

Greater Cleveland Aquarium

RIVERS & LAKES – Keeping Our Great Lakes Great

Teacher Guide

Theme: Science & History of the Cuyahoga River

Grade Band: 3-5

Program Length: 3 hours

Overview

Become water quality scientists to investigate the health of the Cuyahoga River. Students explore how Cleveland's industrial history affected animal life in the water. Students conduct hands-on water quality experiments, tour the Ohio Lakes & Rivers gallery, and learn the importance of protecting our waters from pollution.

Goal

Students will gain an understanding of the impact humans have on the environment by investigating the history of the Cuyahoga River. Students utilize project-based science inquiry learning to rate the Cuyahoga River for its ability to sustain life.



Standards: 3rd Grade

Grade	Strand	Topic	Content Statement
3	Science	Inquiry and Application	Observe and ask questions about the natural environment.
3	Science	Inquiry and Application	Employ simple equipment and tools to gather data and extend the senses.
3	Science	Inquiry and Application	Use appropriate mathematics with data to construct reasonable explanations.
3	Earth & Space Science	Earth's Resources	Earth's nonliving resources have specific properties.
3	Earth & Space Science	Earth's Resources	Some of Earth's resources are limited.
3	Life Science	Behavior Growth and Changes	Individuals of the same kind differ in their traits and sometimes the differences give individuals an advantage in surviving and reproducing.
3	History	Historical Thinking and Skills	Events in local history can be shown on timelines organized by years, decades and centuries.
3	History	Historical Thinking and Skills	Primary sources such as artifacts, maps and photographs can be used to show change over time.
3	History	Heritage	Local communities change over time.
3	Geography	Human Systems	Evidence of human modification of the environment can be observed in the local community.
3	Government	Civic Participation and Skills	Members of local communities have social and political responsibilities.
3	Government	Civic Participation and Skills	Individuals make the community a better place by solving problems in a way that promotes the common good.
3	Mathematics	Operation and Algebraic Thinking	Represent and solve problems involving multiplication and division.
3	Mathematics	Measurement and Data	Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects.

Standards: 4th Grade

Grade	Strand	Topic	Content Statement
4	Science	Inquiry and Application	Observe and ask questions about the natural environment.
4	Science	Inquiry and Application	Employ simple equipment and tools to gather data and extend the senses.
4	Science	Inquiry and Application	Use appropriate mathematics with data to construct reasonable explanations.
4	Earth Science	Earth's Surface	Earth's surface has specific characteristics and landforms that can be identified.
4	Life Science	Earth's Living History	Changes in an organism's environment are sometimes beneficial to its survival and sometimes harmful.
4	History	Historical Thinking and Skills	The order of significant events in Ohio and the United States can be shown on a timeline.
4	History	Historical Thinking and Skills	Primary and secondary sources can be used to create historical narratives.
4	Geography	Places and Regions	The economic development of the United States continues to influence and be influenced by agriculture, industry and natural resources in Ohio.
4	Geography	Human Systems	People have modified the environment since prehistoric times. There are both positive and negative consequences for modifying the environment in Ohio and the United States.
4	Geography	Human Systems	Ohio's location and its transportation systems continue to influence the movement of people, products and ideas in the United States.
4	Economics	Economic Decision Making and Skills	Tables and charts help people to understand information and issues. Tables organize information in columns and rows. Charts organize information in a variety of visual formats (pictures, diagrams, graphs).

Standards: 5th Grade

Grade	Strand	Topic	Content Statement
5	Science	Inquiry and Application	Identify questions that can be answered through scientific investigations.
5	Science	Inquiry and Application	Use appropriate mathematics, tools and techniques to gather data and information.
5	Science	Inquiry and Application	Analyze and interpret data.
5	History	Heritage	European exploration and colonization had lasting effects which can be used to understand the Western Hemisphere today.
5	Geography	Human Systems	Variations among physical environments within the Western Hemisphere influence human activities. Human activities also alter the physical environment.
5	Economics	Economic Decision Making and Skills	The choices people make have both present and future consequences.

Objectives

1. Students use a photograph timeline of the history of the Cuyahoga River to compare the river of the past to the river today and to explain how humans have affected the river.
2. Students will be able to discuss the role the Cuyahoga River played in environmental awareness.
3. Students use visual clues to predict the river's water quality and its ability to support animal and plant life.
4. Students use colorimetric water quality tests to analyze river water.
5. Students share data by recording all results on a Google data page and rate the water's quality.

Vocabulary

Cuyahoga	Turbidity	Observation
Phosphate	Quality	Conclusion
Nitrate	Industry	Hypothesis
Dissolved Oxygen	Human Impact	Native
pH	Environmental	Pollution

Pre-Activities

Lessons to help prepare your students and enhance your field trip experience:

1. Meet the Cuyahoga River
 - a. Study the map of the Cuyahoga River Watershed at the end of this guide.
 - i. Locate the river's sources in Geauga County
 - ii. Locate the river's mouth in Lake Erie
 - iii. Trace the path the river flows. Notice it flows south to Akron and then north to Cleveland.
 - iv. Locate your school on the map. Is it within the boundary of the Cuyahoga River Watershed? If not, what watershed is it a part of?
 - v. Locate Cleveland on the map. Explain that this is where the students will be doing the water quality experiments at the aquarium.
 - b. Cuyahoga means "crooked river." Discuss why the Native Americans gave it this name.
2. Match the Terms
 - a. Print and cut out the "Match the Terms" activity from the end of this guide. Have students match the vocabulary term to the definition.
 - b. Facilitate a discussion to define unfamiliar terms.

3. Healthy Lake Sort

- a. Ask students how we know if a lake is healthy or unhealthy? What are some factors we could look at to find out?
- b. Print and cut out the “Healthy Lake Sort” from the end of this guide. Have students sort the items into the Healthy Lake and Unhealthy Lake categories. Answer key is included.
- c. Are these factors the same for a river? Discuss why or why not.

4. Read the original 1969 *Time Magazine* article about the famous Cuyahoga River fire. “America’s Sewage System and the Price of Optimism.”

- a. Email education@greaterclevelandaquarium.com for a copy of the article. We have adapted the article to include pictures of the river and a glossary of difficult vocabulary.
- b. Have students imagine a river burning. How did the river get so polluted?
- c. Discuss how the river has changed since the article was written.

5. Discover pH with a Cabbage Lab

- a. At the aquarium, students use colorimetric tests to determine the quality of the water in the river. This activity will prepare them for the experimental process.
- b. Check out the lab: <http://www.stemmom.org/2013/03/ph-cabbage-indicator-tutorial-and-labs.html>
- c. To view the test kit we use at the aquarium, check out: <http://www.carolina.com/environmental-science-water-quality/lamotte-green-water-quality-monitoring-kit/652567.pr?question=earth+forc>

6. Familiarize the students with the aquarium by viewing the aquarium map and by visiting the Greater Cleveland Aquarium website: www.greaterclevelandaquarium.com

Post-Activities

Lessons for the classroom to help reinforce concepts from your field trip experience:

1. Log the results of your tests on our Google data share.
 - a. To record results: <http://goo.gl/forms/l9bY3L5LnA>
 - b. To view results from other classes:
https://docs.google.com/spreadsheets/d/1MESYeiQpiNGU7H5eH4h5hudVPvEGQghl6jVGi_3Y8yU/edit?usp=sharing

2. Construct a Cuyahoga River Timeline
 - a. Recreate the timeline presented during the field trip. Review how the river changed over time and how people contributed to these changes.
 - b. Have students construct their own timeline of the river. Include a picture of what they think the river will look like in the future.
 - c. For ideas of how to create a timeline:
<http://teachinginroom6.blogspot.com/2013/05/how-do-you-timeline.html>
 - d. For a timeline template: <https://docs.google.com/file/d/0B5-R28AdFXfoTTFaTlplbko5M1k/edit?pli=1>

3. Test the water quality of another body of water. Compare and contrast to the Cuyahoga River.

4. Learn more about how water travels through the watershed.
 - a. Review the water cycle terms evaporation, condensation, precipitation, runoff, etc. Have students create a diagram or map to trace the flow of water.
 - b. Compare this water cycle to the Urban Water Cycle. The Northeast Ohio Regional Sewer District has some great resources:
<http://neorsd.org/products.php>
 - i. Ask us for a class set of Wally Waterdrop Workbooks when you visit the aquarium. We have sets available to take back to the classroom with you.
 - c. Think of ways people can conserve water in our daily lives. Hint: shorter showers, turning off water while brushing your teeth, and keeping trash out of the watershed are a few.

Additional Resources

Cuyahoga River

<http://www.pophistorydig.com/topics/cuyahoga-river-fires/>

<http://www.nps.gov/cuva/cuyahoga-river.htm>

<http://www.epa.gov/greatlakes/aoc/cuyahoga/>

Water Quality

<http://water.usgs.gov/edu/waterquality.html>

http://www.ohionowcast.info/nowcast_cuyahoga.asp



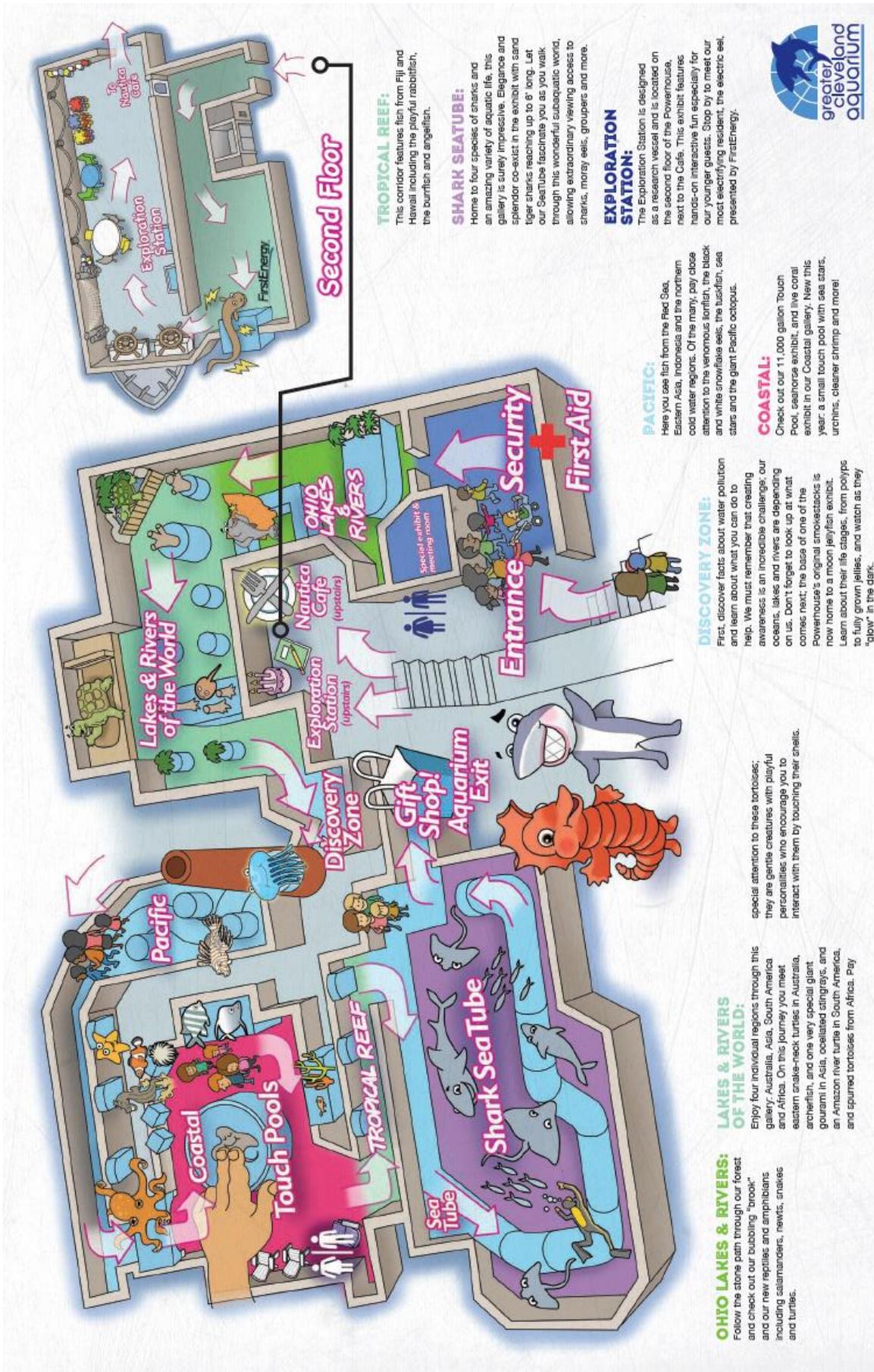
Education Department

Greater Cleveland Aquarium

2000 Sycamore Street

Cleveland, Ohio 44113

www.greaterclevelandaquarium.com



OHIO LAKES & RIVERS:
Follow the stone path through our forest and check out our bubbling "brook" and our new reptiles and amphibians including salamanders, newts, snakes and turtles.

LAKES & RIVERS OF THE WORLD:
Enjoy four individual regions through this gallery: Australia, Asia, South America and Africa. On this journey you meet eastern snake-neck turtles in Australia, garfish, and one very special giant gourami in Asia, coelacated stingrays, and an Amazon river turtle in South America, and spurred tortoises from Africa. Pay

special attention to these tortoises; they are gentle creatures with playful personalities who encourage you to interact with them by touching their shells.

DISCOVERY ZONE:
First, discover facts about water pollution and learn about what you can do to help. We must remember that creating awareness is an incredible challenge; our oceans, lakes and rivers are depending on us. Don't forget to look up at what comes next; the base of one of the Powerhouse's original smokestacks is now home to a moon jellyfish exhibit. Learn about their life stages, from polyps to fully grown jellies, and watch as they "glow" in the dark.

COASTAL:
Check out our 11,000 gallon Touch Pool, seahorse exhibit, and live coral exhibit in our Coastal gallery. New this year, a small touch pool with sea stars, urchins, cleaner shrimp and more!

PACIFIC:
Here you see fish from the Red Sea, Eastern Asia, Indonesia and the northern cold water regions. Of the many, pay close attention to the venomous lionfish, the black and white snowflake eels, the busfish, sea stars and the giant Pacific octopus.

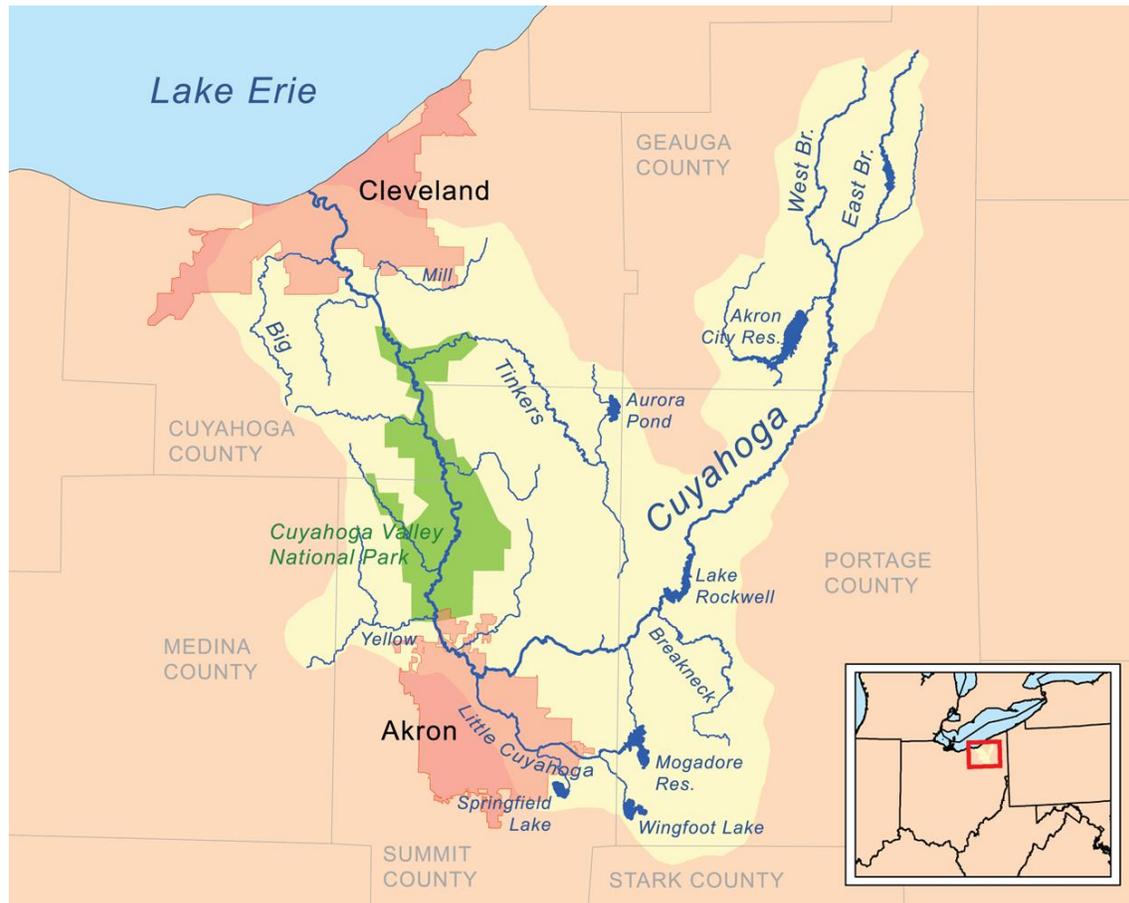
EXPLORATION STATION:
The Exploration Station is designed as a research vessel and is located on the second floor of the Powerhouse, next to the Café. This exhibit features hands-on interactive fun especially for our younger guests. Stop by to meet our most electrifying resident, the electric eel, presented by FirstEnergy.

TROPICAL REEF:
This corridor features fish from Fiji and Hawaii including the playful rabbitfish, the burritin and angelfish.

SHARK SEATUBE:
Home to four species of sharks and an amazing variety of aquatic life, this gallery is surely impressive. Elegance and splendor co-exist in the exhibit with sand tiger sharks reaching up to 8' long. Let our Seatube fascinate you as you walk through this wonderful subaquatic world, allowing extraordinary viewing access to sharks, moray eels, groupers and more.



Cuyahoga River Watershed



Match the Terms

Turbidity	Cloudiness of water	Nitrate	Plant nutrient
Dissolved Oxygen	Oxygen in the water	Temperature	Warm or Cold
Phosphate	Plant nutrient	Pollution	Things that harm nature
PH	Acid or Base	Quality	Health of the water

Healthy Lake Sort

Cut apart and divide these terms into the correct category.

Signs of a Healthy Lake		Signs of an Un-Healthy Lake	
green algae	foamy waves	oxygen	raw sewage
phosphorus	water snake	blue-green algae	bald eagle
sand grass	bad smell	lake trout	cloudy water
Asian Carp	floating trash	zebra mussel	sea gulls

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