



Education Dept.
Georgia Aquarium
225 Baker Street NW
Atlanta, GA 30313
404.581.4198

Aqua Adventure Teacher Guide

Grades 6-8

Dear Educators,

We are happy you are visiting us here at the Georgia Aquarium and extending your classroom to include our saltwater and freshwater habitats.

The following guide has been designed to make your day at the Aquarium engaging and fun for you and your students. We have divided it into five sections – *lesson overview, student guide, teacher guide, pre visit activities, and post visit activities.*

Extension of your classroom: We are excited to offer you this as an extension of your own classroom. The following activities are correlated to the sixth, seventh, and eighth grade Georgia Performance Standards. In just a morning or an afternoon you and your students can address the following objectives and GPS's:

Enduring Understandings:

- Freshwater and marine ecosystems are home to diverse populations of organisms.
- All organisms, whether they live in freshwater or marine ecosystems, have characteristics that allow them to survive in their natural habitats.
- Humans play an important role in maintaining healthy ecosystems and the balance of nature.

Objectives:

- Students will examine freshwater species and identify characteristics that allow them to survive in their natural habitats.
- Students will learn and discuss how humans play an important role in maintaining healthy river systems and maintaining the balance of nature.
- Students will understand how an artificial reef is a model of a natural ecosystem.
- Students will discover the interdependence of organisms in an ecosystem.
- Students will comprehend that authentic research includes observing, questioning and analyzing the living world.

Georgia Performance Standards Addressed:

Sixth Grade

S6CS3: Students will use computation and estimation skills necessary for analyzing data and following scientific explanations.

d. Draw conclusions based on analyzed data.

S6CS5: Students will use the ideas of system, model, change and scale in exploring scientific and technological matters.

a. Observe and explain how parts are related to other parts in a system, such as an ocean system, including how the output from one part of the system can become the input to other parts.

S6E3: Students will recognize the significant role of water in earth processes.

a. Explain that a large portion of the earth's surface is water, consisting of oceans, rivers, lakes, underground water and ice.

ELA6RC2: The student participates in discussions related to curricular learning in all subject areas.

c. Relates messages and themes from one subject area to those in another area.

f. Recognizes and uses the features of disciplinary texts (charts, graphs, photos, maps, highlighted vocabulary).

ELA6RC3: The student acquires new vocabulary in each content area and uses it correctly.

c. Explores understanding of new words found in subject area texts.

M6D1. Students will pose questions, collect data, represent and analyze data and interpret results.

a. Formulate questions that can be answered by data. Students should collect data by using samples from a larger population (surveys), or by conducting experiments.

M6P4: Students will make connections among mathematical ideas and to other disciplines.

b. Recognize and apply mathematics in contexts outside of mathematics.

Common Core:

6SP5: Summarize numerical data sets in relation to their context, such as by:

- Reporting the number of observations.

- Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.

- Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.

- Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.

Seventh Grade

S7CS3: Students will use computation and estimation skills necessary for analyzing data and following scientific explanations.

d. Draw conclusions based on analyzed data.

S7CS5: Students will use the ideas of system, model, change and scale in exploring scientific and technological matters.

a. Observe and explain how parts are related to other parts in a system, such as ocean system including how the output from one part of the system can become the input to other parts.

S7L4: Student will examine the dependence of organisms on one another and their environment.

c. Recognize that changes in environmental conditions can affect the survival of both individuals and entire species.

e. Describe the characteristic of earth's major aquatic communities.

ELA7RC2: The student participates in discussions related to curricular learning in all subject areas.

c. Relates messages and themes from one subject area to those in another area.

f. Recognizes and uses the features of disciplinary texts (e.g., charts, graphs, photos, maps, highlighted vocabulary).

ELA7RC3: The student acquires new vocabulary in each content area and uses it correctly.

c. Explores understanding of new words found in subject area texts.

M7D1: Students will pose questions, collect data, represent and analyze the data, and interpret results.

g. Analyze and draw conclusions about data, including describing the relationship between two variables.

M7P4: Students will make connections among mathematical ideas and to other disciplines.

c. Recognize and apply mathematics in contexts outside of mathematics.

Common Core:

7SP2: Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions.

Eighth Grade

ELA8RC2: The student participates in discussions related to curricular learning in all subject areas.

c. Relates messages and themes from one subject area to those in another area.

f. Recognizes and uses the features of disciplinary texts (e.g., charts, graphs, photos, maps, highlighted vocabulary).

ELA8RC3 The student acquires new vocabulary in each content area and uses it correctly.

c. Explores understanding of new words found in subject area texts.

M8P4: Students will make connections among mathematical ideas and to other disciplines.

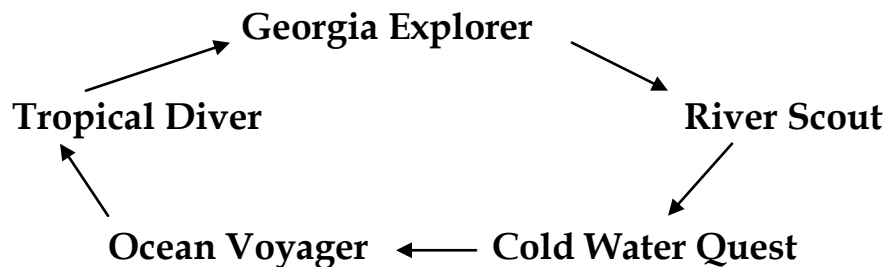
c. Recognize and apply mathematics in contexts outside of mathematics.

Overall Format: Each gallery has a few stops where we recommend you spend a little more time with your students. Each stop is highlighted by an exhibit overview along with some guiding questions for the students (and answers for the adults). These questions are meant to highlight key concepts for your group, whether it be observing an animal’s behavior or simply finding some of our favorite animals in the exhibit. Students will need to bring **clipboards** and **writing utensils** with them to complete the activities.

Whenever your group is in front of the larger gallery windows at the aquarium, we ask that students sit cross-legged in a few rows close to the window. Please allow space for other groups at the windows.

At our touch pools, students will have the opportunity to explore using their senses. For the safety of the animals, please make sure they are touching softly with two fingers and not grabbing. Please make sure that you watch your students carefully for their safety as well as that of the animals.

Your groups: While at the aquarium, the smaller the individual group the better. We recommend one chaperone with five to seven students. This allows everyone to see the exhibits and helps with traffic in the galleries. We also recommend that your entire group does not start at the same gallery. There are 5 galleries, have them **split up** and start in **different** galleries and rotate. Here is our recommendation on how to rotate:



Since each gallery exits to the main atrium, it is easy to set up a meeting point for all groups before exiting through the gift shop or eating. **We recommend all the adults pick up a map when you enter the Aquarium to help orient you in the building.**

Rules: Finally, to ensure a great visit, we ask that you share the following rules with your students and chaperones for the safety of our animals and your students.

- No running
- Be respectful of the other guests
- No horseplay, pushing or shoving
- Use indoor voices
- No tapping on the windows - it can be very bothersome to our animals
- **Stay with your chaperones/students at all times**
- No gum
- Only touch with two fingers

We hope you have an amazing day here at the Georgia Aquarium, the world's most engaging aquarium, and that the tips and tricks listed in this guide are useful in extending your classroom to the watery world. Please be sure to complete our online *Teacher Survey!*

Best Fishes!

The Georgia Aquarium Education Department



Aqua Adventure
Student Guide
Grades 6-8

Are you ready for your adventure? Head inside the Georgia Explorer Gallery. Look to your left and FIND the Gray's Reef touch pool. Touch the animals in the touch tank with two fingers.

VISIT the loggerhead sea turtle in the Gray's Reef exhibit. Loggerhead sea turtles are an endangered species that nest on Georgia's beaches each summer. In April of 2008, Dylan, a loggerhead sea turtle who lived at the Georgia Aquarium, was rehabilitated and released back into the ocean. Before being released, scientists attached a satellite transmitter to Dylan's shell so that her movements could be tracked.

BRAINSTORM with your group and think of 2 things scientists might be able to learn about sea turtles through satellite tracking:

COME ABOARD the boat and check out the touch tank! Remember, two finger touch only. Did you know that horseshoe crab blood is blue. It has copper in it instead of iron, which is what makes our blood red. Horseshoe crab blood is also used by NASA scientists to test their equipment for bacteria before it is sent to space!

WATCH the sea turtle video (near the mouth of the whale slide).
NAME two things that are dangerous for sea turtles:

AND

BEFORE you leave the gallery, be sure to look up at our shrimp net to see a Turtle Excluder Device (TED) like the one in the video! Can you see where the sea turtle is able to escape?

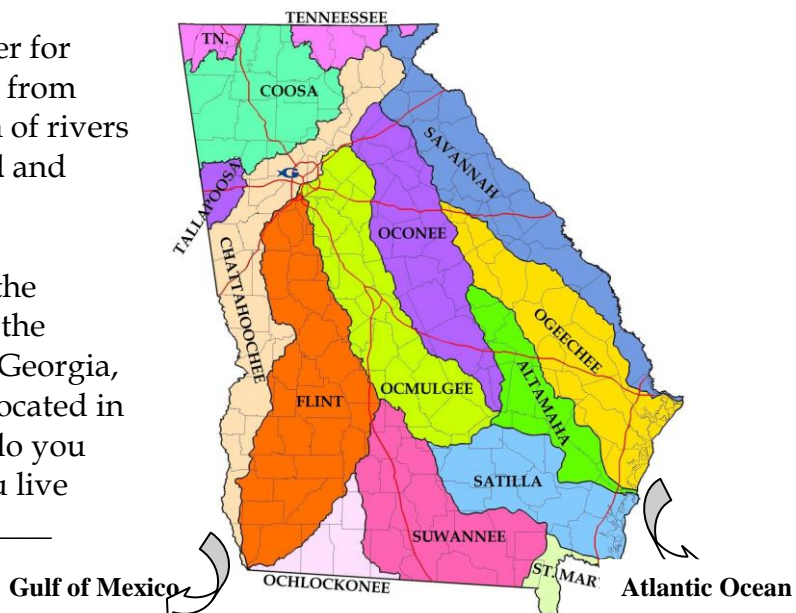
Loggerhead sea turtles and northern right whales are both endangered. What do you think you can do to help endangered marine animals? _____



Now you are entering our River Scout Gallery, which showcases freshwater habitats from around world. Freshwater is very important not only to these animals but also to humans.

Here in the Southeastern US, we rely on freshwater for drinking water, recreation, and food. Originating from precipitation, freshwater travels through a system of rivers and streams, all the water drains into a **watershed** and ultimately ends up in the ocean.

The Mississippi River **watershed** is the largest in the United States, and it extends across the middle of the country from the Rockies to the Appalachians. In Georgia, we have 14 major watersheds. The Aquarium is located in the Chattahoochee Watershed. What watershed do you live in? Check the map to find the watershed you live in. _____



What body of saltwater does the rivers in your community flow to?

CHECK OUT the African cichlids inside River Scout. How do cichlids protect their eggs while they are waiting for them to hatch? (Hint: Look above the African cichlid exhibit).

Continue through the gallery and LOOK UP. This is the North American river exhibit. What colors are the fish? _____

Why do you think they are that color? _____

CHECK OUT the Emerald Tree Boa. How do they kill their prey?

DID YOU KNOW the albino alligators have a genetic abnormality where they cannot produce the skin pigment **melanin**; this gives them white skin instead of olive, brown, and black. They cannot survive in the wild because the sun's UV rays are very damaging and they cannot camouflage themselves against predators.

VISIT the electric fish exhibits. Electric eels use two different voltages (strengths) of electricity: low voltage (weaker), and high voltage (stronger). It can produce a shock exceeding 500 volts. What do they use the low voltage for?

What does the elephant nose fish use its electricity for? _____

DID YOU KNOW piranhas are not as aggressive as once believed. In fact, piranhas are unlikely to attack humans unless blood is present in the water. The piranhas swim a safe distance from our divers when they are cleaning the exhibit.

OBSERVE the Asian small-clawed otters for a few minutes. Circle some possible behaviors that you see.

Sleeping

Swimming

Feeding

Playing

Fighting

Other Behaviors: _____

Conservation Alert: Name two threats to Asian small-clawed otters:

_____ and _____

Are Asian small-clawed otters an endangered species? _____



After checking out the kelp forest, touch pool, and Japanese spider crabs, STOP at the beluga whale exhibit for the:

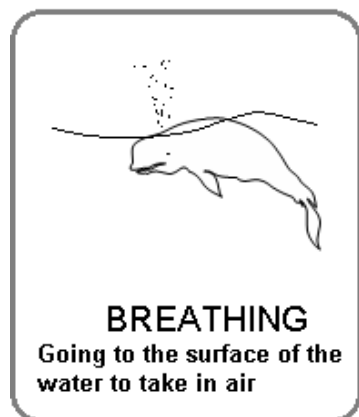
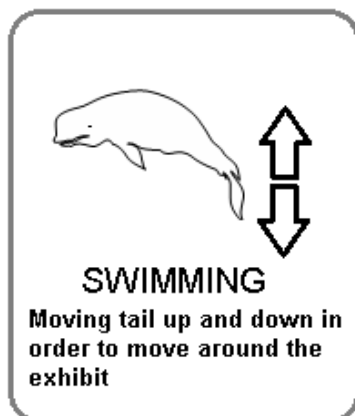
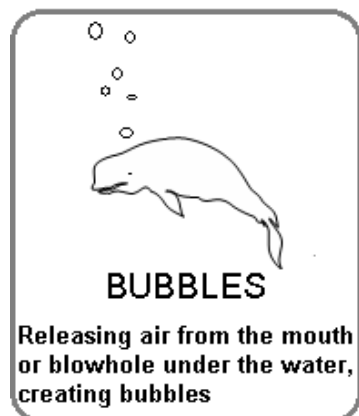
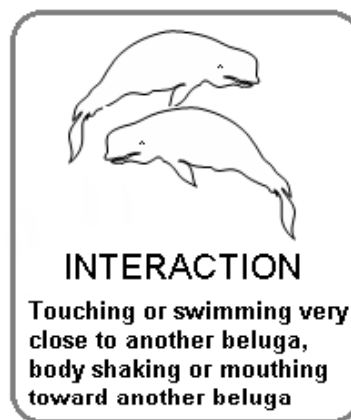
Beluga Behavior Study

One of the jobs of our biologists is to monitor the behavior of the animals for which they are responsible. It is their job to know what is “normal” for each animal. Behaviors can vary throughout the day and from animal to animal. A biologist is able to observe changes in behavior by working with the animals on a daily basis. By knowing individual animal and group behaviors, a biologist can alert the veterinarian to potential problems if they see anything out of the ordinary.

On the next page is a list of common behaviors observed by our biologists, along with an ethogram describing those behaviors. Choose one of our belugas to observe for 5 minutes. Beethoven, our male beluga, is the largest one and can be identified by his large melon (the round lump on a beluga’s forehead) and the gray patches on his skin. Maris, our oldest female, has a smooth white coloration, a smaller melon and no gray patches. The two juvenile beluga whales are Quinu (female) and Grayson (male). They are both a light gray coloration and smaller than the adults. To tell the difference between male and female beluga whale, simply look at the stomach near the tail. All Beluga whales have a slit down the middle, but males will end with a dot and females will have an upside down “V”, these are the mammary glands. During your observations use tally marks (III) to keep track of each time a behavior occurs. Total the tallies to see which behaviors occur most frequently.

Beluga Study Ethogram

An ethogram is a pictorial inventory or list of behaviors of a species. The ethogram below shows common behaviors of the beluga whales. It can help you determine which behaviors you are seeing.



Beluga Behavior Study

Time (5 minutes)

Behavior	Tallies of Observed Behavior	TOTALS
Body Shaking		
Interaction		
Bubbles		
Diving		
Rock Rubbing		
Breathing		
Mouthing		
Swimming		
Not Visible		
Other		

If you observed an "other" behavior, describe it here:

General observations (summary of behaviors):

Back at School: Use your totals and find the percentage a behavior occurred. (Number of times one specific behavior occurred divided by the total number of behaviors seen. Multiply by 100 to find percentage)

VISIT the Southern sea otters. They are listed as a critically endangered species by the International Union for the Conservation of Nature (IUCN).

How many southern sea otters are estimated to be living in the wild? _____

Why are they considered an endangered species? _____

DID YOU KNOW Southern sea otters eat many types of prey including sea urchins, snails, mussels, crabs, scallops, fish, barnacles, octopus, worms, and squid. Sea otters will use hard objects like rocks to break open the shells of their prey to eat them. They must eat 20 to 30 percent of their body weight every day to maintain their normal body temperature in this cold environment. So our largest sea otters, Oz and Gracie, weigh 50-60lbs and consume approximately 12 pounds of food daily.

Using your own body weight, how much would you have to eat every day to maintain your normal body temperature if you were a sea otter? (Hint: Multiply your body weight by 20% and/or 30%). _____

DID YOU KNOW sea otters will use hard objects like rocks to break open the shells of their prey to eat them? They will even use litter like bottles and cans to break open their prey and to also find small animals within.

VISIT the African penguin exhibit. The African penguin is the only penguin species that breeds in Africa. It is known for the donkey-like braying call it makes. If you listen very closely, you can hear the penguins braying. There are only approximately 120,000 African penguins left in the wild and the species is listed as endangered on the IUCN Red List. Threats to the African penguins are oil spills, overfishing of surrounding waters by people, and natural competition and predation from seals and straw-necked ibis. When a species of animal is endangered, there is a great chance that it could become extinct in the wild. What does extinct mean?

DID YOU KNOW our African penguins have beads on their wings to distinguish their sexes? The beads closest to the midline of their bodies are either **pink** or **blue** – pink for females and blue for males.



Welcome to the world ocean! We call it the world ocean because all oceans are part of one large ocean that covers the entire world, allowing animals to roam from one area to another. **Pick up a species identification card at the beginning of the gallery to help in identifying the animals.**

HOW wide can a Manta ray get? _____

HOW long can a Giant grouper get? _____

WHY is the Largetooth sawfish endangered? _____

WHAT is the sawfish's rostrum ("saw") used for?

VISIT the whale shark transport exhibit. What an amazing process it was to bring the whale sharks to the Georgia Aquarium! Many people from different professions had to work together to pull it off.

Based on the pictures and videos, what different backgrounds and jobs did the team members need that helped with the transport of the Whale Sharks?

WHERE did our whale sharks come from? _____

VISIT the Ocean Matters exhibit. What can WE do to prevent ocean debris from ending up in our One World Ocean?

The Georgia Aquarium has partnered with Mote Marine Laboratory and the Mexican government to study the whale sharks. Though they have studied these gentle giants for close to ten years and have learned a lot, there is still much more to learn.

WATCH the video to the left or right of the main viewing window and answer the following question:

WHAT are we learning about whale sharks by researching them in the Gulf of Mexico?

DID YOU KNOW sharks have 8-15 rows of teeth that are continually replaced throughout their lives. The average shark can lose, on average, between 27,000-30,000 teeth in its lifetime!! When a tooth is lost, another moves forward into its spot, like a conveyor belt.

PLEASE DROP OFF THE SPECIES ID CARD AS YOU EXIT THE GALLERY. THANKS!



CHECK OUT the **garden eel** exhibit (the first window as you enter Tropical Diver).

Which fish in this exhibit swim in large schools? _____

Why do you think the garden eels all face the same direction? _____

OBSERVE the jellies. In recent years, populations of jellies around the world have been growing rapidly due to a decrease in predator numbers as well as an increase in water temperatures. How might the growth of jellies affect an ecosystem?

DID YOU KNOW jelly tentacles have *nematocysts*, toxic stinging cells used to catch prey? The toxins are species-specific (they only affect certain animals) and do not harm members of their own species. If you see two sea nettles weaving together, they're not hurting each other. A sea nettle, however, is quite capable of catching and eating a moon jelly!

CONTINUE to the **coral reef** window. One of the most interesting animals that lives in the coral reef is the **coral polyp**. There can be thousands of polyps living on each piece of coral. Corals get most of their food from *zooxanthellae*, a type of algae that live inside them. Zooxanthellae use energy from the sun to create food for the coral using *photosynthesis* (same process used by plants).

Coral reefs are beautiful but fragile ecosystems and can be harmed by human activities.

How are we connected to all of the world's coral reefs? _____

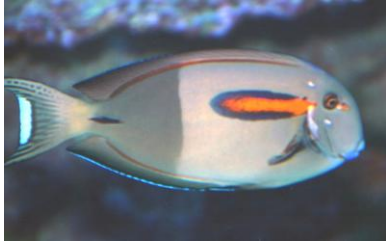
What can you do to help protect coral reefs? _____

DID YOU KNOW that less than 1% of the ocean floor (approximately the size of Texas) is occupied by coral reefs, yet these reefs serve as home to as many as one quarter of the world marine species!

Just like a real coral reef, this exhibit has a high level of biodiversity, meaning that it contains many different species. Use the following dichotomous key to identify some of these species.

CORAL REEF FISH DICHOTOMOUS KEY

Select and locate three fish listed below in the reef wall exhibit. Observe each fish for a few minutes. Use the key on the next page step-by-step to determine which species of fish you are observing. Be sure to note the common and scientific names under the picture.



CORAL REEF DICHOTOMOUS KEY

1	Does your fish have a rounded body or a long, slender body?	Rounded body: Go to step 2
		Slender body: Go to step 6
2	Does your fish have a forked tail or a straight-edged tail?	Forked tail: Go to step 3
		Straight tail: Go to step 4
3	Does your fish have an orange spot on its tail or an orange stripe on its side?	Orange spot: It's an Achilles tang!
		Orange stripe: It's an orange band surgeonfish!
4	Is your fish one solid color?	It's a yellow tang!
		Go to step 5
5	Does your fish have vertical stripes or a swirl pattern?	Stripes: It's a sailfin tang!
		Swirl: It's a palette surgeonfish!
6	Does your fish have a forked tail or a straight-edged tail?	Forked tail: Go to step 7
		Straight tail: Go to step 8
7	Does your fish have a purple spot on its side?	It's a male squarespot anthias!
		It's a female squarespot anthias!
8	Does your fish have a long, straw-shaped nose like a hummingbird?	It's a bird wrasse!
		No: go to step 9
9	Does your fish have a yellow face?	It's a Hawaiian cleaner wrasse!
		Go to step 10
10	Does your fish have green stripes on its face?	It's a yellowtail coris!
		It's a painted anthias!

Aqua Adventure Teacher Guide Grades 6-8

GEORGIA EXPLORER

Are you ready for your adventure? Head inside the Georgia Explorer Gallery. Look to your left and FIND the Gray's Reef touch pool. Touch the animals in the touch tank with two fingers.

VISIT the loggerhead sea turtle in the Gray's Reef exhibit. Loggerhead sea turtles are an endangered species that nest on Georgia's beaches each summer. In April of 2008, Dylan, a loggerhead sea turtle who lived at the Georgia Aquarium, was rehabilitated and released back into the ocean. Before being released, scientists attached a satellite transmitter to Dylan's shell so that her movements could be tracked.

BRAINSTORM with your group and think of 2 things scientists might be able to learn about sea turtles through satellite tracking:

Migration patterns, feeding and breeding grounds.

COME ABOARD the boat and check out the touch tank! Remember, two finger touch only. Did you know that horseshoe crab blood is blue. It has copper in it instead of iron, which is what makes our blood red. Horseshoe crab blood is also used by NASA scientists to test their equipment for bacteria before it is sent to space!

WATCH the sea turtle video (near the mouth of the whale slide).

NAME two things that are dangerous for sea turtles:

Plastic bags, fishing nets, they are hit by boats, hatchlings are eaten by predators, hatchlings sometimes mistake urban lights for the horizon and crawl toward artificial light sources instead of the open view of the night sky over the ocean.

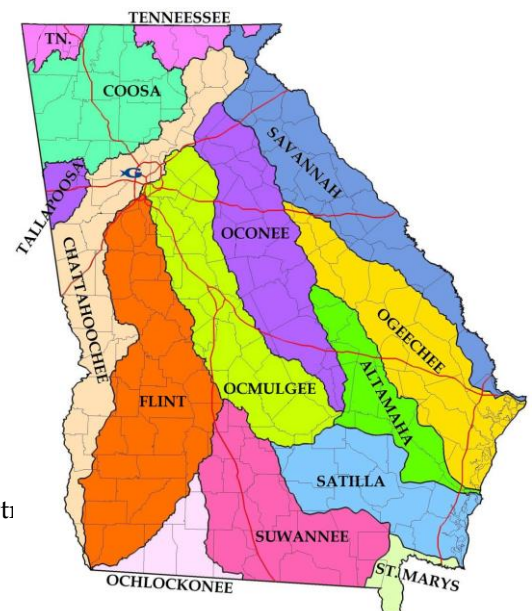
BEFORE you leave the gallery, be sure to look up at our shrimp net to see a Turtle Excluder Device (TED) like the one in the video! Can you see where the sea turtle is able to escape?

Loggerhead sea turtles and northern right whales are both endangered. What do you think you can do to help endangered marine animals? Answers will vary – don't litter, keep the oceans clean, educate others, etc.

RIVERSCOUT

Now you are entering our River Scout Gallery, which showcases freshwater habitats from around world. Freshwater is very important not only to these animals but also to humans.

Here in the Southeastern US, we rely on freshwater for drinking water, recreation, and food. Originating from



precipitation, freshwater travels through a system of rivers and streams, all the water drains into a **watershed** and ultimately ends up in the ocean.

The Mississippi River **watershed** is the largest in the United States, and it extends across the middle of the country from the Rockies to the Appalachians. In Georgia, we have 14 major watersheds. The Aquarium is located in the Chattahoochee Watershed. What watershed do you live in? Check the map to find the watershed you live in. Will vary, depending on where you live.

What body of saltwater does the rivers in your community flow to?
Will vary, depending on where you live.

CHECK OUT the African cichlids inside River Scout. How do cichlids protect their eggs while they are waiting for them to hatch? (Hint: Look above the African cichlid exhibit). They are mouth brooders; females protect eggs in their mouth until they hatch.

Continue through the gallery and LOOK UP. This is the North American river exhibit. What colors are the fish? White, cream, browns.
Why do you think they are that color? Camouflage

CHECK OUT the Emerald Tree Boa. How do they kill their prey?
The Emerald Tree Boa is a type of constrictor; it squeezes its prey to death!

DID YOU KNOW the albino alligators have a genetic abnormality where they cannot produce the skin pigment **melanin**; this gives them white skin instead of olive, brown, and black. They cannot survive in the wild because the sun's UV rays are very damaging and they cannot camouflage themselves against predators.

VISIT the electric fish exhibits. Electric eels use two different voltages (strengths) of electricity: low voltage (weaker), and high voltage (stronger). It can produce a shock exceeding 500 volts. What do they use the low voltage for? Navigate muddy creeks
What does the elephant nose fish use its electricity for? To sense things around them in the dark

DID YOU KNOW piranhas are not as aggressive as once believed. In fact, piranhas are unlikely to attack humans unless blood is present in the water. The piranhas swim a safe distance from our divers when they are cleaning the exhibit.

OBSERVE the Asian small-clawed otters for a few minutes. Circle some possible behaviors that you see.

Sleeping

Swimming

Feeding

Playing

Fighting

Other Behaviors: _____

Conservation Alert: Name two threats to Asian small-clawed otters: Habitat destruction and hunting

Are Asian small-clawed otters an endangered species? They are not endangered, but it is important to monitor their status.

COLDWATER QUEST

After checking out the kelp forest, touch pool, and Japanese spider crabs, STOP at the beluga whale exhibit for the:

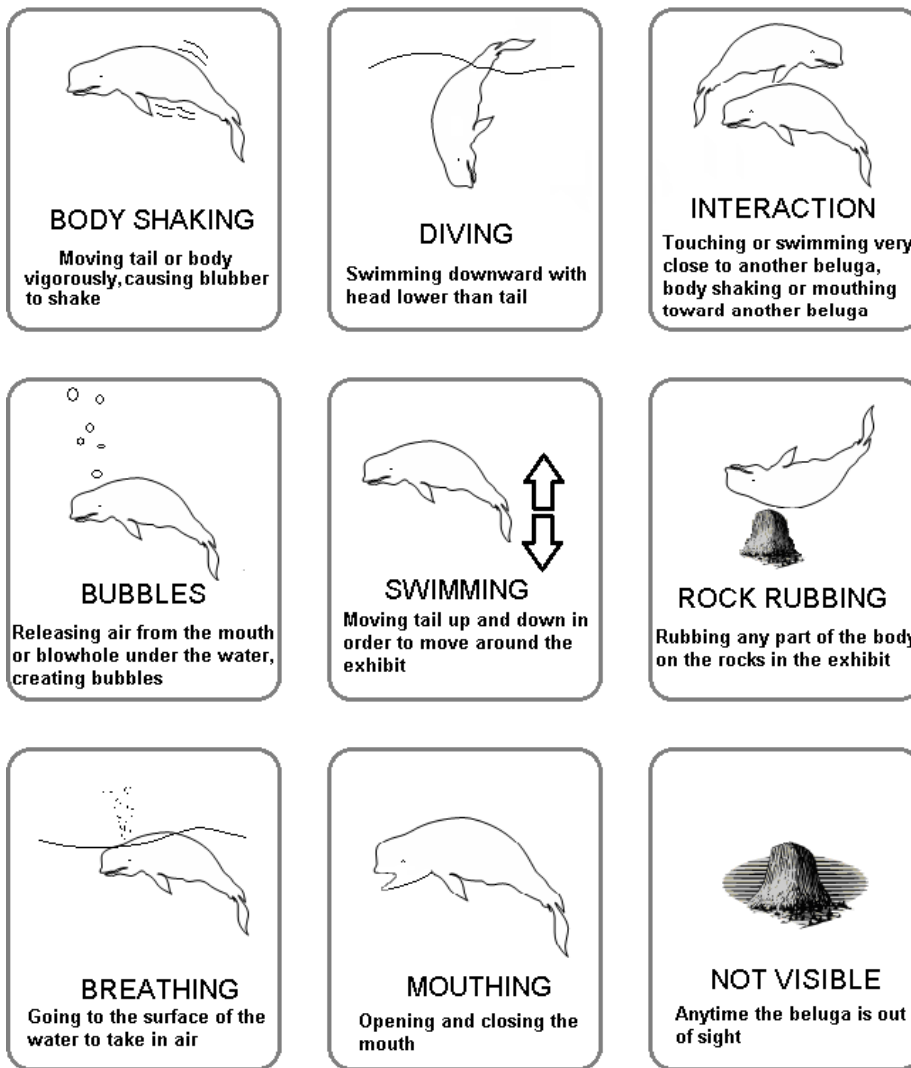
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Beluga Study Ethogram

An ethogram is a pictorial inventory or list of behaviors of a species. The ethogram below shows common behaviors of the beluga whales. It can help you determine which behaviors you are seeing.



Beluga Behavior Study Example

Time (5 minutes)

Behavior	Number of Observed Behaviors	TOTALS
Body Shaking	II	2/23 = .087 = 8.7%
Interaction	III	3/23 = .131 = 13.1%
Bubbles	I	1/23 = .043 = 4.3%
Rock Rubbing	II	2/23 = .087 = 8.7%
Breathing	IIII	5/23 = .217 = 21.7%
Mouthing	0	0/23 = 0 = 0%
Diving	IIII	4/23 = .174 = 17.4%
Swimming	IIIIII	6/23 = .261 = 26.1%
Not visible	0	0/23 = 0 = 0%
Other	0	0/23 = 0 = 0%
Totals as actual number and percentage	23	100%

If you observed an "other" behavior, describe it here:

Answers will vary

General observations (summary of behaviors):

Answers will vary

VISIT the Southern sea otters. They are listed as a critically endangered species by the International Union for the Conservation of Nature (IUCN).

How many southern sea otters are estimated to be living in the wild? Less than 2,800

Why are they considered an endangered species? Pollution from land based activities, great white shark predation, oil spills, and entanglement in fishing nets.

DID YOU KNOW Southern sea otters eat many types of prey including sea urchins, snails, mussels, crabs, scallops, fish, barnacles, octopus, worms, and squid. Sea otters will use hard objects like rocks to break open the shells of their prey to eat them. They must eat 20 to 30 percent of their body weight every day to maintain their normal body temperature in this cold

environment. So our largest sea otters, Oz and Gracie, weigh 50-60lbs and consume approximately 12 pounds of food daily.

Using your own body weight, how much would you have to eat every day to maintain your normal body temperature if you were a sea otter? (Hint: Multiply your body weight by 20% and/or 30%). Answers will vary

DID YOU KNOW sea otters will use hard objects like rocks to break open the shells of their prey to eat them? They will even use litter like bottles and cans to break open their prey and to also find small animals within.

VISIT the African penguin exhibit. The African penguin is the only penguin species that breeds in Africa. It is known for the donkey-like braying call it makes. If you listen very closely, you can hear the penguins braying. There are only approximately 120,000 African penguins left in the wild and the species is listed as endangered on the IUCN Red List. Threats to the African penguins are oil spills, overfishing of surrounding waters by people, and natural competition and predation from seals and straw-necked ibis. When a species of animal is endangered, there is a great chance that it could become extinct in the wild. What does extinct mean?

When a species of animal ceases to exist on Earth.

DID YOU KNOW our African penguins have beads on their wings to distinguish their sexes? The beads closest to the midline of their bodies are either **pink** or **blue** – pink for females and blue for males.

OCEAN VOYAGER

Welcome to the world ocean! We call it the world ocean because all oceans are part of one large ocean that covers the entire world, allowing animals to roam from one area to another. **Pick up a species identification card at the beginning of the gallery to help in identifying the animals.**

HOW wide can a Manta ray get? Up to 30 feet wide

HOW long can a Giant grouper get? 8.9 feet long

WHY is the Largetooth sawfish endangered? Overfishing, using the "saw" as a souvenir, under-protected, entanglement in fishing nets which makes them bycatch

WHAT is the sawfish's rostrum ("saw") used for? The rostrum is used for digging up the sandy bottom to locate prey, protection, and spearing fish out of schools.

VISIT the whale shark transport exhibit. What an amazing process it was to bring the whale sharks to the Georgia Aquarium! Many people from different professions had to work together to pull it off.

Based on the pictures and videos, what different backgrounds and jobs did the team members need that helped with the transport of the Whale Sharks?

Pilot, co-pilot, engineer, lead master diver, biologist, veterinarian.

WHERE did our whale sharks come from? Taiwan

VISIT the Ocean Matters exhibit. What can WE do to prevent ocean debris from ending up in our One World Ocean? ecycle our litter; do not throw debris into watersheds which makes its way to the ocean, etc.

The Georgia Aquarium has partnered with Mote Marine Laboratory and the Mexican government to study the whale sharks. Though they have studied these gentle giants for close to ten years and have learned a lot, there is still much more to learn.

WATCH the video to the left or right of the main viewing window and answer the following question:

WHAT are we learning about whale sharks by researching them in the Gulf of Mexico?

Answers will vary - Animal migration, feeding behavior, animal measurements, gender, population dynamics, etc.

DID YOU KNOW sharks have 8-15 rows of teeth that are continually replaced throughout their lives. The average shark can lose, on average, between 27,000-30,000 teeth in its lifetime!! When a tooth is lost, another moves forward into its spot, like a conveyor belt.

PLEASE DROP OFF THE SPECIES ID CARD AS YOU EXIT THE GALLERY. THANKS!

TROPICAL DIVER

CHECK OUT the **garden eel** exhibit (the first window as you enter Tropical Diver).

Which fish in this exhibit swim in large schools? Pigmy sweepers, anthias fish

Why do you think the garden eels all face the same direction? They face the current which brings them food

OBSERVE the jellies. In recent years, populations of jellies around the world have been growing rapidly due to a decrease in predator numbers as well as an increase in water temperatures. How might the growth of jellies affect an ecosystem?

An overabundance of jellies in an area can cause a sharp decline in other plankton including larva or spawn, therefore decreasing future population numbers. The mass of jellies can also hinder movement of species through a certain area.

DID YOU KNOW jelly tentacles have *nematocysts*, toxic stinging cells used to catch prey? The toxins are species-specific (they only affect certain animals) and do not harm members of their own species. If you see two sea nettles weaving together, they're not hurting each other. A sea nettle, however, is quite capable of catching and eating a moon jelly!

CONTINUE to the **coral reef** window. One of the most interesting animals that lives in the coral reef is the **coral polyp**. There can be thousands of polyps living on each piece of coral. Corals get most of their food from *zooxanthellae*, a type of algae that live inside them. Zooxanthellae use energy from the sun to create food for the coral using *photosynthesis* (same process used by plants).

Coral reefs are beautiful but fragile ecosystems and can be harmed by human activities.

How are we connected to all of the world's coral reefs? *All of the world's water is connected through watersheds - water near our homes drains into lower lying water and eventually makes its way to the ocean.*

What can you do to help protect coral reefs? *Answers will vary - don't litter, don't use a lot of fertilizers on the lawn (this eventually makes its way to the oceans through our watersheds), don't introduce a new species of fish into a habitat where it is not naturally found, educate others, etc.*

DID YOU KNOW that less than 1% of the ocean floor (approximately the size of Texas) is occupied by coral reefs, yet these reefs serve as home to as many as one quarter of the world marine species!

Just like a real coral reef, this exhibit has a high level of biodiversity, meaning that it contains many different species. Use the following dichotomous key to identify some of these species.

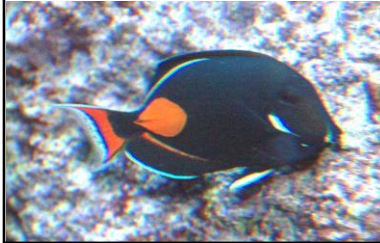
CORAL REEF FISH DICHOTOMOUS KEY

Select and locate three fish listed below in the reef wall exhibit. Observe each fish for a few minutes. Use the key on the next page step-by-step to determine which species of fish you are observing. Be sure to note the common and scientific names. Check your answers on the touch screens in the back of the room.

Orangeband surgeonfish
Acanthurus olivaceus



Achilles tang
Acanthurus Achilles



Bird wrasse
Gomphosus varius



Male squarespot anthias
Pseudanthias pleurotaenia



Hawaiian cleaner wrasse
Labroides phphthiophagus



Female squarespot anthias
Pseudoanthias pleurotaenia



Yellow tang
Zebrasoma flavescens



Sailfin tang
Zebrasoma veliferum



Yellowtail coris
Coris gaimard



Palette surgeonfish
Paracanthurus hepatus



Painted anthias
Pseudoanthias pictilis



Classification of the Coral Reef (Pre-visit Activity)

Grade: 6th – 8th

Objective: Students will become familiar with some animals that are found in the coral reef ecosystem and learn how scientists classify them.

Duration: 50 minutes

Vocabulary: Classification, family, phylum, mollusk, echinoderm, cnidarian, arthropod

Materials:

- One copy of 12 animal descriptions per group of students
- One copy of 12 animal pictures per group of students
- Copies of 2 student worksheets for each student
- 24 large index cards (per group)

Background:

Scientists use a classification system to organize living things into groups and help them understand how certain animals are related to one another. All animals are classified into the kingdom Animalia. Animals that share the same basic characteristics are classified in the same phylum. Other classification levels are (in order of most general to most specific): class, order, family, genus, and species. Important coral reef phyla in the animal kingdom include the mollusks, echinoderms, arthropods and cnidarians. All of these phyla include animals that are commonly found living in the coral reef ecosystem.

The name “mollusk” comes from the Latin word meaning “soft.” All mollusks have soft bodies, which may or may not be covered by a shell. Mollusks have highly variable body plans. Some move across the floor of the ocean by sliding with a single foot. Others have highly developed brains and eyes similar to our own, and swim with the help of tentacles. Mollusks include snails, slugs, squid, octopuses, nudibranchs, clams and oysters.

Echinoderms have a hard skeleton that gives the body a spiny appearance. Their appropriate Latin name means “spiny-skinned.” Most of the animals have bodies arranged in five parts of equal size. Most have hundreds of tube feet that are used for locomotion. The tube feet are similar to suction cups and move the animal across the bottom of the ocean or help them to capture food. Echinoderms include sea stars, sea cucumbers, sand dollars and sea urchins.

The arthropods are the largest and most diverse group of animals. The Latin word “arthropod” means “jointed leg.” All arthropods have many jointed legs and bodies with distinct, segmented skeletons. Another feature of the arthropods is their exoskeleton, which is a hard outer skeleton. They may also have antennae. Arthropods include insects, crabs, spiders, lobsters, shrimp and barnacles.

The Latin name Cnidaria means “nettle-like.” Cnidarians may live attached to the ocean floor in large groups (as a polyp), or may be free-swimming (as a medusa). Cnidarians have no skeleton inside their body and therefore have very soft, jelly-like bodies. All cnidarians have tentacles containing nematocysts, or stinging cells. The stinging tentacles are used both to capture food and in defense. Cnidarians include corals, sea anemones, zooanthids and jellies.

Procedure:

1. Make copies of animal descriptions and pictures (1 per group). Students may work in groups of four to five students. Cut out the 12 animal descriptions and paste them onto index cards. Cut out the 12 animal pictures and paste them onto another set of index cards.
2. Prepare copies of the two student worksheets, to be handed out to the students during the second part of the activity.
3. Discuss how scientists use classification to group animals according to their common characteristics. Tell the students they will be classifying 12 animals by putting them in groups according to their physical characteristics and common traits.
4. Hand out a set of descriptions and picture cards to each group. Have students work in groups to identify the 12 animals according to the descriptions. The students should match each description with its appropriate animal.
5. Have students classify the 12 animals using their own methods by putting the animals into groups according to the characteristics that the students can see. Allow students to use their own observational skills. They may choose to classify the animals by shape, presence of tentacles, presence of eyes, etc.
6. Hand out the two student worksheets, and introduce the scientific classification system. Discuss the characteristics of the following four scientific groups (phyla) of animals: **cnidarians**, **arthropods**, **mollusks** and **echinoderms**. Have the students re-classify the animals according to these groups that scientists use. Point out to the students that they will need to understand the characteristics of each group and then be able to identify these characteristics in the individual animals.
7. Go over the results with the class.

Answer Key:

Groups	Which animals belong to this group?
Mollusks	Pink conch, octopus, clam
Echinoderms	Sea star, sea cucumber, sea urchin
Arthropods	Lobster, crab, krill,
Cnidarians	Coral, sea anemone, jelly

Assessment:

- Check that each group of students has correctly classified 90% of the animals in the table.
- Have students compare their own classification system with the system used by scientists. Were there many differences between the system they used and the system used by scientists?

- Have students classify the following animals into the same four groups: snail, sand dollar, shrimp, insect, and squid.

Resources:

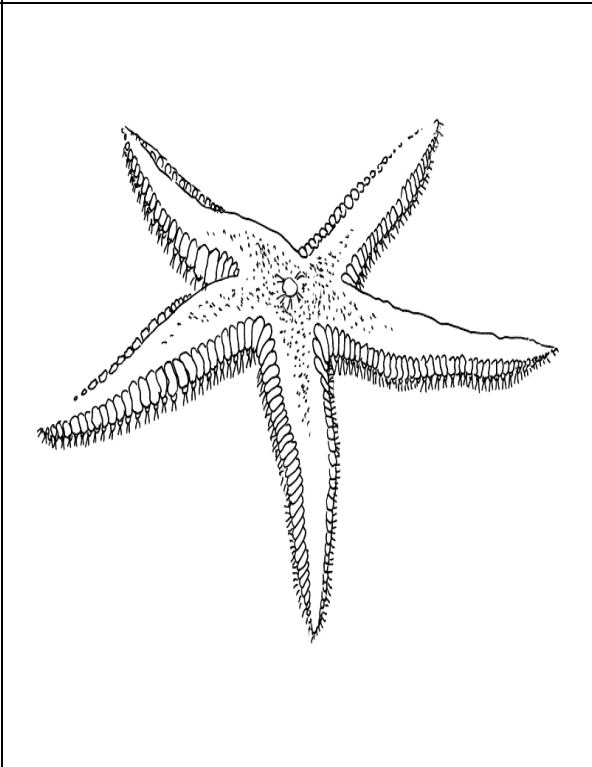
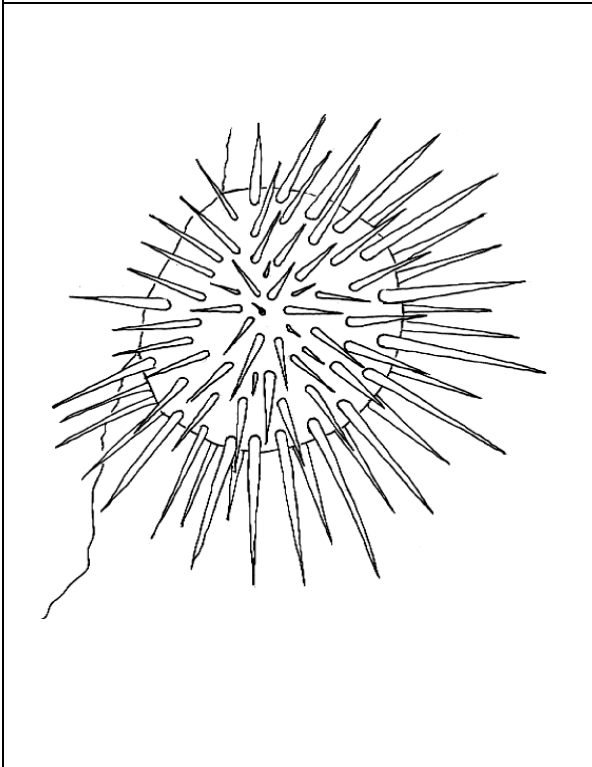
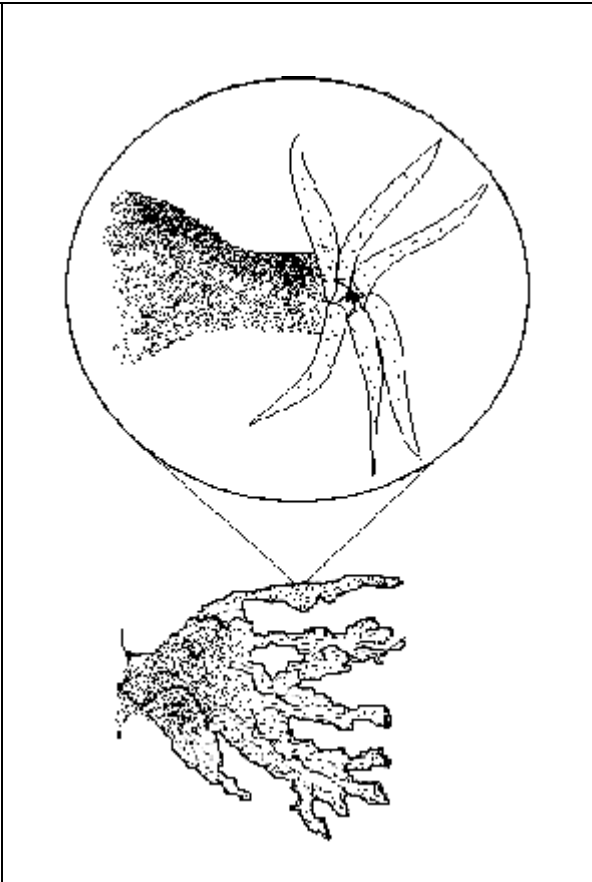
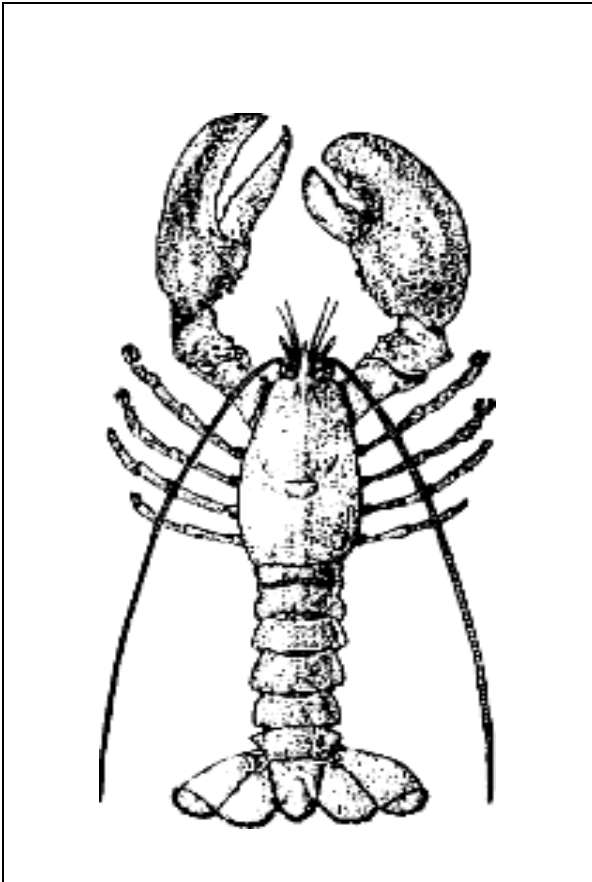
Alevizon, William S. 1994. *Pisces Guide to Caribbean Reef Ecology*. Houston, Texas: Gulf Publishing Company.

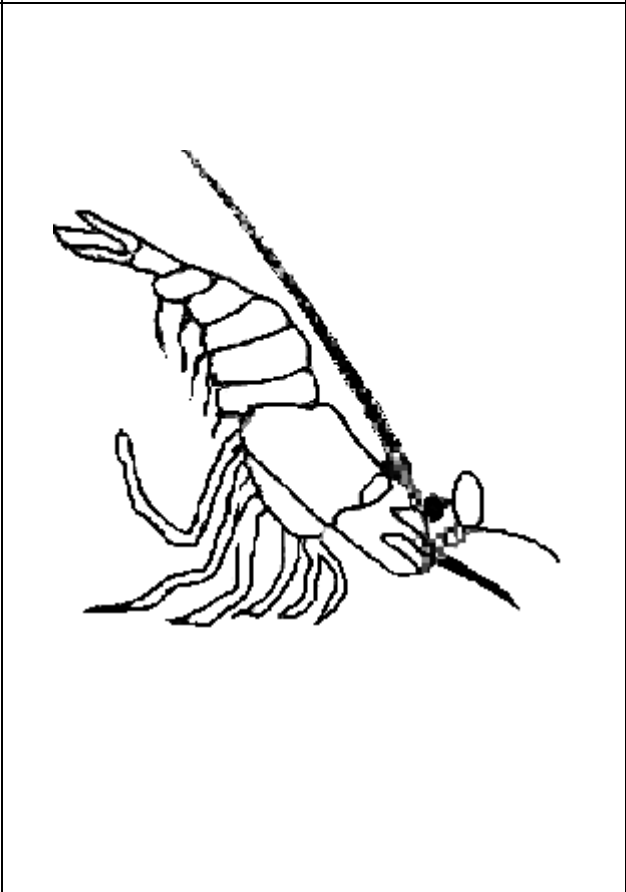
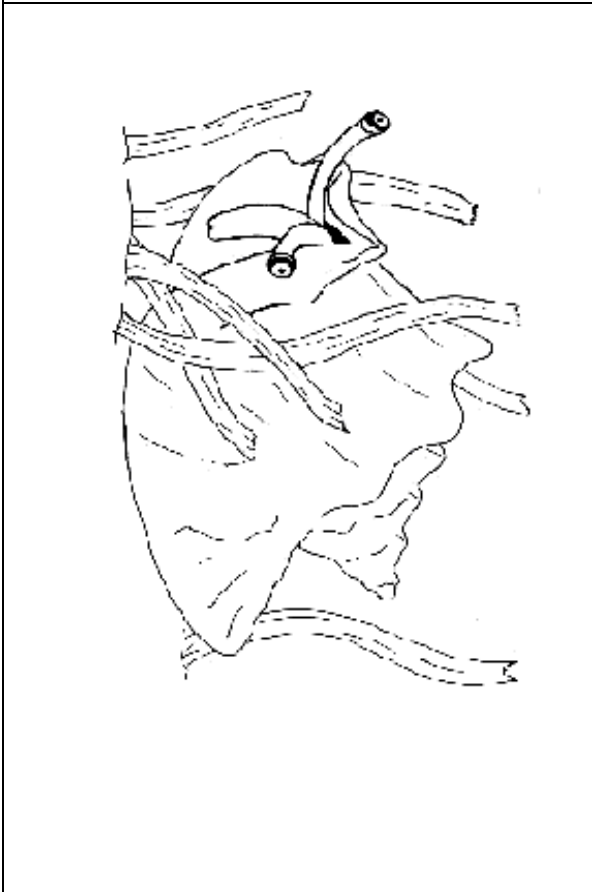
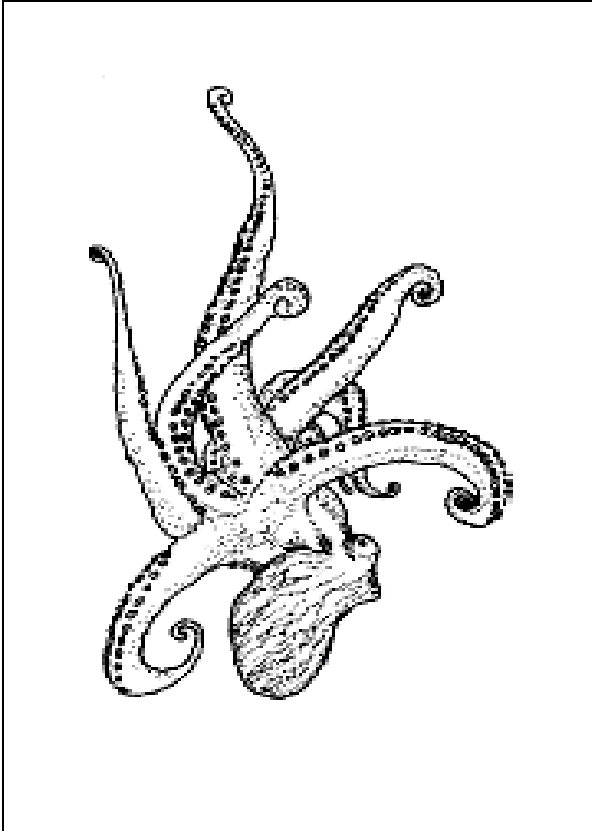
* Drawings from MacGillivray Freeman's Coral Reef Adventure Guide Educational Activities & Resources (<http://www.coralfilm.com/edu.html>).

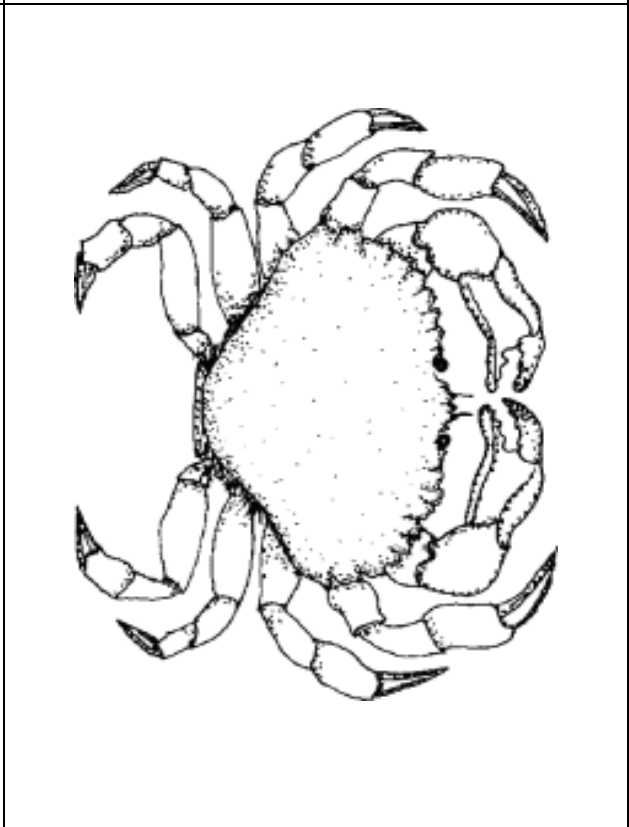
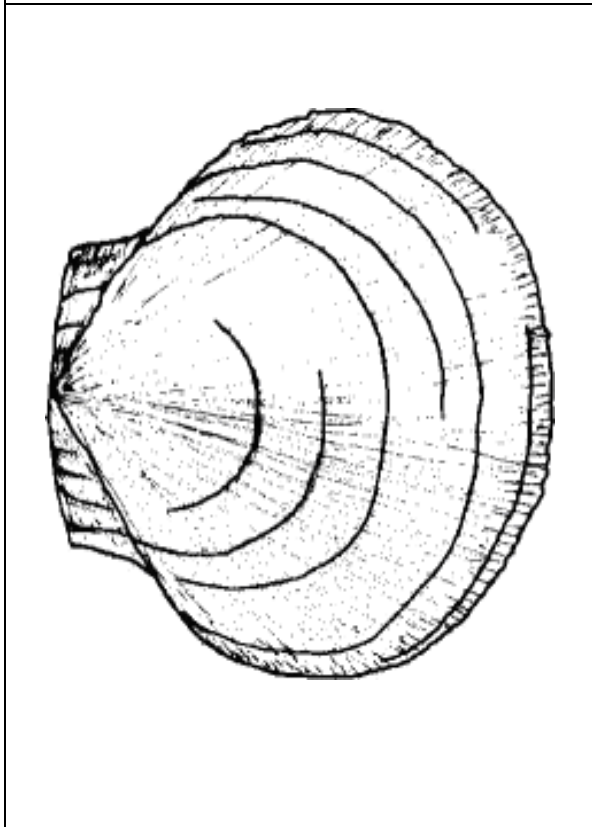
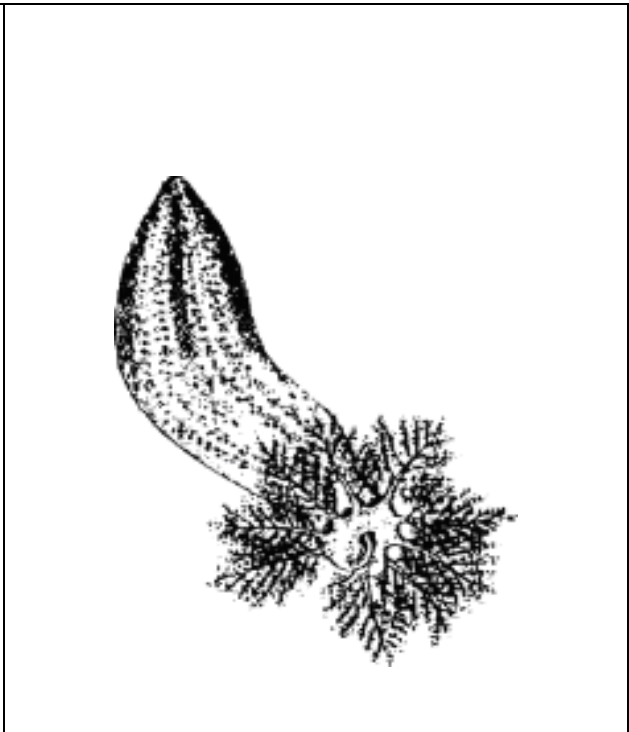
** Drawing by Fisheries and Oceans Canada, "To the Horizon - The Nearshore" (<http://www.glf.dfo-mpo.gc.ca/sci-sci/bysea-enmer/nearshore-littoral-e.html>), Reproduced with the permission of Her Majesty the Queen in Right of Canada, 2005.

<p>A sea star is an animal with five arms. It can be found on the ocean floor where it moves very slowly in search of food. Most sea stars are carnivorous and eat other animals such as clams, oysters, or corals. When the sea star eats, it pushes its stomach out of its mouth, and digests its prey on the outside of its body. The sea star moves and clings to its prey with hundreds of tube feet, which provide suction for the sea star to grip.</p>	<p>A crab is a round-bodied animal with a hard skeleton on the outside of its body. It has well-developed claws that can be used for protection and feeding. It also has four pairs of legs which are used for movement. There are many species of crabs, and they have varied diets; some eat plants, some eat animals, and some eat both plants and animals. Some crabs live in water and others live on land.</p>
<p>The sea cucumber is a long, cylinder-shaped animal that lives in the sand on the sea floor. It eats by taking in the sand, filtering out small plants and animals and then forcing out the sand. The animal uses tube feet for locomotion and the head is sometimes surrounded by tentacles. The body has 5 parts, but the animal has no arms. The largest sea cucumber can reach a length of 6 feet. Predators include sea turtles, some fish, and humans. Some sea cucumbers can give off a toxin that can deter predators.</p>	<p>A coral is a tiny animal that usually lives in a large group or colony. A single animal is called a coral polyp, and each polyp has 6 tentacles surrounding its mouth. The tentacles contain nematocysts, or stinging cells, which help the animal catch its food. The coral polyps have soft bodies, but each polyp makes a shell outside its body made of limestone. This shell formed by many polyps in a community together forms a coral reef. The coral reef is an important part of the ocean ecosystem because it is home to many other animals.</p>
<p>An anemone looks like a flower but it is actually an animal. It lives at the bottom of the ocean and has many tentacles to help it to trap food. The tentacles have stinging cells called nematocysts that are used to catch and paralyze its prey. These tentacles surround the animal's mouth, which is connected to its stomach. The anemone has no skeleton and has a soft, jelly-like body.</p>	<p>A conch is an animal that lives inside a beautiful, large shell that has been collected by people and used for decoration. Inside the shell is the animal's soft body, and it uses a single foot to move across the sea floor. The conch lives in beds of sea grasses or in the sand on the ocean floor. They have two eye spots that are located on the end of a pair of tentacles.</p>

<p>As its name suggests, the jelly has a soft, jelly-like body. It swims in the water using a pulsing motion and has a mouth surrounded by many stinging tentacles. The tentacles, which contain stinging cells called nematocysts, are used to trap and eat their prey. Some species of jelly have enough venom to severely injure a human. The largest jelly can have a body of up to 3 feet in diameter! The jelly is eaten by some species of fish and is a favorite food item of sea turtles.</p>	<p>The octopus has a soft body and has 8 arms. There are many species of octopus, and the biggest can grow up to 23 feet from the arm tip to arm tip. Octopuses have good eyesight and will hunt many food items including crabs, snails and fish. When threatened, an octopus can squirt dark ink into the water, allowing it to escape. In addition, the octopus can change its skin color to blend into its background, using camouflage to hide from its predators.</p>
<p>Krill are small, shrimp-like animals that live in the ocean in large groups. They have a hard exoskeleton and segmented bodies with 5 pairs of jointed legs used for swimming. Krill eat phytoplankton, tiny, one-celled plants that float in the ocean. Many predators, such as fish, birds and whales depend on them for food, so they are very important in marine food chains.</p>	<p>Clams are animals that burrow into the sea floor. They eat by drawing water into a siphon, and pulling small microscopic pieces of food out of the water. They have soft bodies which are protected by two shells. Muscles called abductors are used to hold the two shells together and are used to open and close the shells. The animal uses a foot to bury itself in the sand and for movement. Predators of clams include eels, sea stars, and humans.</p>
<p>A lobster has a hard, segmented skeleton on the outside of its body. Some species of lobster have pincers which are used for protection. All lobsters have antennae and 5 pairs of jointed legs (including pincers). Lobsters are active at night and hide during the day. They are eaten by many animals, including fish, octopuses, other lobsters, and humans.</p>	<p>A sea urchin is a round animal with many spines. The spines are attached to its outer skeleton. Its mouth is located on the bottom of the body, and it possesses a set of five teeth which it uses to eat by scraping algae off of rocks. The sea urchin moves very slowly with the use of tube feet, which act like suction cups to grip the rocks.</p>







CLASSIFICATION—GROUPING ANIMALS

Student Worksheet

Scientists use a **classification** system, which helps them understand how certain animals are related to one another. For example, two animals that are very closely related might be classified in the same **family**. A group of animals that shares the same basic characteristics are classified in the same **phylum**. See if you can classify the above 12 animals into the following four phyla (groups) of animals:

Mollusks

The name “mollusk” comes from the Latin word meaning “soft.” All mollusks have soft bodies, which may or may not be covered by a shell. Mollusks have highly variable body plans. Some move across the floor of the ocean by sliding with a single foot. Others have highly developed brains and eyes similar to our own, and swim with the help of tentacles.

Echinoderms

Echinoderms have a hard internal skeleton that give the body a spiny appearance. Most of the animals have bodies arranged in five parts of equal size. Most have hundreds of tube feet that are used for locomotion. The tube feet are similar to suction cups and move the animal across the bottom of the ocean or help them to capture food.

Arthropods

The arthropods are the largest and most diverse group of animals. The word “arthropod” means “jointed leg.” All arthropods have many jointed legs and bodies with distinct, different skeletons. Another feature of the arthropods is their exoskeleton, which is a hard outer skeleton. They may also have antennae.

Cnidarians

Cnidarians may live attached to the ocean floor in large groups, or may be free-swimming. Cnidarians have no skeleton inside their body and therefore have very soft, jelly-like bodies. All cnidarians have tentacles containing nematocysts, or stinging cells. The stinging tentacles are used both to capture food and in defense.

CLASSIFICATION OF ANIMALS

Student Worksheet

Classify the 12 animals into the following four phyla (groups) according to the scientific classification system. List the defining characteristics of each animal phylum and compare them to the characteristics of each of the animals that were identified. Then, sort each of the 12 animals into the appropriate phylum.

Animal Phylum	Main Characteristics of this phylum	Which animals belong to this phylum?
Mollusks		
Echinoderms		
Arthropods		
Cnidarians		

Exploring Your Watershed (Post-visit Activity)

Adapted from: U.S. Environmental Protection Agency's Middle School Activities

Grade: 6th-8th

Objective: Students will study rivers and waterways around them by using the Internet, maps, and their knowledge of local landscapes. Students will be introduced to the concept of watersheds and use an Environmental Protection Agency website to investigate the properties of the watershed in which they live.

Duration: 45-minute sessions

Vocabulary: watershed, headwaters, pollutants, upstream, downstream, delta

Materials: Copies of the Watershed Worksheet for each student

Internet access

Physical or topographical state map and/or county maps

Computers (1 per 2-3 students)

Background:

Did you know that we all live in a watershed? No matter where you live in the United States, you are in a watershed. There are over 2,260 watersheds in the continental United States alone. That's a lot of water to go around! A **watershed** is an area of land where all the water flows or drains into the same place and all living things within that area are linked by a common water source. The area of the river or stream where it originates is called the source or **headwaters**. Rainwater and water from springs drains down slopes of land from the highest to the lowest point where they converge into streams and rivers. As water continues to flow downstream, bodies of water progressively grow larger until that it eventually ends up in the ocean. A **delta** can be any body of water (lake, river, ocean) where a river empties. If you were to trace a drop of water from the highest point of one of Georgia's watersheds, the Chattahoochee Watershed, it will travel through several more watersheds before it makes it way to the Gulf of Mexico! The importance of being able to trace water from its original source is that pollution can be introduced at any point along the path and impact ecosystems and people **downstream**.

You, your family, and pets have an important impact on your local watershed. The practices you use (whether positive or negative) will not only have an impact on your property, but have an impact on your neighbors and the communities located **downstream**. Anything from fertilizers, oil, pesticides, pet wastes, to eroded soil, water can pick up pollutants as it flows. We are ultimately responsible for the health of our watersheds. Good stewardship of these watersheds relies on each individual to do his or her part to ensure their health. Whatever ends up in our streams, creeks, ponds, and lakes eventually makes its way to our rivers and ultimately to our one world ocean.

Procedure:

1. Introduce the concept of a watershed to the students. - A watershed is like a funnel, small streams and rivers converge on the same larger body of water. *Compare it to a shower or a sink, the water hits the walls and flows to the drain.* Ask the students why rivers, lakes and oceans are important to humans? *Source of water and food, recreation, irrigation, transportation.* What could happen to a hillside during a hard rainfall? *Erosion and runoff* How does this relate to watersheds? *Run off and erosion carries pollution into streams and rivers.*

2. Direct students to Environmental Protection Agency's "Surf Your Watershed" website: <http://cfpub.epa.gov/surf/locate/index.cfm>.
3. Students will be completing the "Exploring Your Watershed" worksheet as they explore the site. Have students explore the EPA's "Surf Your Watershed" homepage to determine which watershed they live in.
 - i. Step one (from the website): select your geographic unit as Zip Code (five digit number)
 - ii. Step two: Enter your geographic information (Zip Code) and click submit.
 - iii. Remind students to find their watershed on the paper map and see if it follows county or state lines.
4. Next have the students explore **their** watershed on the results page and find the answers to the questions on the "Exploring Your Watershed" worksheet.
5. Other watersheds **upstream** and **downstream** can be found at the bottom of their watershed page.
6. Based on the information gathered from question 4 (on the "Exploring Your Watershed" worksheet), have students work in groups to brainstorm ideas on how they can protect their own watershed. Students should then present their ideas to the class.

Discussion:

- How does water journey from upstream to locations downstream? *Water flows downstream. If water a water droplet falls in the mountains, it will eventually flow to the ocean. Why does this matter? Pollutants can collect as water flows and carry them downstream*
- If water does not make it to the ocean, where does it go? *Evaporation, absorption and drinking are other ways water can be taken up in a system.*

Assessment:

- Did the students find the name of their watershed?
 - Does your watershed differ from other students?
 - Does your watershed differ from the school's watershed?
- Was each group of students able to brainstorm at least three actions they could take to protect their own local watershed? *Examples: Consider washing your car at a carwash that recycles their water. If washing your car at home, use environmentally safe cleaners. Look for ways to conserve water. Pick up after your pet. Reduce your electricity use. Recycle and use proper trash receptacles.*

Resources:

U. S. Environmental Protection Agency, Wetlands, Oceans and Watersheds;
December 3, 2005: <http://www.epa.gov/owow/>

U.S. Geological Survey, Follow a Drop Through the Water Cycle; August 2010:
<http://ga.water.usgs.gov/edu/followadrop.html>

U.S. Environmental Protection Agency, Exploring Where You Live in your Watershed (worksheet);
September 2010 http://www.epa.gov/owow/NPS/nps_edu/whatx1.html

Name: _____

Exploring Your Watershed

(Adapted from http://www.epa.gov/owow/NPS/nps_edu/whatx1.html)

Looking at the Map

Under the "*Locate by Geographic Unit*" heading on the web site, use the space provided to enter your ZIP code and then click on "Submit." If more than one watershed listed, then click any of the 8-digit numbers for the watershed where you live.

1. What is the name of your watershed?
2. Compare the outline of the watershed to the map of your city or county. Does it follow the same boundaries? If not, why? (remember to use the paper map)

What's Upstream?

Determine whether you live at the **headwaters** of a watershed or whether other watersheds are present **upstream** of your watershed. To do this, scroll down to near the bottom of the Web page. Look in the left column for "*Other Watersheds Upstream.*" Click on the name listed below this title. (If you see more than one name, just pick one of them.)

3. What is the name of the watershed upstream from yours?
4. What would it mean if the word "none" was listed under the "Other Watersheds Upstream" title?
5. How many watersheds are upstream from you? (You can find this answer by counting the number of times you must click on an upstream watershed before you get to a watershed that has no watersheds upstream from it.)

What's Downstream?

Now look the other way and find out where your water goes after it flows past your house. To do this, start at the Web site for **your** watershed listed in question 1. Find the "Other Watersheds Downstream" title and click on the name of the watershed listed there.

6. How many watersheds are between you and the ocean? (Again, count the number of Web sites you need to visit between yours and when there are no more, to choose from.)
7. What would it mean if the word "none" was listed under the "Other Watersheds Downstream" title?

Watersheds in Your Neighborhood

8. Do you cross any bridges on your way to school? Where?
9. What roads do you take every day that run along a river or creek?
10. What watershed is your school in?

Brainstorm with a group **three** ways to protect your watershed.

Hint: explore the "citizen-based groups at work in your watershed" link