands and mountain ranges, and can also cause seafloor spreading, earthquakes, and volcanic activity. There are three different types of boundaries:

- **Divergent:** the plates spread apart causing seafloor spreading as new material is added to the oceanic plates.
- **Convergent:** plates meet and one is dragged down, or subducted, beneath the other. Also called Subduction Zones.
- **Transform Fault:** one plate slides alongside another. Ex: The San Andreas Fault Zone.

Precipitation: rainfall.

Rainforest: a tropical forest with heavy rainfall, over 2.5 meters a year.

Recharge basin: land area where rainwater is absorbed through percolation and replenishes springs.

Reptile: an ectothermic vertebrate with lungs and scaly skin.

Riparian: freshwater alongside rivers and streams.

Runoff: when water cannot be absorbed, as with clay, it flows into bodies of water. In Florida, rainfall usually soaks directly through sand and limestone bedrock.

Species: a group of organisms that can mate with each other and produce offspring which can breed.

Speleogenesis: during percolation, carbonic acid forms in water from exposure to carbon dioxide and dying vegetation, and the acidic water dissolves limestone as it travels through cracks to form caves and caverns underground.

Springs: a water resource formed when a body of groundwater is intersected at or below the water table or surface, causing water to overflow from an aquifer onto the land. The amount of water flowing from a stream depends on the size of the basin, the water pressure in the aquifer, and the amount of precipitation.

Surface water: water on top of the ground in oceans, reservoirs, lakes, rivers, and streams.

Sustainability: using Earth's resources without depleting them or harming natural cycles; ensuring that Earth's resources will last for future generations.

Taxonomic classification: scientific classification of organisms from the largest category of classification (Kingdom) to the smallest (Species.)

Kingdom>Phylum>Class>Order>Family>Genus>Species.

Here's an acronym to help you remember: King Phillip Came Over From Great Spain.

Transpiration: plants absorb water from the soil, removing nutrients and pollutants, then "breathe" it back into the atmosphere through leaves and stems.

Vertebrates: animals that have a vertebral column or spine, including mammals, birds, reptiles, amphibians, and fish.

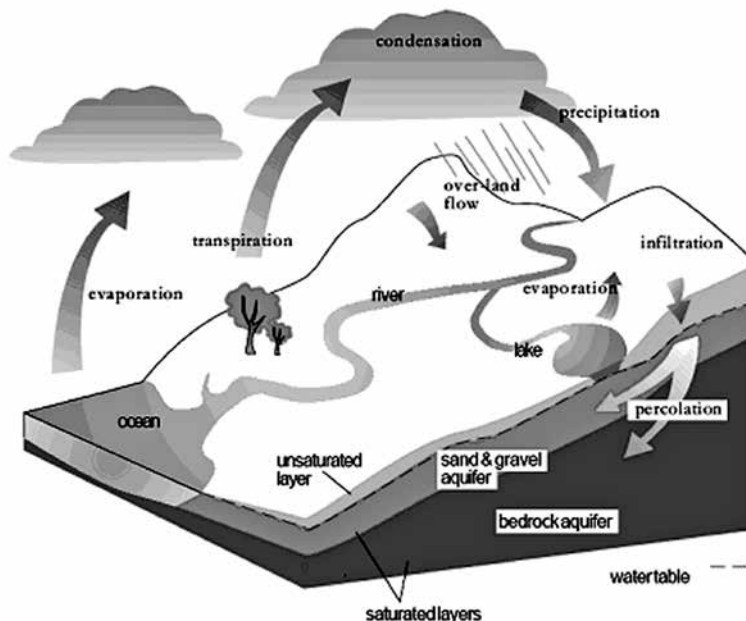
Water column: a vertical section of ocean, lake, or river.

Water cycle: Precipitation>Infiltration/Percolation>Evaporation>Condensation

Wetland: an ecosystem located between land and open water where land is saturated or soaked with water, trapping silt and sediment carried in by rivers. It is a plentiful area providing breeding and hatching grounds for aquatic creatures.

Zooplankton: tiny animals found in oceans, lakes, ponds, and rivers. Numbers of zooplankton used to determine the health of an ecosystem (very sensitive to temperature of water, light, and nutrients or pollutants present in water.) Each species is adapted to an area's unique ecosystem. Adaptations: flat bodies to help flotation, bright colors, transparency and bad tastes to detract predators.

The Water Cycle:



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