GEORGIA AQUARIUM

Georgia Aquarium

Teacher's Guide

Grades 3-5

Content created by TurnKey Education, Inc. for Georgia Aquarium
TurnKey Education, Inc.: www.turnkeyeducation.net

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Welcome to Georgia Aquarium!

What to Expect on Your Field Trip

Georgia Aquarium is a must-see field trip destination for students (and teachers!) of all ages. On your class trip, you will experience one of the largest, indoor, aquatic habitats and one of the most abundant collections of marine life in the world.

Georgia Aquarium is dedicated to global leadership in the research and conservation of aquatic animals. Since its founding, Georgia Aquarium has been committed to educating and inspiring current and future generations through the respectful display of marine mammals, fish, invertebrates and many other aquatic species. Aquarium staff, volunteers and partners positively impact the future of our planet by instilling in your students an appreciation for these extraordinary animals and empowering them to become advocates on their behalf.

The seven distinct galleries and more than 100 exhibits within Georgia Aquarium represent aquatic environments ranging from arctic to tropical waters. Your students will discover a diverse assortment of animals sure to amaze, inspire and engage them like never before.

Ocean Voyager Built by The Home Depot is the largest exhibit at Georgia Aquarium and represents our "one world ocean." The habitat holds 6.3 million gallons of water and features whale sharks, which are the largest fish in the world, and the only manta rays in a U.S. aquarium. This is also where you can spot Tank, the 450-pound sea turtle!

In **Cold Water Quest,** you will see animals from arctic regions and temperate seas, including beluga whales, southern sea otters and African penguins. If you are lucky, you may see a penguin waddling by during your visit. Trainers lead several African penguins on a daily **Waddle Walk** across the main Atrium.

Students can learn firsthand about the plight of this endangered species and the Aquarium's preservation efforts.

Tropical Diver is the colorful home to more than 300 species of fish and other aquatic animals representing Indo-Pacific reef ecosystems. With 164,000 gallons of water, the Pacific Barrier Reef habitat is one of the largest living reef exhibits in the United States. Look closely. Approximately 25% of the reef wall is live coral.

Southern Company River Scout is an immersive experience showcasing the diversity of freshwater species around the world. In this gallery, students walk amidst the waters of an overhead river to discover the incredible variety of animals found in the lakes and rivers of Africa, South America, Asia and right here in Georgia. Watch out for the piranha!

SunTrust Pier 225 is home to the charismatic California sea lion. These playful pinnipeds (the name for marine mammals that have front and rear flippers) and their dedicated trainers give students the chance to see training activities firsthand while they learn about sea lion conservation and what they can do to help.

Upstairs in **Aquanaut Adventure: A Discovery Zone** your students will navigate through a series of activities and challenges. Along the way, they will learn about aquatic animals and ecosystems to become a certified Georgia Aquarium Aquanaut!

AT&T Dolphin Tales features an educational presentation that shows your class how the incredible dolphins at Georgia Aquarium are trained and cared for and how to protect dolphins in their natural habitat. In addition, the newly renovated **4D Funbelievable Theater** employs interactive seats and special effects

built into the theater itself. There is a rotating series of 20-minute films based on animated theatrical releases. Your field trip tickets include the theater and all animal galleries and presentations. Please know that presentations are subject to availability and are on a first come, first served basis.

Georgia Aquarium offers your students a unique opportunity to see STEAM (science, technology, engineering, the arts and math) learning at work, both above the ground and under the water. You will find that you can use the topic of aquatic life, along with the enriching experiences at the Aquarium itself, to connect the educational themes of these galleries to your national and local STEAM curricula and content requirements.

Using this Teacher's Guide

As a companion to your experience at Georgia Aquarium, this Teacher's Guide has been created to complement your classroom instruction and make the most of your school field trip. It contains original, assessable, STEAM-related classroom lesson plans for you to use and share.

The Elementary School Teacher's Guide includes dynamic activities and assignments for students in grades three through five. There are also Teacher's Guides for Middle School and High School. Each Guide is designed to be flexible and used to best meet the needs and capabilities of your class. You know your students better than anyone else!

Following this **Introduction**, you will find **"STEAM Stream,"** a section consisting of five interdisciplinary Classroom Lesson Plans, each featuring a gallery you will visit on your field trip to the Aquarium. The lesson plans begin with instruction pages and answer keys for teachers. These include a list of the appropriate content areas and skills addressed by the activities in the lesson. Rounding out the lessons are ready-to-copy Student Activity worksheets that center on key STEAM topics featured on your tour.

The first lesson plan is "**Cold Water Quest: An Underwater Forest**." Students will complete four activities to learn what science, engineering, history and art have to do with understanding the importance of giant kelp.

"**River Scout: Fish Families and Folklore,**" the second lesson plan, invites students to compare and contrast three species of catfish based on appearance and habitat. Students combine science, literature and art to create illustrations for one of two traditional folktales featuring catfish.

In the next lesson, "**Pier 225: Survive and Thrive,**" students compare the maximum speed of a sea lion with the speeds of several other non-fish residents at the Aquarium. Next, they will investigate possible connections between El Niño and the unusual mortality events, or UMEs, threatening marine life off the coast of California.

"Tropical Diver: Coral in the Classroom" asks students to solve math problems about the Pacific Barrier Reef habitat and then create colorful sculptures that replicate coral reefs.

The fifth lesson plan is **"Ocean Voyager: Sizing Up Sharks."** Whale sharks take center stage in this lesson plan that begins with a historic description of the species. Students will design a life-sized, two-dimensional outline of a whale shark for the classroom and compare these gentle giants to other sharks at the Aquarium.

Next, in **"Make a Splash,"** games and puzzles relate to themes you encounter on your visit to Georgia Aquarium. One is a word search and the other is a word scramble. These are excellent activities for your bus ride to and from the Aquarium or to assign for extra credit as you see fit. Under **"Beneath the Waves,"** the next section in this Teacher's Guide, you will find facts and figures, a list of Aquarium awareness days and a timeline of Aquarium history.

We know how important it is to justify field trips and document how instructional time is spent outside of your classroom. To that end, this Teacher's Guide is directly correlated to the Common Core State Standards for Mathematics and English Language Arts, the Next Generation Science Standards, the C3 Framework for Social Studies State Standards and the National Core Arts Standards. These correlations are organized by content and grade level. You can readily see how they fit into your required curriculum, making it easy to connect a field trip to Georgia Aquarium with your classroom

instruction. Following the national curricula, you will find the Georgia Performance Standards and Standards of Excellence. In addition, specific requirements are provided for Alabama, Florida, North Carolina, South Carolina and Tennessee.

This Teacher's Guide features a curriculum designed to offer a memorable learning classroom experience that is interdisciplinary and applicable across several grade levels. You can use this Guide before and after your visit to Georgia Aquarium, year after year. It will help prepare students for the teachable moments found throughout Georgia Aquarium. When you get back to school, refer to the Guide as you continue to explore connections between the themes of the field trip and your classroom STEAM instruction.

Ready to get started? Let's blow the trainer's whistle and dive right in!

Lesson Plan 1
Cold Water Quest: An Underwater Forest

Teacher Instructions

Giant kelp might look like plants your students see on land, but it is actually a kind of algae—a very large brown alga, *Macrocystis pyrifera*. It is one of the fastest growing organisms on Earth. In fact, it can grow up to one foot in a day. Imagine if the kelp habitat at Georgia Aquarium had live, growing kelp. It wouldn't take long for the kelp to be taller than the building!

Instead, the kelp at the Aquarium is made of plastic. The base is thick and flat, so it can be buried in the bottom of the habitat. If there is a lot of movement in the water, a flat sheet of plastic is attached to the base for extra stability. While the kelp in the **Cold Water Quest** gallery is not real, the animals living there most certainly are.

This unique underwater forest is home to purple sea urchins (*Strongylocentrotus purpuratus*). They are a food source for an animal featured in its own habitat in **Cold Water Quest**, the southern sea otter (*Enhydra lutris nereis*). This otter is considered a "keystone species," which means it plays an important role in keeping its ecosystem healthy and balanced. A kelp forest ecosystem is one of the most diverse and delicately balanced ecosystems on Earth.

Your students will complete four activities to learn what science, engineering, history and art have to do with understanding the importance of giant kelp. Depending on the grade level of your students and your class schedule, these activities can be done as a group (one per day) or in teams at stations set up around your classroom. If you are in need of a fifth station, provide an area with dictionaries for your students to define the "Terms to Know" from the introduction to the Student Activity.

Activity 1, Science: Balance an Ecosystem

Students will work in groups using multi-colored clay and toothpicks to create a model that represents the delicate balance needed in order for the kelp forest ecosystem to stay healthy. Blue clay stands for the balanced ecosystem, purple symbolizes the urchins, green corresponds to the kelp and brown represents the otters. Play-Doh® can be used in place of clay. Students will then answer questions about their observations and conclusions.

Materials

- 1 container of blue modeling clay (each group needs enough to make a ping-pong-sized ball)
- 1 container of purple modeling clay (each group needs enough to make a marble-sized ball)
- 1 container of brown modeling clay (each group needs enough to make a marble-sized ball)
- 1 container of green modeling clay (each group needs enough to make a marble-sized ball)
- Toothpicks (3 per group)

Answer Key

1. Green = kelp, brown = otter, purple = urchin
2. The "pyramid" becomes lopsided and falls over. It might be able to be stand up balanced on just the two toothpicks with the purple and green clay, but only briefly.
3. No, it falls over and cannot support the blue ball. The model is no longer balanced.
4. The otters will disappear and the urchins will destroy the kelp again, creating another urchin barren.

Activity 2, History: Read a Primary Source

Students will read a part of an interview with Dorothy Barnes, an artist and basket maker from Ohio. The interview was conducted and recorded in 2003 for the Smithsonian Institution. (*Oral history interview with Dorothy Gill Barnes, 2003 May 2-7, Archives of American Art, Smithsonian Institution.* www.aaa.si.edu/collections/interviews/oral-history-interview-dorothy-gill-barnes-12427). This excerpt describes time she spent with the Maori people in New Zealand and the ways they used giant kelp in their everyday lives, beyond weaving it into baskets. To set this activity up as a station, print the passage from the Student Activity page in large font for a poster, or project it on a screen for the students in the group to read together and answer the questions that follow.

Answer Key

1. Ball
2. They made slippers out of it.
3. Plastic bags
4. They had a ceremony to return the kelp to the sea.

Activity 3, Art: Weave a Basket

Students will weave their own baskets using strips of paper or raffia to represent kelp. Older students can cut their own strips of paper, but younger students may work best with precut materials. Display your class artwork in your room or the Media Center before or after your field trip to Georgia Aquarium.

For inspiration, show your students images of baskets woven by contemporary artists with giant kelp and bull kelp (another large, brown alga):

- www.vincentmasseypottery.com/baskets/kelp/
- www.cnch.org/cnchnet/spring-2011/kelp-basketry/
- www.pointreyesart.com/artist/Lina%20Jane%20Prairie

Materials

- Paper cup (1 per student)
- Scissors
- Long strips of construction paper or raffia in browns and greens
- Tape

Activity 4, Design Challenge: Engineer Buoyant Kelp

After reading about the major structures of giant kelp—the holdfast, stipe and blades—on the Student Activity page, your class will attempt to "reverse engineer" the pneumatocysts. Pneumatocysts are the gas-filled floats of the kelp plant that keep it upright and buoyant, allowing the blades to reach sunlight for photosynthesis. Even the artificial kelp in **Cold Water Quest** uses hollow floats to help it stay upright.

Provide each group of students with a box containing the supplies listed below for the design challenge. Students will not know which materials they have to work with until they open the box. The list is not definitive so feel free to include additional materials. Students will have one chance to test their model in a container of water and revise their design as needed before their final presentation to the class.

Students should discover that creating floats of their own, such as using the small balloons or ping-pong balls full of air, is the best method of keeping the kelp vertical. Although there is not one correct way to build a model, each design must meet the following criteria:

- The stipe must be made from the piece of rope.
- The blades have to be made from the strips of plastic bags or the plastic streamers.
- There should be at least three blades.
- The kelp model must stay anchored to the bottom of the aquarium or container.
- The stipe must be able to stay upright for one minute.

Materials to test the model:

- Aquarium or large transparent plastic bin
- Water
- Stopwatch or clock

Materials in a box for the design challenge:

- Pipe cleaners
- Rocks
- Straws
- Tape
- Glue
- Scissors
- Ping pong balls
- Golf balls
- Baggies
- Sand
- Small balloons
- Plastic streamers
- Strips cut from plastic grocery and trash bags
- Pieces of rope cut to a length that is just under the height of your water tank
- Plastic and paper cups of various sizes
- Beads of different sizes
- Rubber bands
- Paper clips
- Yarn

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Cold Water Quest: An Underwater Forest

Student Activity

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Instead, the kelp at the Aquarium is made of plastic. The base is thick and flat, so it can be buried in the bottom of the habitat. If there is a lot of movement in the water, a flat sheet of plastic is attached to the base for extra stability. While the kelp in the Aquarium's **Cold Water Quest** gallery is not real, the animals living there most certainly are.

This unique underwater forest is home to purple sea urchins (*Strongylocentrotus purpuratus*). They are a food source for an animal featured in its own habitat in **Cold Water Quest**, the southern sea otter (*Enhydra lutris nereis*). This otter is considered a "keystone species," which means it plays an important role in keeping its ecosystem healthy and balanced. A kelp forest ecosystem is one of the most diverse and delicately balanced ecosystems on Earth.

Complete the following four activities to learn what science, engineering, history and art have to do with understanding the importance of a giant kelp forest.

***Terms to Know**: algae, barren, buoyant, century, diverse, excerpt, frond, indigenous, keystone species, Maori, mimic, photosynthesis, pneumatocyst, slat*

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Activity 1, Science: Balance an Ecosystem

The southern sea otter has its own large habitat in the **Cold Water Quest** gallery. But in the wild, it is often found in kelp forests where it feasts on sea urchins. All three of these species—urchins, otters and kelp—must be in the right amount to balance this unique ocean ecosystem. Otters eat sea urchins. Sea urchins eat kelp. Kelp attracts the urchins, as well as other favorite food sources for the otters. Thousands of other species find food and shelter in the kelp forests, too.

Follow these instructions to build a model of this ecosystem and discover what happens when it becomes unbalanced.

Materials

- Blue modeling clay
- Purple modeling clay
- Brown modeling clay
- Green modeling clay
- 3 toothpicks

Steps

1. Roll the blue clay into a ball about the size of a ping-pong ball. This blue ball represents a healthy California kelp forest in the Pacific Ocean.
2. Roll the purple clay into a small ball about the size of a marble.
3. Roll the brown clay into a small ball about the size of a marble.
4. Roll the green clay into a small ball about the size of a marble.
5. Connect each of the smaller balls of modeling clay to the larger one with the three toothpicks. Form a pyramid, or tripod, that balances the blue ball on top with the three smaller balls on your table or desk.

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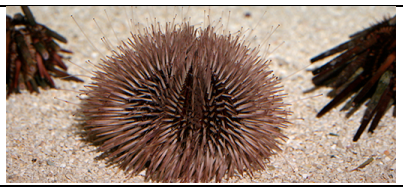		
Sea urchin	**Sea otter**	**Giant kelp**

1. Each of the three smaller balls (purple, brown and green) stands for a part of the California kelp forest ecosystem model. Look at the pictures of the urchin, otter and kelp to match each one to the colored clay representing it.

Green: _____ Brown: _____ Purple: _____

2. In the last century, otters in the kelp forests off the coast of California were almost hunted to extinction for their fur. Remove the brown ball and its toothpick from your habitat model and describe what happens. Will it still stand up? Is the blue ball still supported?

_____

_____

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3. Without the otters to eat the sea urchins, there was nothing to stop the urchins from eating the kelp. When urchins ate through the kelp until there was nothing left, it caused what is called an “urchin barren.” Everything else in the kelp forest also lost their home, food and protection. Now remove the green ball and toothpick from your model. What happens to it? Can it stand up? What has happened to your balanced model?

4. Although they cannot be hunted anymore, otters are still endangered and face many threats around the world, from oil spills to parasites to diseases caused by pollution. Based on what you learned from your model, what could happen to the kelp forest ecosystem if humans don’t find ways to protect the otters?

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Activity 2, History: Read a Primary Source

Dorothy Gill Barnes is an artist and basket maker who lives in Ohio. She traveled the world to learn and teach about basketry. In this interview for the Smithsonian Institution (the world's largest museum and research complex), she describes time she spent in New Zealand with the native Maori people. She learned how they used giant kelp in their everyday lives, beyond weaving it into baskets. Read the excerpt below from Dorothy Gill Barnes and answer the questions that follow.

> *We made balls that could be bounced. And we made slippers that the Maori used to make by drawing around your foot on giant kelp, opening it, and putting your foot in it so that you could walk on the beach without your feet getting too hot. So it was a mix of wonderful tradition and ethnic stories about their past and how they carried these kelp things between canoes with blankets in them to keep them [the blankets] dry; they used them like plastic bags: this big piece of kelp.*
>
> *So all that was fun, but the thing that was most wonderful at the end was the incredible respect the Maori had for the material. When we finished with it … we had a very quiet, respectful, little ceremony at the edge of the water, and we put the kelp back into the sea. We did not throw it in the garbage. We put it back where we had taken it, and with the kind of respect that I think is beautiful.*

1. What kind of toy could they make with the kelp? _____

2. How did the Maori use kelp to protect their feet?

_____

3. To what does she compare the piece of kelp used to keep blankets dry in canoes?

_____

4. How did the Maori show respect for their environment and natural resources?

_____

_____

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Activity 3, Art: Weave a Basket

Indigenous peoples have used giant kelp as a natural resource for centuries. It is perfect for weaving baskets because it is long, strong and flexible. Today, when kelp is used to weave baskets, it is respected as a form of art. Follow the steps below to weave your own basket, similar to those still made from kelp today. Display your class artwork in your class room or in the Media Center before or after your field trip to Georgia Aquarium.

Materials

- Paper cup
- Scissors
- Long strips of construction paper or raffia in browns and greens
- Tape

Steps

1. Make vertical (up-and-down) cuts all the way around the paper cup. Start at the top and cut, down to the bottom but do not cut into the bottom of the cup.
2. Lay your cut cup out flat on the table. It should look like a sun with long rays.
3. Tape your first strip of paper to the bottom of the cup.
4. Begin weaving the paper strips over and under, around the vertical slats. Pull the strips tight enough that the cup, which is becoming your basket, begins to stand upright again.
5. Use the tape to attach additional paper strips as you go.
6. Continue weaving until you reach the top of the cup to form your basket.

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Activity 4, Design Challenge: Engineer Buoyant Kelp

Kelp forests are important because of their high productivity and diversity.

https://www.nps.gov/cabr/learn/nature/kelp-forest.htm

The kelp at Georgia Aquarium is made of plastic but it mimics real structures of giant kelp, including its holdfasts, stipes and blades. A **holdfast** looks like the roots of a land plant but it does not work like one. Its only job is to attach the kelp to something on the bottom of the ocean. Since photosynthesis takes place in the **blades,** or fronds, they need to reach the sunlight at the surface of the water. The "stem" or "trunk" of the kelp is the **stipe**. It is floppy and cannot stand up on its own. If the stipe does not support the kelp, then how does it stay buoyant and grow upright? Engineer your own kelp model to find out how!

Using only the items in the box provided by your teacher, create a kelp model that follows these rules:

- The stipe must be made from the piece of rope.
- The blades have to be made from the strips of plastic bags or the plastic streamers.
- There should be at least three blades.
- The kelp model must stay anchored to the bottom of the aquarium or container.
- The stipe must be able to stay upright for one minute.

You will have one chance to test your model in water and make any changes to your design before your final presentation to the class.

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1. Which materials did you use?

2. Describe changes you made to your design after you tested it in water the first time, including changes in the materials you used.

3. How long did your final design stay afloat?

4. Sketch your final design in the space below.

Lesson Plan 2
River Scout: Fish Families and Folklore

Teacher Instructions

Rivers are a source of life for animals and people all over the world. The **Southern Company River Scout** gallery at Georgia Aquarium showcases a wide variety of animals found in the rivers of four continents - Africa, South America, Asia and North America. As you explore the Overhead River habitat on your field trip, encourage your students to look up. In addition to fish from all over North America, they will see many species native to the state of Georgia. Watch for familiar varieties of bass, trout and gar!

This "fish-eye" view of a typical North American river contains about 45,000 gallons of water and is home to the three kinds of catfish you will read about in this lesson: the channel catfish, blue catfish and flathead catfish. About 3,000 known species of catfish are swimming around on Earth. There are probably even more waiting to be discovered since they live on every continent except Antarctica.

Catfish range in length from just a few inches to about nine feet long. The largest freshwater fish in the world is probably the giant catfish from the Mekong River in southeast Asia. Some catfish even live in saltwater! Most catfish are nocturnal, have barbels and live at the bottom of freshwater habitats.

In Part 1, students will use a chart with data on three common catfish from North America: channel catfish (*Ictalurus punctatus*), blue catfish (*Ictalurus furcatus*) and flathead catfish (*Pylodictis olivaris*). Questions will compare and contrast the fish based on appearance and habitat. Note that the lengths provided in the chart are maximums. The average specimen seen in its natural habitat and on your class visit to **River Scout** will be much smaller.

In Part 2, students will read two Native American folktales about a catfish and a moose, each with a very different ending. The first story has been attributed to both the Menominee peoples in the Great Lakes region and the Sioux of the Great Plains. However, it is likely that versions of this tale were told wherever catfish and moose shared territory. The second story is also from a Menominee tale, but has been retold for more than a century as a morality tale, or fable. The activity concludes with an opportunity for your students to combine science, literature and art to create illustrations or a graphic novel for one of the two folktales.

Answer Key

Part 1

1. Channel, blue
2. Answers can include any two of the following: same number of barbels, same habitats, all found in North America, all can be predators.
3. Channel
4. Channel = 4 ft 4 in, blue = 5 ft 5 in, flathead = 5 ft 1 in

5. Blue, flathead
6. Channel
7. Flathead
8. Channel, blue; because the first word in their scientific name is the same (Ictalurus)

Part 2

1. (a.) catfish and moose, (b.) pond or lake
2. Catfish in the first one; moose in the second one.
3. Moose in the first one; catfish in the second one.
4. The moose stomped on them for trying to stab him with spears.
5. Answers will vary, but should explain the last line about not judging someone by their size or about being nice to everyone no matter who you are.
6. Answers will vary depending on your location, but for any place in the southern or eastern US, they do not. These stories could be from the northeast region (long ago), upper Midwest, or northwestern US.

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River Scout: Fish Families and Folklore

Student Activity

Rivers are a source of life for animals and people all over the world. The **Southern Company River Scout** gallery at Georgia Aquarium showcases a wide variety of animals found in the rivers of four continents - Africa, South America, Asia and North America. As you explore the Overhead River habitat on your field trip, be sure to look up. In addition to fish from all over North America, you will see many species native to the state of Georgia. Watch for familiar varieties of bass, trout and gar.

This "fish-eye" view of a typical North American river contains about 45,000 gallons of water and the three kinds of catfish you will read about here: the channel catfish, blue catfish and flathead catfish. About 3,000 known species of catfish are swimming around on Earth. There are probably even more waiting to be discovered since they live on every continent except Antarctica.

Catfish range in length from just a few inches to nearly nine feet long. The largest freshwater fish in the world is probably the giant catfish from the Mekong River in southeast Asia. Some catfish are even found in saltwater! Most catfish are nocturnal, have barbels and live at the bottom of freshwater habitats. Get ready to combine science, math, literature and art to learn more about catfish families and folklore.

Terms to Know: *ancestors, antagonist, barbels, bellow, carnivore, ecosystem, maximum, native, nocturnal, omnivore, protagonist, species, traits*

Part 1: Catfish Families

Scientists divide the animal kingdom into phyla, classes, orders and families based on physical traits, like whether or not an animal has a backbone, and what their common ancestors might be. All catfish belong to one order, called "Siluriformes," which means "ray-finned fishes." This one order is further divided into about 40 different families of catfish.

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The three species of catfish swimming overhead in **River Scout** belong to the same family. Channel, blue and flathead catfishes are all "Ictalurids." Use the chart below to compare and contrast these three common North American catfishes based on how they look and how they live.

			
	Channel catfish	**Blue catfish**	**Flathead catfish**
Tail fin	forked	forked	rectangular
Barbels	8	8	8
Maximum length	52 inches (132 cm)	65 inches (165 cm)	61 inches (155 cm)
Diet	omnivore	carnivore	carnivore
Habitat	lakes, ponds, rivers, streams	lakes, ponds, rivers, streams	lakes, ponds, rivers, streams
Continent	North America; introduced in Europe and Asia	North America	North America
Role in ecosystem	predator and prey	predator and prey	predator
Scientific name	*Ictalurus punctatus*	*Ictalurus furcatus*	*Pylodictis olivaris*

1. Which two catfish have similar tail fin shapes?

   _____

2. List two traits that all three fish share.

   _____

   _____

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3. Which fish eats plants and animals?

4. Convert the maximum length for each fish to feet and inches.

5. Which two catfish are the most similar in size?

6. Although all three fish are native to North America, which one has been introduced to other parts of the world?

7. Which fish is at the top of the food chain in its ecosystem?

8. Based on their scientific names, which of the catfish would you expect to be more closely related? Why?

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Part 2: Catfish Folktales

Catfish have shared their habitats with people for as long as there have been humans on the Earth. How do we know? Catfish show up in ancient folktales told around the world. For example, one Japanese myth explains that earthquakes are caused by a giant catfish living in the mud under the islands.

Catfish also appear in Native American legends. Below, are two short stories that both feature a catfish and a moose, but each story has a very different ending. Read the tales, then compare and contrast them in the questions that follow.

Folktale: *HOW THE CATFISH GOT A FLAT HEAD*

A long time ago, when the animals could still talk, the chief of the catfish tribe announced that he was tired of only eating things in the mud at the bottom of the lake. He decided that the catfish should eat meat instead, like the wolves, and came up with a plan to kill a moose for dinner.

"Let's wait until the moose comes to the edge of the water to drink and eat the lily pads," he told his tribe. "He usually comes at sunset, so we will hide until then, and then we will spear him."

All of the catfish agreed this was a good idea, so they hid and waited among the lily pads. The moose came when the sun was at the edge of the sky. He slowly ate the grasses at the water's edge and eventually walked into the lake.

The chief of the catfish told his tribe, "He is in! But wait until the moose walks farther into the lake. I will spear him when he is in deeper water."

The catfish continued to hide and wait until the moose moved into deeper water. Suddenly, the chief of the catfish speared the moose as hard as he

could! The moose jumped up and bellowed with pain. He was scared and hurt at the same time.

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The moose yelled, “What is this? Who has speared me in my leg? I will find out who has done this!” He put his head under the water and saw all of the catfish, hiding among the grasses and lily pads, waiting to stab him with their spears. The moose realized that the catfish were planning to attack him and eat him.

Now, the moose was very angry with the catfish tribe, and he bellowed again, “Catfish has speared me in my leg! I will make war on them! I will trample this tribe into the mud! Hear me! I will go to war!" He began jumping and stomping in the water along the edge of the lake, trampling the catfish with his big hooves.

“Catfish! You have speared me in the leg and now I will trample you into the mud!” he announced. When he had stomped and flattened every catfish he could find into the muddy lake bottom, Moose felt satisfied and left the water. Slowly, the members of the catfish tribe that had survived the stomping began to wiggle out of the mud and swim away.

Today, all of the catfish have flat heads because of the war waged on their grandfathers by the moose who stomped on them long ago. The catfish also still carry their spears, which are stuck onto their heads as barbels. Now, they are so afraid of the moose that they hide during the day and only come out to eat at night.

Folktale: *THE CATFISH AND THE MOOSE*

Moose was walking along the river bank when he saw Catfish. "Why are you lying there in the water?" Moose bellowed.

"I came here because I chose to," said the little fish. "What business is it of yours? I was made to live in the water, and I have a perfect right to be here."

Name _____ Class _____ Date _____

"Well, what's the good of your getting angry?" demanded Moose. "You are so small compared to me. All I need to do is to kick you just once, and that will settle you. I have half a mind to do it, too."

So Moose rushed straight into the water to stomp on the Catfish, just because he could. As Moose raised his leg to kick Catfish, the fish rolled over on his back. He pointed his fins at Moose, yelling: "Take that!"

Moose stomped on Catfish, driving one of the stinging fins way into his foot. The pain was so great that Moose leaped clear out of the water and ran up into the woods. The sting from Catfish was like fire, and it hurt more and more. Moose lay down on the ground, rolling over and over in pain until he died.

It is wrong to despise any living thing, no matter how small and humble it appears to be.

1. (a.) Who are the main characters in both stories? (b.) What is the setting of both stories?

_____

_____

_____

2. Who is the antagonist, or “bad guy,” in each story?

_____

_____

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3. Who is the protagonist, or "good guy," in each story?

4. According to the first story, why do catfish have flattened heads and barbels?

5. In your own words, what is the moral of the second story?

6. Do the habitats of catfish and moose overlap where you live? Where might the Native Americans who told these stories long ago have lived?

Aquarium Art! Choose a graphic design challenge featuring one of the two catfish folktales.

- Create illustrations to show four important moments from *How the Catfish Got a Flat Head.*

- Recreate *The Catfish and the Moose* as a comic strip or graphic novel, complete with speech bubbles for the animals' words.

Lesson Plan 3
Pier 225: Survive and Thrive

Teacher Instructions

As part of your field trip, your students will enjoy a presentation called "Under the Boardwalk" in the **SunTrust Pier 225** gallery. There, they will meet Georgia Aquarium's California sea lions (*Zalophus californianus*). Two of them, Neptune and Jupiter, survived a recent unusual mortality event, or UME. These two animals, and thousands more, were found stranded and malnourished on the beaches of California in 2015. Despite many attempts to rehabilitate Neptune and Jupiter, they continued to wash ashore. Finally, experts at the National Oceanic and Atmospheric Administration (NOAA) decided they could not be released into the ocean again.

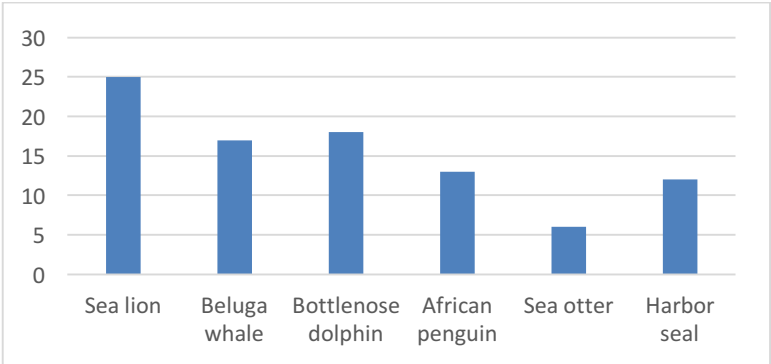
To see how these two sea lions made their journey from California to Atlanta, show your students this short video: "Caring Together for Sea Lions: Rescue and Arrival" at www.youtube.com/watch?v=29yBPKrJDTA.

Georgia Aquarium is proud to provide a caring home to these pinnipeds, the name for marine mammals that have front and rear flippers. Along with other rescued sea lions at **Pier 225**, Neptune and Jupiter interact with Aquarium trainers to educate guests about the challenges they face in their natural habitat in the Pacific Ocean.

In Part 1 of this lesson plan, students compare the maximum speed of a sea lion with the speeds of several other non-fish residents at the Aquarium. Students will also consider how physical adaptations make it easier for these mammals to thrive in the ocean. Part 2 takes a statistical and historical look at sea lion UMEs, including the one that resulted in Neptune and Jupiter coming to Georgia Aquarium. At its conclusion, students will design an investigation into the connections between El Niño and UMEs.

Answer Key

Part 1

1. 

2. Sea otter, harbor seal, African penguin, beluga whale, bottlenose dolphin, sea lion
3. 19 mph
4. Beluga whale and bottlenose dolphin, African penguin and harbor seal

5. 10-20 mph
6. sea otter
7. Answers will vary and might include flippers, fins, and webbed feet; whiskers; streamlined bodies; ability to hold their breath; or blubber
8. Penguin; it's a bird and the rest are mammals
9. Answers will vary but should describe how the "feet" of these mammals look like fins or are spread out like feathers, to help them swim
10. Answers will vary and might include size of the front and back flippers, position of the front and back flippers, or presence of "ears" on the sea lion. In the case of the particular animals at Georgia Aquarium, they are also different sizes and different colors.

Part 2

1. Both states have long coastlines
2. 6/60 = 1/10
3. 10%
4. Assess based on inclusion of the respective cause/effect elements in each phase
5. Timelines should be eight inches long, with each inch representing three years, 1991-2015
6. Timelines should have the six events indicated at the appropriate point on the line
7. (a.) 24; (b.) Answers will vary based on age. Presidential terms: George Bush, Bill Clinton, George W. Bush, Barack Obama
8. 1991
9. They are all biotoxins
10. Answers will vary based on students' opinions of how to begin the investigation. Accept any three reasonable responses as long as they include both the question and the rationale behind the question.

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SunTrust Pier 225: Survive and Thrive

Student Activity

As part of your field trip, you will enjoy a presentation called "Under the Boardwalk" in the **SunTrust Pier 225** gallery. There, you will meet Georgia Aquarium's California sea lions (*Zalophus californianus*). Two of them, Neptune and Jupiter, survived a recent unusual mortality event, or UME. These two animals, and thousands more, were found stranded and malnourished on the beaches of California in 2015. Despite many attempts to rehabilitate Neptune and Jupiter, they continued to wash ashore. Finally, the National Oceanic and Atmospheric Administration (NOAA) decided they could not be released into the ocean again.

Georgia Aquarium is proud to provide a caring home to these pinnipeds, the name for marine mammals that have front and rear flippers. Along with other rescued sea lions at **Pier 225**, Neptune and Jupiter interact with Aquarium trainers to educate guests about the challenges they face in their natural habitat in the Pacific Ocean.

Terms to Know: *adaptation, biotoxin, climatologist, coincide, ecological, infectious, malnourished, mortality, phenomenon, rehabilitate, undisputed*

Part 1: Swimming with Sea Lions

The undisputed speed racers of the seas are large fishes like sailfish, sword fish, and marlin. Although California sea lions can't keep up with those fish, they are the fastest of all the sea lions. For a short distance, they can swim up to 25 mph (miles per hour). Not bad for a mammal under water! How does their burst of speed compare to some of their non-fish neighbors at Georgia Aquarium?

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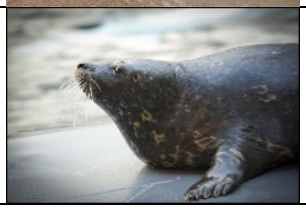
1. Create a bar graph to show the maximum swimming speeds of these six animals. Use the template on the following page to complete this activity.

Animal		Maximum Swimming Speed
	California sea lion (*Zalophus californianus*)	25 mph
	Beluga whale (*Delphinapterus leuca*)	17 mph
	Bottlenose dolphin (*Tursiops truncates*)	18 mph
	African penguin (*Spheniscus demersis*)	13 mph
	Southern sea otter (*Enhydra lutris nereis*)	6 mph
	Harbor seal (*Phoca vitulina*)	12 mph

Graph Title: _____

30						
25						
20						
15						
10						
5						
0	Sea lion	Beluga whale	Bottlenose dolphin	African penguin	Sea otter	Harbor seal

2. Write the animals listed in the order of their maximum swimming speeds, slowest to fastest.

_____

_____

3. How much faster is a sea lion, compared to a sea otter?

_____

4. Which animals on the graph have the most similar speeds?

_____

_____

_____

5. Do most of the animals on the graph swim between O and 10 mph, 10 and 20 mph, or 20 and 30 mph?

_____

6. The fastest human swimmer on record has a maximum speed of 5 mph. Which animal has a speed closest to that of the fastest human?

_____

7. Identify at least one adaptation these animals have in common that helps them swim and hunt in the water.

_____

_____

_____

8. Which one of these six animals is the most different from the others? Why?

_____

_____

9. California sea lions are pinnipeds, a group of swimming mammals that includes seals, walruses and other sea lions. The word “pinniped” means feather-footed or fin-footed. Why do you think their group has this name?

_____

_____

_____

10. Many people confuse sea lions with seals, their fellow pinnipeds. Look at the images of the California sea lion and the harbor seal again. How are they different?

Name Class Date

Part 2: Rescuing Sea Lions

In 2013, marine mammal rescue centers in California found many stranded and dead California sea lions on the beaches. There were so many sea lions that the Fisheries department of NOAA announced a UME, or unusual mortality event. A UME is declared when an unexpectedly high number of marine animals are stranded or die in a short amount of time. The 2013 UME continued through 2015, the year it affected Neptune and Jupiter.

1. Why are California and Florida most often involved in a UME? (Hint: If you are not sure, look at a map!)

_____

_____

_____

2. UMEs were first recognized in 1991. There were 60 events between 1991 and 2013. Six of the 60 UMEs involved California sea lions. Write and reduce the fraction that shows how many of the UMEs affected sea lions.

_____

3. Based on your answer for #2, calculate the percentage and complete this statement:

_____*% of the UMEs between 1991 and 2013 involved California sea lions.*

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4. A UME is often at the end of a chain reaction. Draw a series of pictures in the three squares below to illustrate these cause-and-effect events. Make each scene detailed enough that a younger student who cannot read would understand the process.

1. If ocean temperatures rise, sea lions' prey fish leave to find the colder waters they prefer.
2. When their prey fish leave, sea lions become malnourished.
3. Malnourished sea lions end up sick and stranded.

5. On separate paper, use a ruler to draw a line eight inches long. Place a small mark on the line at each inch; put marks at the very beginning and end of your line, too. Each inch on your timeline represents the passing of three years. Label each mark with a year, starting with 1991 at the beginning of the line: 1991, 1994, 1997, 2000, 2003, 2006, 2009, 2012, 2015.

Name Class Date

6. Add the six sea lion UMEs from this chart to the timeline.

Years	Causes
1991	Infectious disease
1992-1993	Ecological factor
1998	Biotoxin
2000	Biotoxin
2002	Biotoxin
2013-2015	Undetermined

7. (a.) How many years does the timeline cover? (b.) For a historical perspective, add the year of your birth and the terms of the U.S. presidents during this time to the line.

_____

8. One UME was caused by an outbreak of leptospirosis, a bacterial infection that affects the liver. Which year was this UME?

_____

9. What are the causes of the three UMEs grouped closest together on your timeline?

_____

Name Class Date

10. Design a research project! One possible reason for the UME in 1992-1993 is El Niño. El Niño is a climate phenomenon that causes water temperatures in the Pacific Ocean to be warmer than usual. Other El Niño years that coincide with sea lion UMEs include 1998, 2002 and 2015. Scientists believe that El Niño years result in high numbers of marine mammal strandings.

If you were a climatologist, marine biologist or veterinarian, how would you go about tracking down the connections, if any, between El Niño and unusual mortality events? List three questions with which you would begin your research. Explain how answering these questions will help your investigation.

Dr. Alexa McDermott (L), associate veterinarian at Georgia Aquarium, Dianne Cameron (C), marine mammal manager at Six Flags Discovery Kingdom, and Dennis Christen (R), senior director of zoological operations at Georgia Aquarium interact with the rescued sea lions as they prepare for their transport to Atlanta. (Georgia Aquarium/Tyler Andrews)

http://georgiaaquariumblog.org/georgia-aquarium-blog/2015/8/19/georgia-aquarium-rescues-stranded-california-sea-lions.html

Two of the Aquarium's sea lions, Neptune and Jupiter, were deemed non-releasable after stranding repeatedly during a recent unusual mortality event on the California coast.

http://georgiaaquariumblog.org/georgia-aquarium-blog/2015/12/11/name-reveal-sea-lion-pups.html

Lesson Plan 4
Tropical Diver: Coral in the Classroom

Teacher Instructions

When your students visit **Tropical Diver** at Georgia Aquarium, they will "dive" into one of the most diverse ecosystems in the world! The habitats and exhibits in this gallery provide views into the coral reefs of the Indian and Pacific Oceans. Students can explore the ways a shipwreck becomes an artificial coral reef, watch garden eels sway in the current and become mesmerized by the flowing jellies.

At the center of this colorful gallery is one of the largest living reef exhibits of any aquarium in the United States, the Pacific Barrier Reef. Often called the "rainforests of the ocean," coral reefs occupy less than 1% of the marine environment and yet are home to more than 25% of all marine life. They are disappearing at an alarming rate, largely because of human behavior. Damage caused by people includes water pollution, marine debris and dangerous fishing tactics like poisoning the water to catch dead fish. A reef system that thrived for hundreds of years can be ruined in one day!

Georgia Aquarium works with coral reef experts around the world to help protect and regrow damaged coral reefs. Students will explore the diversity and beauty of these reefs with two activities in this lesson plan. In Part 1, students solve math problems and answer questions to learn more about the Pacific Barrier Reef habitat and the amazing creatures in the **Tropical Diver** gallery at Georgia Aquarium. Students will need scratch paper or calculators to answer the questions in this section.

For Part 2, students will follow the instructions to create a colorful coral sculpture that replicates the corals they see in the Pacific Barrier Reef habitat. This 3-D art project puts a tropical twist on a wire-and-hose sculpture activity. The stunning images in the Student Activity pages should be projected or shared if they are not printed in color to showcase the beauty and intensity in the colors and shapes of a coral reef.

This project may be broken up over several days, depending on your class schedule, to allow for the gesso to dry on the sculptures before painting. If you prefer the students not use a staple gun, pre-drill two holes into the wood blocks or make holes with a hammer and nail. In that case, students can push the end of the wire into the block and secure it with glue. Remove the hooks from the hangers with wire cutters prior to the project. Alternately, you can purchase artistic wire from craft stores. When all the sculptures are complete, arrange and display them as a coral reef in your classroom!

Supplies for Part 2, per student or pair of students working together:

- Wood block, approximately 3" x 3"
- Wire coat hanger, unbent with hook removed
- Pliers
- Staple gun, if you choose, or glue
- One cut leg from old stocking, tights, or hose; or one trouser sock
- Gesso

- Acrylic paint
- Paint brushes
- Materials to protect the area during painting
- White paper
- Color pencils, markers or crayons

Answer Key

Part 1

1. b. 10 times bigger
2. The number line should show that the depths overlap between 59 feet and 164 feet, which means they share 105 feet.
3. $23^{\circ}C = 73.4^{\circ}F$, $29^{\circ}C = 84.2^{\circ}F$, $25^{\circ}C = 77^{\circ}F$
4. 45,000 gallons (based on dumping 1,500 gallons every two minutes)
5. (a.) Epipelagic, because it's also called the Sunlight Zone and sunlight is needed for photosynthesis. (b.) Bathypelagic Zone and below. (c.) Hadopelagic (Hadal Zone)

Name Class Date

Tropical Diver: Coral in the Classroom

Student Activity

When you visit the **Tropical Diver** gallery at Georgia Aquarium, you will "dive" into one of the most diverse ecosystems in the world! These habitats and exhibits provide views into the coral reefs of the Indian and Pacific Oceans. You can explore the ways a shipwreck becomes an artificial coral reef, watch garden eels sway in the current, and become mesmerized by the flowing jellies.

At the center of this gallery is one of the largest living reef exhibits of any aquarium in the United States, the Pacific Barrier Reef. Often called the "rainforests of the ocean," coral reefs occupy less than 1% of the marine environment and yet are home to more than 25% of all marine life. They are disappearing at an alarming rate, largely because of human behavior. Damage caused by people includes water pollution, marine debris and dangerous fishing tactics like poisoning the water to catch dead fish. A reef system that thrived for hundreds of years can be ruined in one day!

Georgia Aquarium works with coral reef experts around the world to help protect and regrow damaged coral reefs. Explore the diversity and beauty of these reefs—which you will see for yourself in **Tropical Diver**—with these two activities. At the end of this lesson, you will be able to display hand-crafted coral in your classroom!

***Terms to Know**: algae, anemones, bioluminescence, Celsius, coexist, Fahrenheit, invertebrate, marine, photosynthesis, polyp, symbiotic, Tropic of Cancer, Tropic of Capricorn*

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Part 1

As you solve these math problems and answer the questions, you will learn more about the Pacific Barrier Reef habitat and the amazing creatures in the **Tropical Diver** exhibit at Georgia Aquarium.

1. The Pacific Barrier Reef habitat holds 164,000 gallons of water. The garden eels live in 16,500 gallons of water. Estimate how many times bigger the reef habitat is than the eel habitat and circle the best answer.

a. Twice as big
b. 10 times bigger
c. 100 times bigger

2. Both the splendid garden eel (*Gorgasia preclara*) and the spotted garden eel (*Heteroconger hassi*) are found in tropical Indo-Pacific waters, but in different areas of the ocean and at different depths. The splendid garden eel lives in 59 to 264 feet (18-75 m), and the spotted garden eel thrives between 23 and 164 feet (7-50 m) of water. However, if their ranges do overlap in the wild, would they find themselves sharing the ocean floor? Create a number line here to show the depth range where they could coexist.

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3. Although cold-water corals have recently been discovered, most tropical coral reefs are located near the equator between the Tropic of Cancer and the Tropic of Capricorn. Tropical corals generally need water between 23° Celsius and 29° Celsius. Georgia Aquarium keeps its Pacific Barrier Reef at 25° Celsius.

Celsius (°C) is the temperature measurement for the metric system and is used by scientists around the world. To change Celsius temperatures into Fahrenheit, first multiply the number in Celsius by 9. Then divide by 5. Last, add 32. Convert these coral reef temperatures into Fahrenheit (°F).

23°C = _____ °F 29°C = _____ °F 25°C = _____ °F

4. In addition to warm water, coral reefs also require high oxygen levels in the water to support the coral polyps. The Pacific Barrier Reef exhibit at Georgia Aquarium has its own wave machine to help create an oxygen-rich environment. It dumps about 1,500 gallons of water every two minutes. How many gallons of water does it dump in an hour?

_____

Every two minutes, buckets dump water onto the Pacific Barrier Reef exhibit to act as waves.

http://georgiaaquariumblog.org/georgia-aquarium-blog/2016/3/21/the-water-purification-of-our-pacific-barrier-reef-exhibit.html

Name Class Date

5. Corals may look like plants, but they are invertebrate animals related to jellies and anemones. However, the algae that live on coral reefs are like plants because they photosynthesize. The nutrients provided by algae feed the hard corals, which build the reefs that become homes for millions of organisms.

(a.) According to the chart below, what is the name of the ocean zone where coral reefs live? How do you know?
(b.) In which zone or zones would you find marine organisms with bioluminescence, which means they create their own light?
(c.) Which zone was named for Hades, the Greek god of the underworld?

Depth	Ocean Zone (and Nickname)
0 to 660 feet (0-200 m)	Epipelagic (Sunlight Zone)
660 to 3,300 feet (200-1,000 m)	Mesopelagic (Twilight Zone)
3,300 to 13,000 feet (1,000-4,000 m)	Bathypelagic (Midnight Zone)
13,000 to 20,000 feet (4,000-6,000 m)	Abyssalpelagic (Abyss Zone)
Below 20,000 feet (6,000 m)	Hadopelagic (Hadal Zone)

Name Class Date

Part 2

The names of the tropical fish swimming around the Pacific Barrier Reef habitat in **Tropical Diver** are often as unusual and colorful as the animals themselves. Squarespot anthias (*Pseudanthias pleurotaenia*) fish glow in red, pink, orange, yellow and purple. Palette surgeonfish (*Paracanthurus hepatus*) stand out with their bright blue bodies and bold black markings. Copperband butterflyfish (*Chelmon rostratus*) "fly" by in their orange and white stripes while coral beauty angelfish (*Centropyge bispinosa*) can be easily spotted by their sparkling purple color.

		
Copperband butterflyfish	**Palette surgeonfish**	**Squarespot anthias**

Fish are not the only inhabitants that brighten coral reefs with jeweled tones. The reefs themselves are alive with corals in all shapes, sizes and colors. Sometimes, it is the algae living on the animal that gives it color. Zooxanthellae, a kind of algae, live in and on reef-building hard corals. The algae provide nutrients to the corals, and the corals protect the algae. This arrangement is called a symbiotic relationship.

You don't need to go on expedition to the Indian or Pacific Oceans to recreate the colors of a tropical reef. Follow the directions below to create coral for your classroom, based on those you see in the Pacific Barrier Reef habitat at Georgia Aquarium. They can be as colorful as you can imagine!

Name Class Date

Supplies:

- Wood block, approximately 3”x3”
- Wire coat hanger, unbent with hook removed
- Pliers
- Staple gun, if provided, or glue
- One leg from old hose, stockings, or tights
- Gesso
- Acrylic paint
- Paint brushes
- Materials to protect area during painting
- White paper
- Color pencils, markers or crayons

1. Bend one end of the wire into a 90-degree angle. Use the staple gun (if provided) to attach the end of the wire to the wood block, which is your base. Otherwise push the end of the wire into the holes in the block and secure it with glue.

2. Use your hands and the pliers to bend, shape, twist and form the structure for your coral.

3. Experiment with different designs. Make sure it will remain balanced and not topple over when the other end of the wire is attached to the block.

4. See how it looks with the stocking/hose stretched over the wire frame. Be careful as you work with the form; you don’t want to poke any holes in it.

5. When you are happy with your coral’s wire skeleton, use the staple gun or glue to attach the free end of the wire to the wood block.

6. With the stocking stretched over the frame you created, cover your coral with gesso to prepare it for painting. While you wait for the gesso to dry, sketch ideas on paper for the colors and design you plan to paint on your coral.

7. When the gesso has dried, paint your colorful coral creation.

Lesson Plan 5
Ocean Voyager: Sizing Up Sharks

Teacher Instructions

At 6.3 million gallons (that's right, 6.3 MILLION gallons!) the **Ocean Voyager Built by The Home Depot** gallery at Georgia Aquarium is the one of the world's largest indoor aquatic habitats. Some of the biggest animals at the Aquarium live in **Ocean Voyager**, including four whale sharks (*Rhincodon typus*) and four manta rays (*Manta sp. cf. birostris*). With thousands of fish representing more than 80 species, your students will have many opportunities to see some magnificent animals in this habitat.

The whale sharks' story began in Taiwan. They traveled in specially-designed containers – complete with advanced life support systems - from Asia to Atlanta by UPS. That must have been one special delivery! During the trip, their health was checked constantly by the Aquarium's Zoological Operations and Veterinary teams. Upon arrival at Georgia Aquarium, a crane carefully lifted the whale sharks from their containers and lowered them into the water of their new home in Ocean Voyager.

Whale sharks are the largest species of fish in the world. They are sharks and not whales, but students will soon discover how their size may have confused scientists a long time ago. Exactly how big are these big fish? How do they compare to other sharks at Georgia Aquarium? It's time to size up some sharks!

Part 1 of the lesson plan features a 19th-century description of a whale shark from South Africa. The excerpt comes from a book by Dr. Andrew Smith, a Scottish physician and zoologist who spent time with the British army in South Africa from 1820 to 1837. He published *Illustrations of the Zoology of South Africa* in 1845. His notes on the whale shark begin with a detailed illustration here: http://biodiversitylibrary.org/page/41799269#page/126/mode/1up.

Students will use the dimensions of the shark from this primary source to answer questions, with the aid of a dictionary, and then create a life-sized outline out of masking tape on the floor of your classroom. Students can work in teams, which allows for comparisons among the different ways they envision and manifest their design. If there are space constraints, students can work in groups with each one assigned a portion of the shark that together creates one outline. Students will need rulers, yard sticks and masking tape. They will also need access to an image of a whale shark from their Student Activity pages or one can be projected for the whole class to reference.

Whale sharks are not the only sharks at Georgia Aquarium. Your students will see eight different species of sharks during their field trip. They may even have a chance to touch one of the smaller ones in the Shark and Ray Touch Pool in the **Ocean Voyager** gallery! How do the other seven species of shark measure up to a whale shark? Based on a bar graph of maximum species lengths, in Part 2, students will match each shark to its size by writing its name in a chart that follows the graph.

An excellent way to introduce whale sharks is with the 26-minute video "Biggest Fish in the Sea." This video highlights work that Georgia Aquarium does to help this endangered species: www.youtube.com/watch?v=t_DQjTEgibE).

Answer Key

Part 1

Match: 1.d, 2.a, 3.e, 4.g, 5.b, 6.h, 7.f, 8.c

Design Challenge

1. 16 ft 6 in
2. Answers will vary but most elementary school classrooms are large enough
3. The two circumferences
4. Pectoral fin (length of 3 ft 2 in, as opposed to the first dorsal height of 1 ft 3 in)
5. Its mouth
6. Answers will vary based on the students' heights
7. Dr. Smith's shark is similar to the smallest of the Aquarium's sharks (16 feet)
8. Answers will vary based on the students' lunches, but they should all respond that yes, they would need to eat more often

Part 2

1. Whale shark
2. Sandbar shark
3. Pacific blacktip reef shark
4. Epaulette shark
5. Zebra shark
6. Spotted wobbegong
7. Tasseled wobbegong
8. Swell shark

GEORGIA AQUARIUM

Name Class Date

Ocean Voyager: Sizing Up Sharks

Student Activity

At 6.3 million gallons (that's right, 6.3 MILLION gallons!) the **Ocean Voyager Built by The Home Depot** gallery at Georgia Aquarium is one of the world's largest indoor aquatic habitats. Some of the biggest animals at the Aquarium live in **Ocean Voyager**, including four whale sharks (*Rhincodon typus*) and four manta rays (*Manta sp. cf. birostris*). With thousands of fish representing more than 80 species, you will have many chances to see some magnificent animals in this habitat.

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Whale sharks are the largest species of fish in the world. They are sharks and not whales, but you will soon discover how their size may have confused scientists a long time ago. Exactly how big are these big fish? How do they compare to other sharks at Georgia Aquarium? It's time to size up some sharks!

Terms to Know: *acrylic, anatomical, breadth, carnivorous, circumference, filter feeder, hoisted, maximum, plankton, Taiwan, zoological, zoologist*

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Part 1

Supplies:

- Dictionary
- Masking tape
- Rulers
- Yard sticks

Andrew Smith, a Scottish doctor and zoologist, lived in South Africa from 1820 until 1837. He explored the area as much as he could when he wasn't treating patients. In 1829, he wrote the first known description of a whale shark in the article "Dr. A. Smith's Contributions to the Natural History of South Africa."

In 1845, he published a more detailed description of the whale shark in his book *Illustrations of the Zoology of South Africa*. He included this chart of whale shark measurements. Use a dictionary to match Dr. Smith's anatomical terms (in bold) with their meanings.

	Feet	**Inches**
From mouth to 1st **dorsal fin**	8	6
1st to 2nd dorsal fin	2	0
2nd dorsal fin to **caudal fin**	1	8
Length of upper **lobe** of tail	4	0
Lower lobe of tail	2	10
Distance between tip of nose and 1st **branchia**	2	10
Distance between tip of nose and eye	0	6
Distance between eye and **temporal spiracle**	0	4 ½
Width of mouth	2	8
From tip of nose to **anterior** edge of pectoral fin	3	3
Length of **pectoral fin**	3	2
Breadth at its base	2	0
Height of 1st dorsal fin	1	3
Breadth of head about one foot in front of branchia	3	8 ½
Circumference of body immediately behind pectoral fins	9	3
Circumference of body one foot behind pectoral fins	8	5
Total length of fish	16	6

Name Class Date

Match

a. Dorsal fins
b. Caudal fin
c. Lobe
d. Branchia
e. Temporal
f. Spiracle
g. Anterior
h. Pectoral fins

1. _____ gills
2. _____ fins of the animal's back
3. _____ on the sides of the head
4. _____ front
5. _____ tail fin
6. _____ fins on the side
7. _____ holes some sharks have on their heads to help with breathing
8. _____ a section or half of something

Design Challenge

Now, your group will use rulers, yard sticks, masking tape and the chart above to measure and map out a life-sized outline of Dr. Smith's whale shark on your classroom floor. To begin, answer these questions to help plan your design.

1. What will be the total length of your masking-tape whale shark outline?

_____

2. Measure the width and length of your classroom. Will the whale shark fit in your classroom? Do you need to move to the hallway or a larger room?

_____

3. Which two measurements might be the most difficult to show in your design, because your outline will be two-dimensional instead of three-dimensional?

_____

Name Class Date

4. Which is bigger, the shark's pectoral fin or the first dorsal fin?

5. What part of the whale shark's body was two feet, eight inches wide?

6. How many times can you lie down, head to toe, within the length of the shark?

7. Scientists suspect whale sharks in the Pacific Ocean may grow to be 40 feet long. The four whale sharks in **Ocean Voyager** range in length from about 16 feet to a little over 21 feet. How do these sizes compare to Dr. Smith's whale shark?

8. Whale sharks are carnivorous but they can only eat plankton and other small organisms. Their throats are not much larger than a quarter, and they swallow their food whole. If you only ate food that could pass through a hole smaller than a toilet paper tube—without chewing—which parts of your school lunch today would you be able to eat? Would it change how many times a day you had to eat in order to stay healthy?

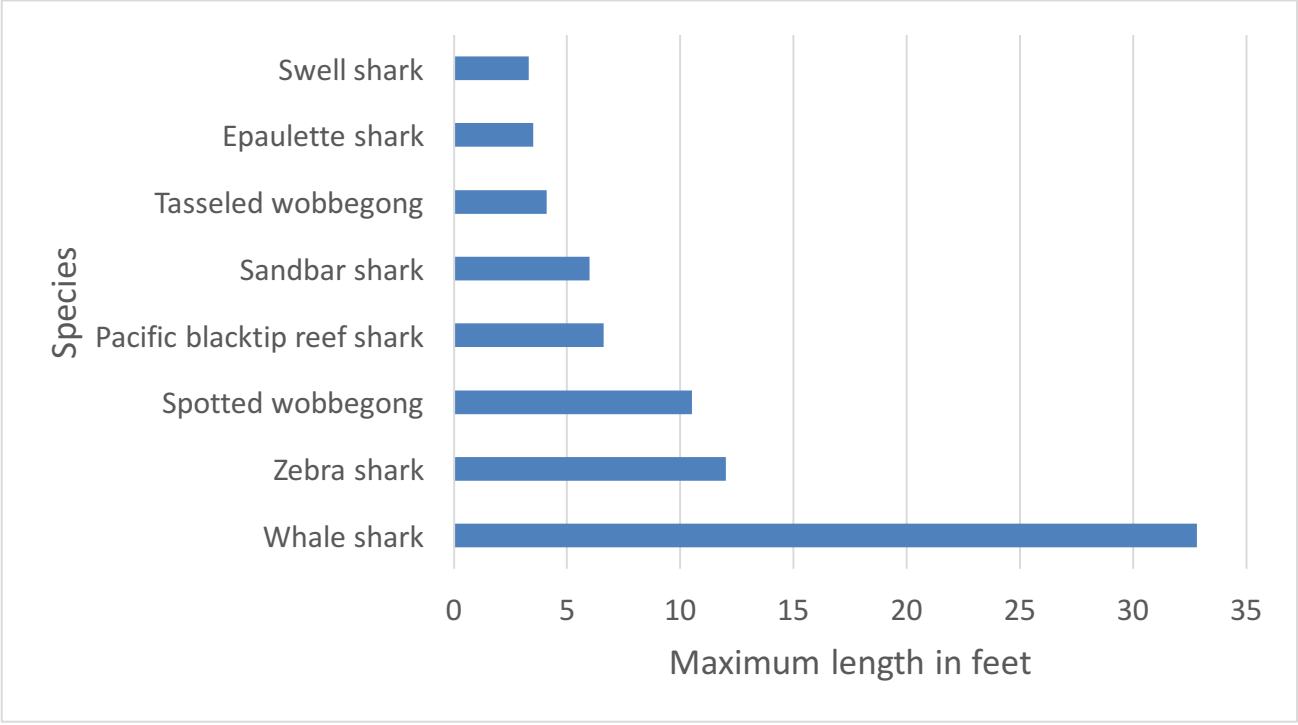
GEORGIA AQUARIUM

Name Class Date

Part 2

Whale sharks are not the only sharks at Georgia Aquarium. You can see eight different species of sharks during your field trip. Most of them live in **Ocean Voyager** but you might have a chance to touch one of the smaller ones in the Shark and Ray Touch Pool!

How do the other seven species of shark measure up to a whale shark? Based on the bar graph of maximum species lengths, below, match each shark to its size by writing its name in the chart that follows the graph.



GEORGIA AQUARIUM

Name Class Date

Shark	Common length
1.	40 feet, 7 inches
2.	8 feet, 2 inches
3.	6 feet, 7 inches
4.	3 feet, 6 inches
5.	12 feet
6.	10 feet, 6 inches
7.	4 feet, 1 inch
8.	3 feet, 4 inches

Individual whale sharks are identified by their unique patterns of white spots. Scientists take pictures of each whale shark they encounter to compare or add to a worldwide database.

http://georgiaaquariumblog.org/georgia-aquarium-blog/2015/2/23/spectacular-st-helena.html

Staff from Georgia Aquarium study whale sharks in the wild near the island of St. Helena in the southern Atlantic Ocean.

http://news.georgiaaquarium.org/multimedia/album?p=16&s=order&page=2&id=53f4add5c80467123b00c36e&t=photo

GEORGIA AQUARIUM

Name Class Date

Word Scramble: Animal Offspring

Unscramble the first word to find the name of an animal that resides at Georgia Aquarium. Next to it, you will find the term used for its baby or youngster. Did you know you saw a fry and a pup on your field trip?

1. GLUEAB Calf: _____
2. YLLJE Ephyra: _____
3. UCOOSPT Larva: _____
4. ELE Elver: _____
5. IHSF Fry: _____
6. TROET Pup: _____
7. NINPEGU Chick: _____
8. LRTETU Hatchling: _____

GEORGIA AQUARIUM

Name Class Date

Word Search: Oceans and Seas

Many people use the terms "ocean" and "sea" interchangeably when speaking about the ocean, but there is a difference between the two terms when referring to geography (the study of the Earth's surface). Seas are smaller than oceans and are usually located where the land and ocean meet. Search for the names of these three oceans and five seas.

ARCTIC Ocean
ATLANTIC Ocean
BERING Sea
CARIBBEAN Sea
INDIAN Ocean
MEDITERRANEAN Sea
PACIFIC Ocean
RED Sea

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

GEORGIA AQUARIUM

Answer Keys

Word Scramble

1. beluga
2. jelly
3. octopus
4. eel
5. fish
6. otter
7. penguin
8. turtle

Word Search

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

(Over, Down, Direction)

ARCTIC (7, 2, SW)
ATLANTIC (13, 3, S)
BERING (9, 1, S)
CARIBBEAN (3, 9, N)
INDIAN (3, 6, SE)
MEDITERRANEAN (13, 13, NW)
PACIFIC (2, 12, E)
RED (13, 1, W)

Go Figure!

Teachers: Let numbers (and maybe a little math) tell the story of Georgia Aquarium to your students. Swim around this list to locate information you can use as reference material in your classroom. *Please note*: this data is subject to change.

PEOPLE

- More than **24 million** guests have visited Georgia Aquarium since it opened in 2005.
- Guests from all **50 states** and **143 countries** on **six continents** have visited the Aquarium.
- Volunteers have served more than **1.6 million** hours since 2005.

SIZE

- **One-and-a-half White Houses** could fit into the 84,000 square-foot AT&T Dolphin Tales gallery.
- The Dolphin Tales Theater's impressive viewing window is the length of **two school buses**.
- Georgia Aquarium is one of the world's largest aquariums with more than **10 million gallons** of water in more than **100 habitats**.
- Tropical Diver's Pacific Barrier Reef habitat is one the largest reef exhibits in the United States, at about **164,000 gallons**.
- Georgia Aquarium is the only aquarium in the United States that is home to manta rays and the only Aquarium in North America that is home to whale sharks, the **largest fish** in the world.
- Ocean Voyager is one of the world's largest indoor aquatic habitats at **6.3 million gallons**.

FOOD (Per Year!)

- The Georgia Aquarium commissary prepares more than **600,000 pounds** (272,158 kg) of food for its animals.
- Collectively, the four whale sharks in Ocean Voyager eat more than **91,500 pounds** (41,504 kg) of krill, fish and gel.
- Penguins are offered **18,500 pounds** (8,391 kg) of diet items.
- Beluga whales are offered more than 70,000 lbs (31, 751 kg) of fish.
- Sea otters are offered more than 18,500 lbs (8,391 kg) of clams, squid, crab, shrimps, scallops and other assorted seafood.
- The commissary handles enormous amounts of seafood including **76, 500 pounds** (34,700 kg) of krill, **250,000 pounds** (113,399 kg) of capelin, and **8,700 pounds** (3,946 kg) of fish-based gel.

WATER

- Each minute, the Aquarium's life support system filters more than **170,000 gallons** of water.
- The building uses about **70 miles** of pipes...enough to circle the city of Atlanta along I-285.
- Georgia Aquarium's Life Support Systems are able to recover and reuse **99.5%** of all exhibit water each week.
- Georgia Aquarium has **reduced water usage by about 24%** each month through a combination of condensation recaptured from cooling units, waterless urinals and operational improvements to life support systems.

GEORGIA AQUARIUM

Aquarium Awareness Days

This month-by-month list includes key dates that readily connect your students to the STEAM themes found within Georgia Aquarium. Be creative, have fun—go deep!

For example,

- For African Penguin Awareness Day in October, research the *MV Treasure* Oil Spill. Morty Waddlesworth, the elder statesman of the Aquarium spokespenguin family, is a survivor of this historic event.
- Ask students to compare the effects of climate change and the environmental characteristics of the North Pole to their hometown for International Polar Bear Day, February 27.
- On World Oceans Day in June, make a school-wide commitment to take a pass on disposable bottles, utensils and wrappers, as these items often end up as plastic trash in our ocean.

Note: Dates in **bold** are observed at Georgia Aquarium

January
- **17: National Dolphin and Whale Protection Awareness Day**
- **20: Penguin Awareness Day**

February
- 2: World Wetlands Day
- 14: World Whale Day
- 27: International Polar Bear Day

March
- 3: World Wildlife Day
- 22: World Water Day
- 28: Earth Hour

April
- 16: Dolphin Day
- **17: Autism Awareness Day**
- **22: Earth Day**
- 25: World Penguin Day

May
- **16: Endangered Species Day**
- **21: Armed Forces Day**
- 22: World Biodiversity Day
- 23: World Turtle Day

June
- 5: World Environment Day
- **8: World Oceans Day**
- 24: Catfish Day

July
- 14: Shark Awareness Day
- 16: World Snake Day

August
- **30: International Whale Shark Day**

September
- **18: Sea Otter Awareness Week**
- 18: World Water Monitoring Day
- 27: World Rivers Day

October
- 4: World Animal Day
- 5: World Habitat Day
- 8: World Octopus Day
- **8: Cephalopod Awareness Days**
- **13: African Penguin Awareness Day**
- 21: Reptile Awareness Day

November
- 3: Jellyfish Day

GEORGIA AQUARIUM

Georgia Aquarium: Through the Years

These significant moments in the history of Georgia Aquarium, from Bernie Marcus' initial dream to the Aquarium's 10-year anniversary celebration, connect to themes, events, people and topics featured in this Teacher's Guide and within the galleries you visit on your field trip.

2001	Bernie Marcus, co-founder of The Home Depot, and his wife, Billi, give a gift of $250 million through the Marcus Foundation to build Georgia Aquarium.
2003	Coca-Cola generously donates the nine and a half acres on which the Aquarium sits. Construction begins on Georgia Aquarium.
2005	Bernie Marcus' dream is fulfilled and the world's largest aquarium at the time is open to the public.
2006	A.D. "Pete" and Ida Correll gift $2.5 million to build the Correll Center for Aquatic Animal Health, a state-of-the-art animal care facility within Georgia Aquarium.
	The three millionth guest visits Georgia Aquarium within its first nine months of opening.
2007	The five millionth guest visits Georgia Aquarium.
2008	Georgia Aquarium announces the "Journey with Gentle Giants" swim and dive immersion program.
	Georgia Aquarium makes a $1.5 million contribution to establish Georgia Aquarium Conservation Field Station, a new marine animal rescue and research facility in Marineland, Florida.
2009	The 10 millionth guest visits Georgia Aquarium.
2010	Three rescued southern sea otter pups find a home at Georgia Aquarium in the Cold Water Quest gallery.
2011	The Aquarium acquires the world's first oceanarium, now known as Marineland Dolphin Adventure, near St. Augustine, Florida.
	AT&T Dolphin Tales, Georgia Aquarium's $110 million dolphin gallery, opens to guests.
	Ocean Mysteries with Jeff Corwin from Georgia Aquarium premieres on television.
2012	Georgia Aquarium's Volunteer department reaches one million hours of contribution.
2014	The Georgia Pacific Penguin Nursery is unveiled to aid in enhancing the Aquarium's already successful African penguin breeding program.
	The 20 millionth guest visits Georgia Aquarium.
2015	Georgia Aquarium opens its new interactive gallery, Aquanaut Adventure: A Discovery Zone.
	Georgia Aquarium researchers and Emory University successfully sequence the first full shark genome using DNA from the whale sharks in Georgia Aquarium's collection.
	Georgia Aquarium concludes its 11th year with the Health and Environmental Risk Assessment (HERA) and researchers discover a major link between human health, dolphin health and the health of our ocean.
	Georgia Aquarium kicks off its year-long 10th anniversary celebration.
2016	A new, educational dolphin presentation, AT&T Dolphin Celebration, replaces the original presentation in the AT&T Dolphin Tales theater.
	Georgia Aquarium's 4D Funbelievable Theater reopens following renovations, with a screening of *Happy Feet*.

Deeper Dive: Curriculum Correlations

Grades 3-5

We know how important it is for you to justify field trips and document how instructional time is spent outside of your classroom. With this in mind, both the activities in this Teacher's Guide and the experiences your students have during their field trip to Georgia Aquarium are correlated to the Common Core State Standards for Mathematics, Common Core State Standards for English Language, the Next Generation Science Standards, the C3 Framework for Social Studies State Standards, and the National Core Arts Standards. These standards are arranged by content area and then by grade.

Following the national curricula, you will find the Georgia Performance Standards and Standards of Excellence. In addition, specific requirements are provided for Alabama, Florida, North Carolina, South Carolina, and Tennessee.

NATIONAL STANDARDS

Common Core State Standards for Mathematics

Standard for Mathematical Practice: CCSS.Math.Practice.MP1, CCSS.Math.Practice.MP2, CCSS.Math.Practice.MP4, CCSS.Math.Practice.MP5, CCSS.Math.Practice.MP6

Grade 3: CCSS.Math.Content.3.OA.A.3, CCSS.Math.Content.3.NBT.A.2, CCSS.Math.Content.3.MD.A.2, CCSS.Math.Content.3.MD.B.3, CCSS.Math.Content.3.MD.B.4

Grade 4: CCSS.Math.Content.4.OA.A.3, CCSS.Math.Content.4.NBT.B.4, CCSS.Math.Content.4.NBT.B.5, CCSS.Math.Content.4.MD.A.1, CCSS.Math.Content.4.MD.A.2

Grade 5: CCSS.Math.Content.5.OA.A.2, CCSS.Math.Content.5.NBT.B.5, CCSS.Math.Content.5.MD.A.1, CCSS.Math.Content.5.MD.C.5

Common Core State Standards for English Language Arts

Grade 3: CCSS.ELA-Literacy.RL.3.1, CCSS.ELA-Literacy.RL.3.2, CCSS.ELA-Literacy.RL.3.3, CCSS.ELA-Literacy.RL.3.4,CCSS.ELA-Literacy.RI.3.1, CCSS.ELA-Literacy.RI.3.2,CCSS.ELA-Literacy.RI.3.3,CCSS.ELA-Literacy.RI.3.4, CCSS.ELA-Literacy.RI.3.7, CCSS.ELA-Literacy.SL.3.1

Grade 4: CCSS.ELA-Literacy.RL.4.1, CCSS.ELA-Literacy.RL.4.2, CCSS.ELA-Literacy.RL.4.3, CCSS.ELA-Literacy.RL.4.4, CCSS.ELA-Literacy.RI.4.1, CCSS.ELA-Literacy.RI.4.3, CCSS.ELA-Literacy.RI.4.4, CCSS.ELA-Literacy.RI.4.7, CCSS.ELA-Literacy.RI.4.9, CCSS.ELA-Literacy.SL.4.1

Grade 5: CCSS.ELA-Literacy.RL.5.1, CCSS.ELA-Literacy.RL.5.2, CCSS.ELA-Literacy.RL.5.3, CCSS.ELA-Literacy.RL.5.4, CCSS.ELA-Literacy.RI.5.1, CCSS.ELA-Literacy.RI.5.3, CCSS.ELA-Literacy.RI.5.4, CCSS.ELA-Literacy.RI.5.7, CCSS.ELA-Literacy.RI.5.9, CCSS.ELA-Literacy.SL.5.1

Next Generation Science Standards

Engineering Design: 3-5-ETS1-1, 3-5-ETS1-2, 3-5-ETS1-3

Grade 3: 3-LS1-1, 3-LS2-1, 3-LS3-2, 3-LS4-2, 3-LS4-3, 3-LS4-4, 3-ESS2-1

Grade 4: 4-LS1-1, 4-LS1-2, 4-ESS2-2, 4-ESS3-1

Grade 5: 5-LS1-1, 5-LS2-1, 5-ESS2-1, 5-ESS2-2, 5-ESS3-1, 5-PS3-1

C3 Framework for Social Studies Standards: D1.3.3-5, D2.Geo.2.3-5, D2.Geo.4.3-5, D2.Geo.5.3-5, D2.Geo.9.3-5, D2.Geo.10.3-5, D2.Geo.12.3-5, D2.His.1.3-5, D2.His.9.3-5, D2.His.14.3-5, D3.4.3-5, D4.7.3-5

National Core Arts Standards: Visual Arts
Grade 3: VA:Cr1.2.3a, VA:Pr6.1.3a
Grade 4: VA:Cr2.1.4a, VA:Pr4.1.4a, VA:Cn11.1.4a
Grade 5: VA:Cr2.1.5a, VA:Re.7.1.5a

GEORGIA

Mathematics
Standards for Mathematical Practice: 1, 2, 4, 5, 6
Grade 3: MGSE3.OA.3, MGSE3.NBT.2, MGSE3.MD.2, MGSE3.MD.3, MGSE3.MD.4
Grade 4: MGSE4.OA.3, MGSE4.NBT.4, MGSE4.NBT.5, MGSE4.MD.1, MGSE4.MD.2
Grade 5: MGSE5.OA.2, MGSE5.NBT.5, MGSE5.MD.1, MGSE5.MD.5

English Language Arts
Grade 3: ELAGSE3RL1, ELAGSE3RL2, ELAGSE3RL3, ELAGSE3RL4, ELAGSE3RI1, ELAGSE3RI2, ELAGSE3RI3, ELAGSE3RI4, ELAGSE3RI7, ELAGSE3SL1
Grade 4: ELAGSE4RL1, ELAGSE4RL2, ELAGSE4RL3, ELAGSE4RL4, ELAGSE4RI1, ELAGSE4RI3, ELAGSE4RI4, ELAGSE4RI7, ELAGSE4RI9, ELAGSE4SL1
Grade 5: ELAGSE5RL1, ELAGSE5RL2, ELAGSE5RL3, ELAGSE5RL4, ELAGSE5RI1, ELAGSE5RI3, ELAGSE5RI4, ELAGSE5RI7, ELAGSE5RI9, ELAGSE5SL1

Science
Grade 3: S3L1, S3L2
Grade 4: S4E4a, S4L1, S4L2a
Grade 5: S5L1a, S5L4b

Social Studies
Information Processing Skills: 1, 3, 6, 7, 11, 12
Grade 3: SS3H1b, SS3G1a

Fine Arts: Visual Arts
Grade 3: VA3MC.1b, VA3CU.1b, VA3PR.1, VA3PR.2a, VA3PR.3, VA3C.1
Grade 4: VA4MC.1b, VA4CU.1b, VA4PR.1, VA4PR.2a, VA4PR.3, VA4C.1
Grade 5: VA5MC.1b, VA5CU.1b, VA5PR.1, VA5PR.2a, VA5PR.3, VA5C.1

ALABAMA

Mathematics
Standard for Mathematical Practice: 1, 2, 4, 5, 6
Grade 3: 3, 11, 17, 18, 19
Grade 4: 3, 9, 10, 19, 20
Grade 5: 2, 8, 18, 22

English Language Arts
Grade 3: 1, 2, 3, 4, 10, 11, 12, 13, 16, 31
Grade 4: 1, 2, 3, 4, 10, 11, 12, 13, 16, 32
Grade 5: 1, 2, 3, 4, 10, 11, 12, 13, 16, 32

Science
Grade 3: 8, 10, 11, 12, 14
Grade 4: 9, 11
Grade 5: 8, 10, 11, 16

Social Studies
Grade 3: 1, 3, 11
Grade 5: 3

Arts Education: Visual Arts
Grade 3: 1, 2, 9
Grade 4: 1, 5, 8
Grade 5: 2, 6

FLORIDA

Mathematics
Grade 3: MAFS.3.MD.1.2, MAFS.3.MD.2.3, MAFS.3.MD.2.4, MAFS.3.NBT.1.2, MAFS.3.OA.1.3
Grade 4: MAFS.4.MD.1.1, MAFS.4.MD.1.2, MAFS.4.NBT.2.4, MAFS.4.NBT.2.5, MAFS.4.OA.1.3
Grade 5: MAFS.5.MD.1.1, MAFS.5.MD.3.5, MAFS.5.NBT.2.5, MAFS.5.OA.1.2
Mathematical Practice: MAFS.K12.MP.1.1, MAFS.K12.MP.2.1, MAFS.K12.MP.4.1, MAFS.K12.MP.5.1, MAFS.K12.MP.6.1

English Language Arts
Grade 3: LAFS.3.RI.1.1, LAFS.3.RI.1.2, LAFS.3.RI.1.3, LAFS.3.RI.2.4, LAFS.3.RI.3.7, LAFS.3.RL.1.1, LAFS.3.RL.1.2, LAFS.3.RL.1.3, LAFS.3.RL.1.4, LAFS.3.SL.1.1
Grade 4: LAFS.4.RI.1.1, LAFS.4.RI.1.2, LAFS.4.RI.1.3, LAFS.4.RI.2.4, LAFS.4.RI.3.7, LAFS.4.RL.1.1, LAFS.4.RL.1.2, LAFS.4.RL.1.3, LAFS.4.RL.2.4, LAFS.4.SL.1.1
Grade 5: LAFS.5.RI.1.1, LAFS.5.RI.1.2, LAFS.5.RI.1.3, LAFS.5.RI.2.4, LAFS.5.RI.3.7, LAFS.5.RL.1.1, LAFS.5.RL.1.2, LAFS.5.RL.1.3, LAFS.5.RL.2.4, LAFS.5.SL.1.1

Science
Grade 3: SC.3.L.14.1, SC.3.L.14.2, SC.3.L.15.1, SC.3.L.17.2, SC.3.N.1.1, SC.3.N.3.2, SC.3.N.3.3
Grade 4: SC.4.L.16.2, SC.4.L.17.2, SC.4.L.17.3, SC.4.L.17.4, SC.4.N.1.4, SC.4.N.1.7, SC.4.N.1.8, SC.4.N.3.1
Grade 5: SC.5.E.7.2, SC.5.E.7.6, SC.5.L.15.1, SC.5.L.17.1

Social Studies
Grade 3: SS.3.A.1.1, SS.3.G.1.1, SS.3.G.2.6
Grade 4: SS.4.A.8.4
Grade 5: SS.5.A.1.1, SS.5.A.1.2, SS.5.A.2.3, SS.5.G.4.1

Visual Art

Grade 3: VA.3.C.3.2, VA.3.F.1.1, VA.3.F.3.1, VA.3.H.2.2, VA.3.H.3.1, VA.3.S.1.2, VA.3.S.1.3, VA.3.S.2.1, VA.3.S.2.2, VA.3.S.3.1

Grade 4: VA.4.C.1.2, VA.4.C.3.2, VA.4.C.3.3, VA.4.F.1.1, VA.4.H.1.1, VA.4.H.1.3, VA.4.S.1.1, VA.4.S.1.3, VA.4.S.3.1, VA.4.S.3.3

Grade 5: VA.5.C.1.3, VA.5.F.1.1, VA.5.F.3.2, VA.5.H.1.1, VA.5.H.2.2, VA.5.O.2.2, VA.5.S.1.1, VA.5.S.1.3, VA.5.S.2.2, VA.5.S.3.1, VA.5.S.3.3

NORTH CAROLINA

Mathematics

Grade 3: 3.OA.3, 3.NBT.2, 3.MD.2, 3.MD.3, 3.MD.4

Grade 4: 4.OA.3, 4.NBT.4, 4.NBT.5, 4.MD.1, 4.MD.2

Grade 5: 5.OA.2, 5.NBT.5, 5.MD.1, 5.MD.5

Standards for Mathematical Practice: 1, 2, 4, 5, 6

English Language Arts

Grade 3: RL.1, RL.2, RL.3, RL.4, RI.1, RI.2, RI.3, RI.4, RI.7, SL.1

Grade 4: RL.1, RL.2, RL.3, RL.4, RI.1, RI.2, RI.3, RI.4, RI.7, SL.1

Grade 5: RL.1, RL.2, RL.3, RL.4, RI.1, RI.2, RI.3, RI.4, RI.7, SL.1

Science

Grade 3: 3.E.2.1, 3.L.2.1, 3.L.2.2

Grade 4: 4.L.1.1, 4.L.1.2, 4.L.1.3, 4.L.1.4

Grade 5: 5.E.1.3, 5.L.2.1, 5.L.2.2, 5.L.2.3

Social Studies

Grade 3: 3.G.1.3, 3.C.1.2, 3.C.1.3

Grade 4: 4.G.1.2

Grade 5: 5.G.1.2, 5.C.1.4

Arts Education: Visual Arts

Grade 3: 3.V.2.1, 3.V.2.3, 3.V.3.3, 3.CX.1.1, 3.CX.1.5, 3.CX.2.2

Grade 4: 4.V.2.3, 4.V.3.3, 4.CX.2.2

Grade 5: 5.V.2.2, 5.V.2.3, 5.V.3.3

SOUTH CAROLINA

Mathematics

Mathematical Process Standards: 1, 2, 4, 5, 6

Grade 3: 3.NSBT.2, 3.ATO.3, 3.MDA.2, 3.MDA.3, 3.MDA.4

Grade 4: 4.NSBT.4, 4.NSBT.5, 4.ATO.3, 4.MDA.1, 4.MDA.2

Grade 5: 5.NSBT.5, 5.ATO.2, 5.MDA.1

English Language Arts
Grade 3: RL.5.1, RL.6.1, RL.7.2, RL.8.1, RL.10.6, RI.5.1, RI.6.1; C.1.1
Grade 4: RL.5.1, RL.6.1, RL.7.2, RL.8.1, RL.10.6, RI.5.1, RI.6.1; C.1.1
Grade 5: RL.5.1, RL.6.1, RL.7.2, RL.8.1, RL.10.6, RI.5.1, RI.6.1; C.1.1

Science
Grade 3: 3.S.1A.2, 3.S.1A.4, 3.S.1A.5, 3.S.1A.8, 3.S.1B.1, 3.E.4A.2, 3.E.4A.3, 3.E.4B.4, 3.L.5A.1, 3.L.5A2, 3.L.5B.1, 3.L.5B.2
Grade 4: 4.S.1A.2, 4.S.1A.4, 4.S.1A.5, 4.S.1A.8, 4.S.1B.1, 4.E.2B.3, 4.L.5A.1, 4.L.5A.3, 4.L.5B.2, 4.L.5B.1, 4.L.5B.3
Grade 5: 5.S.1A.2, 5.S.1A.4, 5.S.1A.5, 5.S.1A.8, 5.S.1B.1, 5.E.3B.3, 5.E.3B.3, 5.E.3B.4, 5.L.4A.1, 5.L.4A.2, 5.L.4B.1, 5.L.4B.2, 5.L.4B.3, 5.L.4B.4

Social Studies
Grade 4: 4-1.2
Grade 5: 5-6.6
Social Studies Literacy Skills for the Twenty-First Century: Identify and explain cause-and-effect relationships. Identify the locations of places, the conditions at places, and the connections between places.

Visual Arts
Grade 3: VA3-1.3, VA3-1.5, VA3-4.2, VA3-6.1
Grade 4: VA4-1.3, VA4-1.5, VA4-6.1
Grade 5: VA5-1.3, VA5-1.5, VA5-4.3, VA5-6.1

TENNESSEE

Mathematics
Standards for Mathematical Practice: 1, 2, 4, 5, 6
Grade 3: 3.OA.3, 3.NBT.2, 3.MD.2, 3.MD.3, 3.MD.
Grade 4: 4.OA.3, 4.NBT.4, 4.NBT.5, 4.MD.1, 4.MD.2
Grade 5: 5.OA.2, 5.NBT.5, 5.MD.1, 5.MD.5

English Language Arts
Grade 3: RL.1, RL.2, RL.3, RL.4, RI.1, RI.2, RI.3, RI.4, RI.7, SL.1
Grade 4: RL.1, RL.2, RL.3, RL.4, RI.1, RI.2, RI.3, RI.4, RI.7, SL.1
Grade 5: RL.1, RL.2, RL.3, RL.4, RI.1, RI.2, RI.3, RI.4, RI.7, SL.1

Science
Grade 3: GLE 0307.Inq.3, GLE 0307.Inq.4, GLE 0307.2.2, GLE 0307.3.1, GLE 0307.4.1, GLE 0307.5.1, GLE 0307.5.2, GLE 0307.7.1
Grade 4: GLE 0407.Inq.3, GLE 0407.Inq.4, GLE 0407.2.1, GLE 0407.3.2, GLE 0407.5.1
Grade 5: GLE 0507.Inq.3, GLE 0507.Inq.4, GLE 0507.2.1, GLE 0507.2.2, GLE 0507.2.3, GLE 0507.5.1

Social Studies
Grade 3: 3.1, 3.4, 3.9, 3.22, 3.34, 3.42, 3.49, 3.55, 3.67

Arts Education: Visual Art

Grade 3: 1.1, 1.2, 1.3, 1.4. 2.6, 3.1, 4.1, 6.2
Grade 4: 1.1, 1.2, 1.3, 1.4. 2.6, 3.1, 4.1, 6.2
Grade 5: 1.1, 1.2, 1.3, 1.4. 2.6, 3.1, 4.1, 6.2