



Missouri River Detectives

Lesson 1

Lesson Title: Are There Sharks in the Missouri River?

Grade: 4th

Theme: Adaptations Help Fish Survive in the Missouri River

Topic: Claim, Evidence, Reasoning, and Structural Adaptations

Length: 30 minutes

Overview: In this lesson, students will investigate whether it's possible for sharks to live in the Missouri River based on adaptations of fish that currently live in the river. In the activity, students will explore and compare fish mouths and discover how different mouth sizes and shapes allow for survival in the Missouri River. Students will then construct an argument using claims, evidence, and reasoning on the relationship between mouth size and shape and the niche of the fish.

Student Outcomes:

- Understand that adaptations are structures that help fish survive in the Missouri River.
- Know whether evidence is relevant and sufficient to support a claim about the primary function of certain structures that help fish to survive in the Missouri River.
- Be able to make a claim that is supported by evidence and reasoning on how structures help fish survive in the Missouri River.

Next Generation Science Standards: 4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

Getting Ready:

- Materials: Projector, computer, speakers, and pens/pencils for students.
- What to Print:

Number of Copies	Item to Print	Page #
# of Students	Missouri River Detectives: Lesson 1 Worksheet	Attached

- Open the Missouri River Detectives: Lesson 1 video file and have lesson plan available for reference. The video is **(13:48)** minutes in length.
 - Be sure that the computer device and projector used to display the Missouri River Detectives: Lesson 1 video has a working audio system.

- **Space Requirements:** It is best to have the classroom arranged in a way that allows space for students to be able to view the screen and be able to work on and reference the accompanying worksheet.

Background Information:

- **Evidence, Claim, Reasoning:** A claim is a statement of a student’s understanding about a phenomenon or about the results of an investigation. Evidence uses scientific data to support a claim. Evidence must be sufficient (there must be enough of it to support the claim), appropriate (is relevant), and is either qualitative (thoughts) or quantitative (numbers). Reasoning ties together the claim and the evidence by showing how or why the data counts as evidence to support the claim.

SCRIPT:

Slide 1: Introduction Title Page

Slide 2: Sharks in the River?

A question that we are often asked when we take students on the river is “Are there sharks in the Missouri River?” If you Google sharks in rivers, you may see some articles and headlines like this one. This is a story about a man finding a shark in the Osage River which is just below Jefferson City, Missouri. Have you ever heard about someone catching a shark in the river? It can seem convincing, but when looking for the original source, most of the articles and new sites linked back to each other. Further inspection reveals that this story was a hoax.

Slide 3: Sharks in the River? Cont.

Reliable sources are very important when it comes to being a Missouri River Detective. Here is another well-known river shark story. Look and see when this article was published. Yep, that’s right, it was published on April 1st as an April Fool’s joke. The author even included a note at the end of the article as pictured here.

When asked the question of whether or not there are sharks in the Missouri River, many people think of these fictional stories. They do not have reliable sources and are not able to provide a scientific explanation for why sharks might be in the Missouri River beyond the joke articles.

Slide 4: What is a Scientific Explanation?

Before we address the question of whether or not there are sharks in the Missouri River, we need to know how to form a scientific explanation.

Scientific explanations start with a claim, which is what you think. A claim is a statement that can be supported or not supported by evidence. It is NOT a personal opinion, such as “pepperoni pizza is better than mushroom pizza.”

The evidence that supports this claim is all of the data and observations that make you think the claim is true.

Reasoning connects the claim and evidence together and justifies why the evidence is related to the claim. It is the *reason why* this make sense. Reasoning often makes an argument stronger and more easily understood.

Slide 5: Claim, Evidence, Reasoning

When you combine your Claim, Evidence and Reasoning, it adds up to be a Scientific Explanation.

As for sharks in the river, first, we must make a Claim. Our Claim is that, “Sharks do not live in the Missouri River.” Next, we must take a look at our Evidence and Reasoning.

Slide 6: What Shark Will We Investigate?

Most of these stories reference a very specific type of shark, the Bull Shark. So, is it even possible for a Bull Shark to live in the Missouri River? Let’s check out some Bull Shark Facts!

What do we know about Bull Sharks?

Slide 7: What Do We Know About Bull Sharks? Cont.

The reason many of these stories use a Bull Shark is that they are a species of shark that can survive in fresh water. Most shark species can only live in salty ocean water, so it would be impossible for them to survive in the freshwater of the Missouri River.

Another reason that so many of these stories use a Bull Shark is that one was reportedly found in the *Mississippi River* in 1937 near Alton, Illinois. Alton, Illinois is just north of St. Louis, Missouri.

How would a Bull Shark have gotten all the way to Alton, Illinois in 1937? Let’s take a look at the known location of Bull Sharks around North America.

Bull Sharks prefer warm, shallow waters along the coast. The highlighted red area shows regions where Bull Sharks can be found. For a Bull Shark to end up in Illinois, they would most likely have to swim all the way up the Mississippi River, starting down here in the Gulf of Mexico. If we think back to our question, we are looking into whether or not there are Bull Sharks in the Missouri River. The Missouri River starts here and travels all the way to the Mississippi River here, ending in St. Louis. It’s really far away from any warm coastlines.

Slide 8: What is an Adaptation?

One could say that Bull Sharks are adapted to living along coastlines in the ocean. Adaptations are helpful physical or behavioral traits that make it easier for an animal to survive in a specific habitat.

We are going to compare and contrast some of the adaptations that fish who live in the Missouri River and the Bull Shark possess that make them well suited for their habitat. One body part that we will be focusing on is the mouth.

Fish mouths determine how a fish eats, where a fish eats, and what a fish eats. We will also be looking at how they respond to different water temperatures.

Slide 9: What Are the Mouth Types?

The key to being a Missouri River Detective means being organized! Our adaptation clues for Missouri River fish mouth types can be found on your worksheet. Follow along as we study each of these mouth types. Then we will be able to investigate the Missouri River fish that we know have these mouth types.

Sucker Mouths are adapted to suctioning algae and small creatures off of rocks for food. They are often referred to as “Bottom Feeders” as they can be found at the bottom of rivers and lakes.

Clamper Mouths are adapted to clamping their mouth down on small fish. These mouths often have teeth that trap or bite into the prey. Normally their bottom jaw is the only part that moves to clamp onto smaller fish that can be swallowed.

Filter Feeder Mouths are adapted to filter tiny pieces of food such as plankton out of the water. These fish often swim around with a wide-open mouth in order to filter as much water as possible.

Slides 10-14: Missouri River Fish Examples

We are going to be looking at some really neat fish like the Smallmouth Buffalo, the Paddlefish, the Blue Catfish, the Alligator Gar, and the Pallid Sturgeon. Each of these river fish have very different looking mouths, which makes it fun to compare them!

Slide 15: Missouri River Fish Mouth Categorization

Here is the mouth of a Smallmouth Buffalo, what do you notice? Are there teeth? The Smallmouth Buffalo has a Sucker Mouth, it suctions its lips to a hard surface in order to eat algae and small organisms.

Next is the Paddlefish. Take a look at its face! Can you guess how it got its name? Which mouth type requires the fish’s mouth to be wide open? The Paddlefish has a Filter Feeder Mouth.

A lot of people don’t know that Blue Catfish have teeth and often eat smaller fish. What type of mouth could it have? That’s right, a Clamper Mouth.

What about the Alligator Gar? Take a look at that fish mouth! Alligator Gars also have Clamper Mouths. With teeth like those, I don’t think many fishies would be able to escape.

Finally, what type of mouth does a Pallid Sturgeon have? It can be hard to tell, I don't see any teeth and their mouths are on the underside of their body, so it would be difficult to be a Filter Feeder. Pallid Sturgeon have a Sucker Mouth. The location of the mouth on the underside of the body makes it perfect for Bottom Feeding.

Slide 16: Which Mouth Type Does a Bull Shark Resemble the Closest?

Which of the three mouth types we've talked about does a Bull Shark's mouth resemble the most? Do Bull Sharks have teeth? What do they eat? Is it possible that a Bull Shark has a different mouth type altogether? Circle the mouth type on your table provided in your worksheet.

Slide 17: Bull Shark Mouth Type

Here's an up close picture of a Bull Shark's mouth. I am sure that many of you circled "Clamper" on your worksheet. And you would be right in thinking that a Bull Shark's mouth looks most similar to the Clampers of the Missouri River. The big teeth and jaws waiting to catch some prey. But there are some differences between a Bull Shark's mouth and our Missouri River Clamper mouths.

However, unlike Missouri River Clampers, who can only move their bottom jaw to clamp down on their small prey, Bull Sharks are able to move both their top and bottom jaws. This allows them to "grab" prey, which can be much larger than the shark, and tear off a bite. Speaking of prey and predator, how does the difference between mouthtypes determine interactions between fish in the water?

Slide 18: Mouth Type Determines Place in the Food Web

The type of mouth a fish has determines where it exists in a food web. A food web shows us what something eats. It can be a very detailed food web, or a simple one with only a few animals. Here is an example of a food web starting with a small crayfish. Fish with Sucker Mouths, like the Smallmouth Buffalo, feed on small crayfish and algae at the bottom of the rivers. Blue Catfish prefer large, fast moving rivers and have clampers that allow them to grab onto smaller prey and trap them. The Alligator Gar also uses clampers to catch smaller fish and even birds. This means that the Alligator Gar can eat not only the Blue Catfish, but any small fish that can be caught in its teeth, including the Smallmouth Buffalo.

Slide 19: What does a Bull Shark Eat?

Much like the Alligator Gar and Blue Catfish, Bull Sharks are top predators in their habitat. Their prey often consists of bony fish, dolphins, sea turtles, other sharks and schooling fish like the ones pictured here.

Unlike the Missouri River Clampers who prey on small fish, Bull Sharks are used to eating larger prey which are plentiful in the coastal waters but harder to come by in freshwater rivers. If a Bull Shark swam up from the Gulf of Mexico, they would have to

work harder sniffing out enough prey in the fast moving currents of the Missouri River compared to the more bountiful, shallow coastlines.

Slide 20: Design Your Fish (*PAUSE at 10:55*)

Draw a picture of a fish that you think might live in the Missouri River. Include what you learned about fish mouths and draw which type of mouth this fish has. You can use the drawings in your table as inspiration.

10:55 - (*Give students time to make their drawings. Have students share with their peers should there be enough time.*)

Slide 21: Location Reflection Slide

All the fish that we've talked about today typically live in one of these two locations, the Missouri River or the Ocean. Fish like the Pallid Sturgeon, Alligator Gar, Smallmouth Buffalo, Paddlefish, and Blue Catfish all can be found in the fast moving Missouri River. Meanwhile, Bull Sharks are normally found in the Ocean in shallow waters with gentle currents. Think about each location, what do you notice about the habitat of these fish? Think about the climate and weather. What happens to the Missouri River that doesn't happen to warm coastal oceans?

Slide 22: Climate of Habitat (Where fish live and hunt)

That's right! The waters of the Missouri River can get cold and even begin to freeze. This is what the Missouri River looks like during the winter months. Brrrrr! Our local fish are adapted to surviving these seasonal temperature changes ranging from freezing to warm. Many of them become less active during winter months in order to save up just enough energy to maintain a liveable body temperature. Bull Sharks, on the other hand, are only found in waters with a temperature of 68 degrees Fahrenheit and above. The Missouri River only reaches these high temperatures during the Summer months before plummeting down to the 30s during late fall and winter months. These temperatures are deadly to tropical fish.

Would a river with noticeably changing seasons be a good place for a Bull Shark to live?

Slide 23: Design Your Scientific Explanation (*OPTIONAL PAUSE*)

Now it's time to use our claim, evidence, and reasoning, to come up with an explanation to the question: "Are There Sharks in the Missouri River?"

Be sure to write your answer down on your worksheet in the space provided. Use your best Missouri River Detective skills to come up with your explanation.

(There is some time built into the video for discussion at this slide, teachers are welcome to pause the video in order to allow students more time.)

Slide 24: Conclusion

Next time you hear people talk about if they think sharks are in the Missouri River, you can use this explanation to tell them why they're not!

Thank you all for joining Missouri River Relief on this investigation into whether or not there are sharks in the Missouri River. You are well on your way to becoming an official Missouri River Detective. See you on the River!

Slide 25: Credits

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 - Blue Catfish by Ohio River Catfishing
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 - Blue Catfish Mouth by Alan Wolf
 - Paddlefish Mouth by Rob Holm of USFWS
 - Alligator Gar Mouth by FWC Fish and Wildlife Research Institute
- **Fake Shark Stories:**
 - <https://channel45news.com/2019/10/big-fish-story-causes-alarm-in-ozarks-river/>
 - https://missoulian.com/news/state-and-regional/we-got-you-good-the-details-behind-the-ir-fake-shark-story-that-went-viral/article_cec7c3a5-b815-5f8c-a639-81c082065bb0.html

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