



# Readings in Hudson River Natural History

*Students will practice English language arts skills by listening to or reading and then responding to short articles about Hudson River nature, science, and history.*

**Objectives:** Students will respond to articles in ways that require:

- reading, listening, and writing for information and understanding;
- understanding scientific concepts, principles, and theories pertaining to the physical setting and living environment.

**Grade level:** Elementary (Grades 3-5)

**Subject Areas:** English Language Arts, Science

**New York State Learning Standards:**

English Language Arts Standard 1

Mathematics, Science, & Technology Standard 4

**Skills:**

- Read and listen to acquire facts and ideas from texts.
- Gather and organize information about organisms and environmental phenomena.
- Write to interpret, apply, and transmit information.

**Duration:**

Preparation time: 5 minutes for each reading

Activity time: 20-40 minutes for each reading

**Materials:** Each student should have:

- ☐ A copy of the selected article
- ☐ Pencil or pen

**Background:**

The articles in this collection allow teachers to integrate instruction in reading and writing with study of the Hudson River. Their content relates to organisms, events, and phenomena addressed in other lesson plans included in the Hudson River Estuary Program's curriculum offerings. For example, the articles "The Atlantic Sturgeon of the Hudson River" and "Blue Claw" may be assigned to students who are also working on the math skills lessons "On the Trail of the Hudson's Migratory Fish" and "On the Trail of the Blue Crab." The article "From the Mountains to the Sea" is intended to serve as a general introduction to study of the Hudson. Similar lessons for kindergarten to third grade are available at <http://www.dec.ny.gov/education/77601.html> ; they offer simple activities as well as questions on the readings.

**Activity:**

1. Introduce the topic covered in the article.
2. The articles can be read aloud to the class to practice listening skills or assigned as student reading, either in class or as homework.
3. The questions associated with each articles may likewise be covered with the class, or given out as in-class work or homework.

**Assessment:**

- Assess comprehension by having students share answers to questions about the articles, or collect and grade sheets.
- Make up additional questions about the content of the articles.

**Resources:**

These children's books cover the Hudson and related topics.

- Locker, Thomas. *Where the River Begins*. Puffin Books, New York: 1993. Appropriate for ages 4-8.
- Lourie, Peter. *Hudson River: An Adventure From the Mountains to the Sea*. Boyds Mill Press, Honesdale, Pennsylvania: 1998. Appropriate for ages 9-12.
- McKinney, Barbara. *A Drop Around the World*. Dawn Publications, Nevada City, California: 1998. Appropriate for ages 4-8.
- Wallace, Karen. *Think of an Eel*. Candlewick Press, Cambridge, Massachusetts: 2004. Appropriate for ages 4-8.
- Whitcraft, Melissa. *The Hudson River*. Franklin Watts, a Division of Grolier Publishing, New York: 1999. Appropriate for ages 9-12.

## Vocabulary List:

**adapt:** to develop a way of dealing with conditions in a particular environment;

**adaptation:** a feature that allows an organism to deal with environmental conditions

**alien:** an organism from another part of the world

**anadromous:** lives in salt water but migrates back to freshwater to spawn

**bay:** an inlet or small body of water set off from the main body

**behavioral adaptation:** an adaption involving the way an animal acts

**brackish:** mixture of fresh and salt water

**brook:** a small stream

**burrow:** to dig a tunnel for shelter; also the tunnel itself

**camouflage:** colors and patterns that let animals blend in with their surroundings

**canal:** a manmade waterway for boats

**characteristic:** a special quality or appearance that makes an individual or group different from others

**current:** water moving continuously in a certain direction

**dam:** a barrier that holds water behind it

**displace:** to take the place of

**downstream:** in the direction a stream is flowing

**estuary:** a body of water in which fresh and salt water meet

**evergreen:** a tree with leaves that remain green all year round

**explorer:** one who travels in search of new geographic or scientific information

**fin:** a thin extension of a water-living animal's body, used in guiding its movement

**fresh water:** water that is not salty (rainwater is fresh water)

**gill:** in fish and other animals living in water, an organ used to draw oxygen from water

**habitat:** the particular sort of place where a given plant or animal lives

**harbor:** a body of water protected and deep enough to be a safe place for ships

**intertidal zone:** an area covered by water at high tide and uncovered at low tide

**invasive:** likely to spread and take over

**invertebrate:** an animal without a backbone

## **Vocabulary List (continued):**

**lock:** a water-filled enclosure used to lift or lower boats over a dam or along a canal

**marsh:** an area of shallow water with many plants growing through the water's surface

**microscope:** an instrument that uses lenses to magnify images of very small objects

**migrate:** to move from one place to another

**molt:** to shed the shell covering the body and legs

**native:** an organism born in a particular place, not brought there from elsewhere

**organism:** an individual living thing (plant, animal, bacteria, etc)

**oxygen:** a colorless, odorless gas found in the air and also dissolved in water; animals require it to breathe

**permanent:** unchanging; lasting

**photosynthesis:** process in which green plants use sunlight to make the chemical substances that sustain them

**physical adaptation:** an adaptation involving the form of an organism

**pier:** structure built out into the water for use as a docking place or walkway

**predator:** an animal that eats other animals

**rapids:** part of a river that flows fast over and around rocks that break the surface

**repel:** to resist and push away

**river:** a natural stream of water larger than a brook or creek

**salt water:** seawater or other water that contains salt

**school:** a number of fish swimming together as a group

**scientist:** a person skilled in science

**sea level:** the average height of the ocean

**seawater:** salty ocean water

**senses:** parts of an organism that make it aware of its surroundings; usually sight, smell, taste, hearing, touch

**shoreline:** the line where a body of water touches the shore

**spawn:** to lay eggs; usually refers to animals that live in water

**spiny:** having stiff, thorn-like points

**stream:** a small body of running water

## **Vocabulary List (continued):**

**symbol:** something that stands for something else

**threatened:** an animal or plant that exists in such low numbers that care must be taken to keep it from dying out

**tidepool:** a pool of water left when the tide recedes

**tides:** the alternate rising and falling of the surface of the ocean

**transmitter:** a device that sends out signals

**transparent:** see-through

**upstream:** in the direction from which a stream is flowing

**voyage:** a journey, usually by water, from one place or country to another

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# From the Mountains to the Sea: ANSWER KEY

1. This article is **mostly about**
  - a. how people use the Hudson River
  - b. the kinds of fish that live in the Hudson River
  - c. the course of the Hudson River**
  - d. Lake Tear of the Clouds
2. Where did the Hudson River get its name?
  - a. from an explorer**
  - b. from a Native American
  - c. from a fish found in the sea
  - d. from an estuary
3. What is an **estuary**?
  - a. a stream with rapids and waterfalls
  - b. a place where fresh water and salt water mix**
  - c. a kind of ship
  - d. a water route to Asia
4. Where does the Hudson River begin its journey?
  - a. the City of Troy
  - b. the Adirondack Mountains**
  - c. the Hudson Highlands
  - d. the Atlantic Ocean
5. Do you think the Hudson goes over any waterfalls between the dam at Troy and the Atlantic Ocean? Why or why not?  
**No waterfalls. The Hudson is at sea level from Troy to the Atlantic; tides go all the way to the Troy dam.**
6. **Challenge question:** Why do you think Henry Hudson decided that this river did not lead all the way to China?  
**The river water changed from being salty like seawater to being fresh. Rapids and waterfalls blocked Hudson's ship.**

# Atlantic Sturgeon of the Hudson River: ANSWER KEY

1. This article is **mostly about**
  - a. fish that lay eggs
  - b. a fish called the Atlantic sturgeon**
  - c. different shapes and sizes of fish
  - d. striped bass and American shad
  
2. What does it mean to be an **anadromous** fish?
  1. a fish that eats at the bottom of the river
  2. a fish that lives more than sixty years
  3. an animal living in the water
  - 4. a fish that migrates between fresh water and the ocean**
  
3. What does it mean for fish to **spawn**?
  - a. fish swim to the ocean
  - b. fish swim into the Hudson River
  - c. fish lay eggs**
  - d. fish eat crabs, mussels, worms, and insects
  
4. According to the article, which of these statements are true?
  - a. The Atlantic sturgeon is the largest fish in the Hudson. **\_\_\_ TRUE \_\_\_**
  - b. The Atlantic sturgeon spawns in the Atlantic Ocean. **\_\_\_ FALSE \_\_\_**
  - c. The Atlantic sturgeon dies after spawning only once. **\_\_\_ FALSE \_\_\_**
  - d. The Atlantic sturgeon is an anadromous fish. **\_\_\_ TRUE \_\_\_**





# Bald Eagles of the Hudson River: ANSWER KEY

1. What is this article **mostly** about?

- a. migration
- b. the bald eagle**
- c. fish
- d. the Hudson River

2. Which definition best describes **migration**?

- a. to stay in one place
- b. to live on the Hudson River
- c. to move from one place to another**
- d. to find plenty of food

3. According to the article, how many days would it take an eagle to migrate 1,000 miles between its nesting area in Canada and its winter home on the Hudson?

***Eagles may travel up to 100 miles in a day, so it would take 10 days. Younger students can count by 100s to find the answer. Older students might use multiplication or division.***

4. Why do you think bald eagles cannot find their favorite food in northern Canada during the winter?

***Ice prevents eagles from catching fish.***

5. **Challenge question:** Hold your arms straight out to both sides. Have a partner use a tape measure to measure the distance between your fingertips - your "wingspan." Is your wingspan more or less than an eagle's? How much more or less?

***An eagle's wings may measure seven feet from tip to tip. (It may be helpful to convert feet to inches first - seven feet equals 84 inches.) If a student's "wingspan" is less than an eagle's, subtract it from seven feet to find out how much less. In the (unlikely) event that a student's wingspan exceeds an eagle's, subtract seven feet from the student's wingspan to find out how much greater the student's wingspan is.***

# The Eel's Incredible Journey: ANSWER KEY

1. This article is **mostly about**
  - a. the Sargasso Sea.
  - b. *the life cycle of the American eel.***
  - c. different shapes of fish.
  - d. glass eels.
2. Based on the article, when an eel's color turns silvery, the fish is ready to
  - a. migrate from the Sargasso Sea to the coast of North America.
  - b. become an elver.
  - c. *migrate to the Sargasso Sea to spawn.***
  - d. swim up rivers into fresh water.
3. Scientists know that the eel **spawns** in the Sargasso Sea because
  - a. *that is where the smallest baby eels are found.***
  - b. silver eels have been caught there.
  - c. eel eggs have been found there.
  - d. elvers have been seen there.

4. According to the article, which of the following statements are true?
  - a. The American eel is a kind of snake. **FALSE**
  - b. American eels live in both fresh and salt water. **TRUE**
  - c. Some American eels live for more than twenty years. **TRUE**
  - d. Glass eels are brown, green, or yellow in color. **FALSE**

5. Do you know of any other fish that migrate?

***The Atlantic sturgeon (subject of another ELA article in this lesson plan series), striped bass, and American shad are among the Hudson River fish that migrate. Some students will likely be familiar with the migration of salmon, which are not native to the Hudson.***

## Blue Claw! ANSWER KEY

1. Including claws and paddles, how many legs does a blue crab have?  
*Ten.*
2. As a crab **molts**, which of the following things happen?
  - a. Its body grows larger.
  - b. It sheds its shell.
  - c. Its body becomes soft.
  - d. *All of the above things happen.*
3. The blue crab's large claws are used for
  - a. *catching food and defending itself.*
  - b. swimming.
  - c. walking.
  - d. molting.
4. According to the article, which of the following sentences are true?
  - a. Blue crabs can swim. TRUE
  - b. When molting, the body of a blue crab may change form. TRUE
  - c. A tiny baby blue crab looks like its parents. FALSE
5. **Challenge question:** When going out to eat seafood, you might see soft-shelled crabs listed in the menu. These are actually blue crabs, not a different kind of crab. These crabs would just have gone through what part of their life cycle? Use facts from the article to explain your answer.  
*Soft-shelled crabs are adult crabs that have just molted. Their bodies feel like soft rubber. People who are very familiar with blue crabs can recognize crabs that are about to molt, and larger seafood companies will keep these crabs in holding pens. When they molt, these crabs are sold as soft-shelled crabs.*

# Adaptations - Designs for Survival: ANSWER KEY

1. What is an **adaptation**?

*Something that helps an organism do the things it must do to survive in its environments.*

2. Give two examples of animal adaptations from the article. Explain how each helps the animal survive.

*Catfish whiskers have taste buds that allow the fish to find food in the dark. The patterns and colors of an owl's feathers allow the bird to blend in with its surroundings. Monarch butterflies have warning coloration to remind predators of their bad taste. Monarchs also migrate to avoid winter. Shad swim in schools, in which the large number of swirling fish can confuse predators.*

3. Is each of the following a **physical** or **behavioral** adaptation?

(All of these organisms live in the Hudson Valley.)



(a) a map turtle's shell.

*A physical adaptation that protects the turtle's body.*



(b) beavers building dams.

*A behavioral adaptation that creates ponds to shelter the beaver from predators.*



(c) prickly pear cactus spines.

*A physical adaptation that protects the cactus from being eaten or disturbed by large animals.*



(d) a black bear's deep winter sleep.

*A behavioral adaptation for surviving winter.*

# Adapting to Estuaries: ANSWER KEY

1. This article is **mostly about**
  - a. plants of the Hudson River
  - b. how animals and plants adapt to habitats in the Hudson estuary**
  - c. the tides in the Hudson River
  - d. fish migration
2. Which of the following cause conditions in Hudson River **habitats** to change?
  - a. tides
  - b. seasons
  - c. salty seawater entering the estuary
  - d. all of the above**
3. Fill in the blank to complete the following sentences.
  - a. Barnacles close their shells to keep water inside when the tide is low.
  - b. Yellow perch live in fresh water.
  - c. The osprey migrates south when winter comes to the Hudson.
  - d. Spatterdock plants can survive being covered with water at high tide and exposed to the air at low tide.
4. According to the article, why do plants grow where they do in the Hudson?  
***Where a plant grows along the Hudson depends on how well it can survive being flooded at high tide or being out in the air at low tide.***

5. **Challenge questions.** Extend what you learned from the article to answer questions about the Hudson River animals pictured below. Explain your answers.



- a. Where does the map turtle spend the winter?  
***This turtle burrows into the mud of the river bottom.***



- b. The pearly mussel breathes underwater. How does it survive being exposed to the air at low tide?  
***At low tide, it closes up tight to keep water inside its shell.***



- c. The green heron eats fish and frogs. When winter comes, what does it do to survive?  
***The heron migrates south to places where ice doesn't cover the water in winter.***

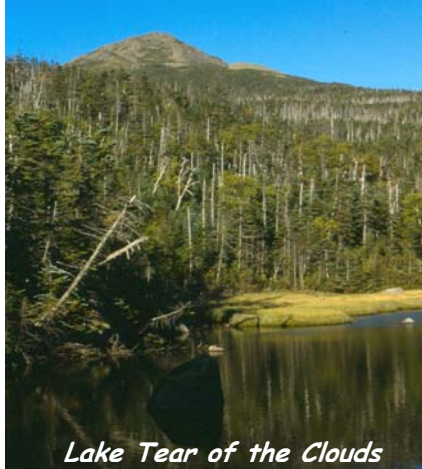


## Alien Invasion! ANSWER KEY

1. This article is **mostly about**
  - a. aliens from outer space.
  - b. ***an invasive plant.***
  - c. animals that live in water chestnut mats.
  - d. the dangers of water chestnut seeds.
2. What does it mean to be an **alien species**?
  - a. one that damages the environment.
  - b. one that lives in Europe or Asia.
  - c. one that is invasive.
  - d. ***One that grows in a place where it didn't live until people brought it there.***
3. Water chestnut is an **invasive** species because
  - a. ***it displaces native plants that grow in shallow waters of the Hudson.***
  - b. the spines of the water chestnut seed can stab people's feet.
  - c. it comes from Europe and Asia.
  - d. its leaves float on the surface of the water.
4. According to the article, which of these statements are true?
  - a. It is dark beneath thick mats of water chestnut leaves. **\_\_\_TRUE\_\_\_**
  - b. Many insects, crustaceans, and worms live on water chestnut. **\_\_\_TRUE\_\_\_**
  - c. Water chestnut is found in salt water. **\_\_\_FALSE\_\_\_**
  - d. "Devil's heads" are the seeds of the water chestnut plant. **\_\_\_TRUE\_\_\_**

Read the following article and answer the questions.

## From the Mountains to the Sea



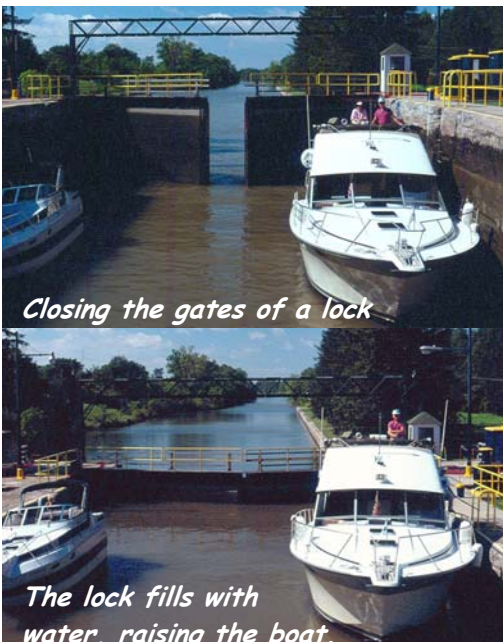
*Lake Tear of the Clouds*

High in the Adirondack Mountains, surrounded by **evergreen** trees, is a little pond called Lake Tear of the Clouds. The tiny **brook** that flows from Lake Tear is starting a journey 315 miles long. Joining with many other **streams**, it will become the mighty **Hudson River** flowing to New York Harbor.

At first, the Hudson rushes downhill over waterfalls and **rapids**. The water from Lake Tear drops 4,000 feet as its **course** winds through the Adirondacks to the city of Glens Falls.



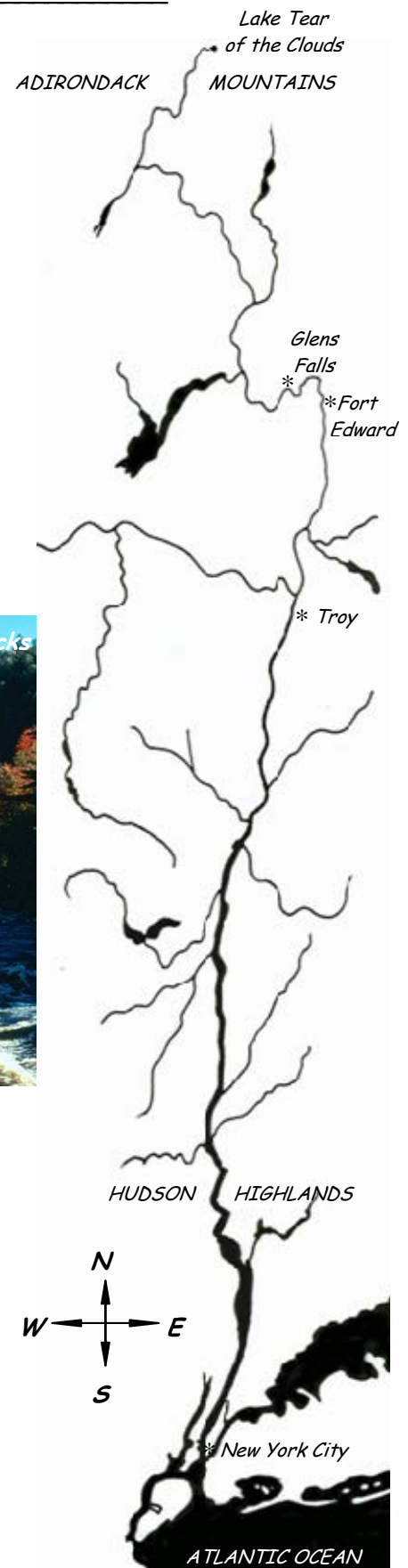
*The Hudson in the Adirondacks*



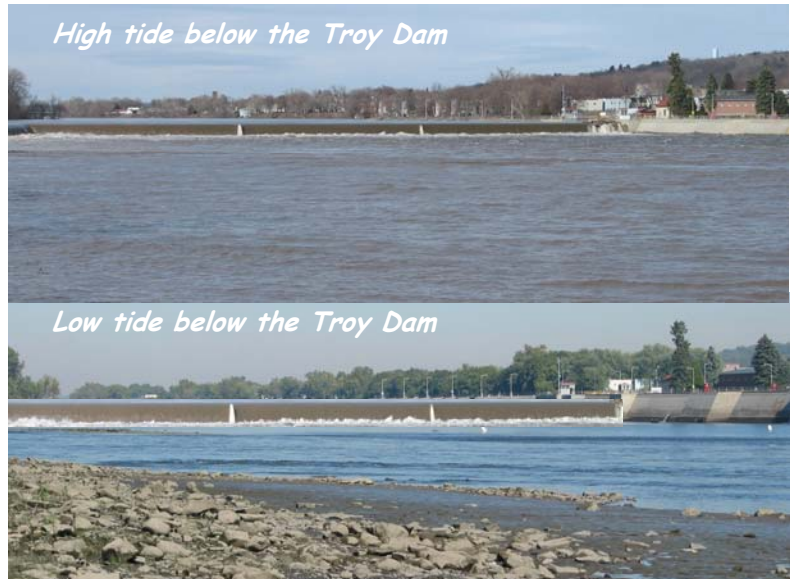
*Closing the gates of a lock*

*The lock fills with water, raising the boat.*

In Fort Edward, a few miles south of Glens Falls, the Hudson becomes a **canal**. The river flows **downstream** over a set of **dams**, each with a **lock** that raises or lowers boats from one section of the river to the next.



The last of these dams and locks is at Troy. When the Hudson goes over this dam, it drops almost to **sea level**. Even though the Atlantic Ocean is more than 150 miles away, it influences the river all the way to Troy. The water level here goes up and down with ocean tides. These are the same high and low tides that affect beaches on Long Island and the New Jersey shore.



Closer to the Atlantic, the river flows through mountains called the Hudson Highlands. Here the ocean starts to influence the Hudson in another way. **Seawater** pushes into the Hudson and mixes with **fresh water**, making the river taste slightly salty. This mix of salt and fresh water is called **brackish water**. Places where this mixing occurs are called **estuaries**.



The Hudson River estuary becomes saltier as it nears New York City and the Atlantic Ocean. Here people catch flounder and other fish of the sea. Cruise ships sail in from the ocean to dock at river **piers**.

Perhaps the estuary's brackish water and tides gave the **explorer** Henry Hudson hope that this river would lead to the Pacific Ocean and China. He sailed up the river on his ship the *Half Moon* in 1609. He was disappointed in the end, but his voyage was remembered. This great river flowing from the Adirondacks to the Atlantic was named after him.



Name \_\_\_\_\_ Date \_\_\_\_\_

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  - a. how people use the Hudson River
  - b. the kinds of fish that live in the Hudson River
  - c. the course of the Hudson River
  - d. Lake Tear of the Clouds
2. Where did the Hudson River get its name?
  - a. from an explorer
  - b. from a Native American
  - c. from a fish found in the sea
  - d. from an estuary
3. What is an **estuary**?
  - a. a stream with rapids and waterfalls
  - b. a place where fresh water and salty ocean water mix
  - c. a kind of ship
  - d. a water route to Asia
4. Where does the Hudson River begin its journey?
  - a. the City of Troy
  - b. the Adirondack Mountains
  - c. the Hudson Highlands
  - d. the Atlantic Ocean
5. Do you think the Hudson goes over any waterfalls between the dam at Troy and the Atlantic Ocean? Why or why not?
6. **Challenge question:** Why do you think Henry Hudson decided that this river did not lead all the way to China?

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*Read the following article and answer the questions.*

## The Atlantic Sturgeon of the Hudson River



The Atlantic sturgeon is the largest fish in the Hudson **River**. Adults are often five to eight feet long. Is that bigger than you are? The biggest Atlantic sturgeon on record was caught in Canada. Fourteen feet long, it weighed eight hundred pounds! That equals the weight of 15 fourth graders!

Sturgeons have rows of bony plates along their bodies, and a mouth like a vacuum cleaner. They eat crabs, mussels, worms, and insects on the bottom.

The Atlantic sturgeon is born in **fresh water** and spends the first years of its life in the Hudson. Then this fish swims out into the Atlantic Ocean. **Scientists** know little about how the sturgeon spends its time at sea except that it does travel far. Hudson River sturgeons have been found as far south as North Carolina and as far north as Massachusetts.

When Atlantic sturgeons are teenagers, they swim back up the Hudson into fresh water. There they lay eggs; this behavior is called **spawning**. Then the fish return to the ocean. This journey back and forth between river and sea is an example of **migration**. Atlantic sturgeons repeat this migration every three years for the rest of their lives. They can live more than sixty years.

Like the Atlantic sturgeon, the Hudson's striped bass and American shad are born in fresh water, swim out into the ocean, and then migrate back to the river to spawn. This is called an **anadromous** life cycle.

1. This article is **mostly about**
  - a. fish that lay eggs
  - b. a fish called the Atlantic sturgeon
  - c. different shapes and sizes of fish
  - d. striped bass and American shad
2. What does it mean to be an **anadromous** fish?
  - a. a fish that eats at the bottom of the river
  - b. a fish that lives more than sixty years
  - c. an animal living in the water
  - d. a fish that migrates between fresh water and the ocean
3. What does it mean for fish to **spawn**?
  - a. fish swim to the ocean
  - b. fish swim into the Hudson River
  - c. fish lay eggs
  - d. fish eat crabs, mussels, worms, and insects
4. According to the article, which of these statements are true?
  - a. The Atlantic sturgeon is the largest fish in the Hudson. \_\_\_\_\_
  - b. The Atlantic sturgeon spawns in the Atlantic Ocean. \_\_\_\_\_
  - c. The Atlantic sturgeon dies after spawning only once. \_\_\_\_\_
  - d. The Atlantic sturgeon is an anadromous fish. \_\_\_\_\_



Scientists caught and released this young Atlantic sturgeon near Haverstraw, New York. It had not yet left the Hudson for the ocean.

*Read the following article and answer the questions.*

## Bald Eagles of the Hudson River



The bald eagle is found all over North America, from Alaska and Canada to northern Mexico. Along the Hudson **River** there are two different groups of bald eagles. One group is made up of eagles that nest along the Hudson and stay here all year. The other group of eagles travels south from Canada and New England to spend the winter here. These birds will fly back north in spring. This movement from one place to another is called **migration**.

**Scientists** attach lightweight radio **transmitters** to eagles. The transmitters send signals that scientists follow to track the birds' migrations. Bald eagles may travel up to 100 miles in a day. Some migrate more than 1,000 miles between their summer and winter homes. Bald eagles fly south in cold weather to find open water and food. Fish is this eagle's favorite food, but it will also eat ducks and mammals.

Eagles are very large birds. They can be three feet long with wings measuring seven feet tip to tip! An adult bald eagle is easy to identify. It has a white head, white tail, and large yellow beak. Young birds do not have the white head and tail, and are mostly brown in color.

The bald eagle is the **symbol** of the United States. The government has classified this bird as a **threatened** species. This means that the number of eagles is low, and they should not be harmed in any way.

1. What is this article **mostly about**?

- a. migration
- b. the bald eagle
- c. fish
- d. the Hudson River

2. Which definition best describes **migration**?

- a. to stay in one place
- b. to live on the Hudson River
- c. to move from one place to another
- d. to find plenty of food

3. According to the article, how many days would it take an eagle to migrate 1,000 miles between its nesting area in Canada and its winter home on the Hudson?

4. Why do you think bald eagles cannot find their favorite food in northern Canada during the winter?

5. **Challenge question:** Hold your arms straight out to both sides. Have a partner use a tape measure to measure the distance between your fingertips - your "wingspan." Is your wingspan more or less than an eagle's? How much more or less?

*This baby eagle was born in a nest overlooking the Hudson River.*





*Read the following article and answer the questions.*

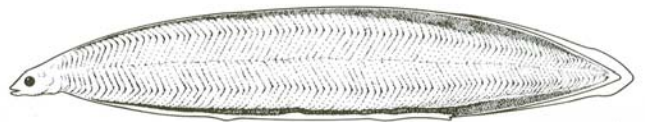
## The Eel's Incredible Journey



Have you ever seen a fish that looks like a snake? If so, you have probably seen an eel. Unlike snakes, eels have **fins** and breathe with **gills** instead of lungs.

The Hudson **River** and other waters in New York are home to the American eel, but it is not born here. Its birthplace is in the Sargasso Sea, part of the Atlantic Ocean southeast of Bermuda. From the Sargasso Sea, ocean **currents** carry baby eels to the coast of North America. This trip takes many months.

At first, baby eels look like bits of clear tape a few inches long. As the young fish leave the ocean currents and swim towards the coast, their bodies become more like pieces of spaghetti. However, they remain **transparent** and are called glass eels. Only the tiny black beads of their eyes and their red gills are easily seen.



Some eels stay in **salt water** and live in **bays** and **marshes** along the coast. Others swim up rivers to live in **freshwater habitats**. Soon after arriving in these new habitats, green, brown, or yellow colors begin to appear on their bodies. At this point they are called **elvers**.

American eels may live in bays, rivers, and **streams** for twenty years or more. But when the time comes to **spawn** (lay eggs), they undergo another change. Their eyes grow larger, and their color becomes more silvery. These silver eels swim **downstream** and out to sea, journeying back to the Sargasso Sea. There they complete their life cycle by spawning and then dying.

For centuries, the location where eels were born was a mystery. Even today, no one has ever seen eels spawning in the Sargasso Sea. Matter of fact, no adult eels or eggs have been found there. So how do we know that this is where eels are born? **Scientists** have used nets with very fine mesh to capture young eels all over the Atlantic Ocean. The very smallest ones—eels that have just hatched—are caught in the Sargasso Sea.

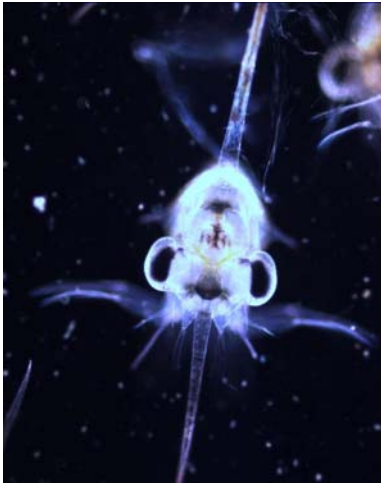
1. This article is **mostly about**
  - a. the Sargasso Sea.
  - b. the life cycle of the American eel.
  - c. different shapes of fish.
  - d. glass eels.
2. Based on the article, when an eel's color turns silvery, the fish is ready to
  - a. migrate from the Sargasso Sea to the coast of North America.
  - b. become an elver.
  - c. migrate to the Sargasso Sea to spawn.
  - d. swim up rivers into fresh water.
3. Scientists know that eels **spawn** in the Sargasso Sea because
  - a. that is where the smallest baby eels are found.
  - b. silver eels have been caught there.
  - c. eel eggs have been found there.
  - d. elvers have been seen there.
4. According to the article, which of the following statements are true?
  - a. The American eel is a kind of snake. \_\_\_\_\_
  - b. American eels live in both fresh and salt water. \_\_\_\_\_
  - c. Some American eels live for more than twenty years. \_\_\_\_\_
  - d. Glass eels are brown, green, or yellow in color. \_\_\_\_\_
5. Do you know of any other fish that **migrate**?



*Read the following article and answer the questions.*

## Blue Claw!

Do you know what a crab looks like? Perhaps you have seen one down at the Hudson **River**. Which of these pictures shows a crab?



*Picture #1*



*Picture #2*



*Picture #3*

If you guessed Picture #3, you would be right. This is a grownup blue crab, also called a blue-claw crab. Its two front legs are big claws for catching food and fighting off **predators**. Its two back legs are paddles for swimming. The crab uses its other six legs to walk over the river bottom.

If you guessed Picture #2, you would also be right. This is a very young blue crab. As the crab gets older, the tail will curve under its belly and stick there.

Guess what? The odd creature in Picture #1 is also a blue crab—a tiny baby that just hatched from an egg. You need a **microscope** to see it.

To grow and change form, crabs **molt** many times. To molt means to shed the shell covering its body and legs. After molting, a crab feels like soft rubber. It takes in water, growing larger. Then a new shell hardens on its body and legs.

In a blue crab's life cycle, the baby in Picture #1 molts about 7 times to become the youngster in Picture #2. After one more molt, this youngster looks like a tiny adult. To grow big enough to lay eggs, it molts at least 20 more times!



*The crab on the top has just molted. Below is its old empty shell. The crab's body is soft after molting. At this time, the crab grows bigger.*

1. Including claws and paddles, how many legs does a blue crab have?
2. As a crab **molts**, which of the following things happen?
  - a. Its body grows larger.
  - b. It sheds its shell.
  - c. Its body becomes soft.
  - d. All of the above things happen.
3. The blue crab's large claws are used for
  - a. catching food and defending itself.
  - b. swimming.
  - c. walking.
  - d. molting.
4. According to the article, which of the following sentences are true?
  - a. Blue crabs can swim. \_\_\_\_\_
  - b. When molting, the body of a blue crab may change form. \_\_\_\_\_
  - c. A tiny baby blue crab looks like its parents. \_\_\_\_\_
5. **Challenge question:** When going out to eat seafood, you might see soft-shelled crabs listed in the menu. These are actually blue crabs, not a different kind of crab. These crabs would just have gone through what part of their life cycle? Use facts from the article to explain your answer.

*Read the following article and answer the questions.*

## **Adaptations – Designs for Survival**

From **shoreline tidepools** to its deep dark bottom, the Hudson **River** is a wild place. Here one can discover many kinds of plants and animals, each with its own **adaptations** for life in and along the river.

Adaptations help **organisms** do the things they must do to survive in their environments. Living things have to take in food and avoid being eaten. They need to survive summer's heat and winter's cold. They must **sense** what is going on around them.

Hard shells, warm fur, and sharp thorns are examples of how an organism's form or body can adapt it for survival. These are called **physical adaptations**. A catfish has whiskers with taste buds. With this physical adaptation, the fish finds food that it can't see in the darkness at the Hudson's bottom.



Color is another physical adaptation that can help creatures survive. The colors and patterns of this owl's feathers resemble the colors and patterns of tree bark. This makes the bird hard to see as it sits against tree trunks. Color and pattern that blends into the background is called **camouflage**.

Can bright color be a useful adaptation? Can't birds easily spot monarch butterflies and make a meal of them? A bird might try this once, but it won't do it again. Monarchs taste bad. Their bright color is a warning of that fact. This adaptation helps to protect monarchs from being eaten.





Behavior also helps animals survive. Monarch butterflies **migrate** south before winter, when the cold would be deadly and there are no flowers to provide food. American shad swim in **schools** for protection. The many fish darting here and there confuse **predators** by making it hard to focus on just one shad. Migration and schooling are examples of **behavioral adaptations**.



1. What is an **adaptation**?
2. Give two examples of animal adaptations from the article. Explain how each helps the animal survive.
3. Is each of the following a **physical** or **behavioral adaptation**?  
(All of these organisms live in the Hudson Valley.)



(a) a map turtle's shell.



(b) beavers building dams.



(c) prickly pear cactus spines.



(d) a black bear's deep winter sleep.

Read the following article and answer the questions.

## Adapting to Estuaries

Imagine living in a **habitat** that is under water for half the day, and out in the air for the other half. Sometimes the water in this habitat is salty like the sea, and sometimes it is fresh like water from a drinking fountain. In summer, this habitat is hot under the bright sun; in winter, it is ice-cold. Most animals and plants would find it difficult to survive in a habitat that changes so much.



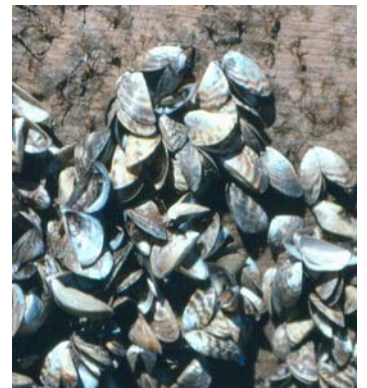
*The Hudson River estuary south of Peekskill*

There are habitats like this in the Hudson River **estuary**. Estuaries are places where **fresh water** mixes with salty **seawater**. They are partly enclosed by land, but open to the ocean and its **tides**.



*oysters*

Few plants and animals can live everywhere in the estuary. Most are **adapted** to survive in a limited range of conditions. For example, many animals live only where the water is salty. Others live only where the water is fresh. In the Hudson estuary, oysters and seahorses live near New York City, where the water is almost as salty as ocean water. Zebra mussels and yellow perch live in fresh water **upstream**, farther away from the sea.



*zebra mussels*



*seahorse*



*yellow perch*





*hogchoker*

A few Hudson River fish are found in both salt and fresh water. Some hogchokers live close to the sea near New York City; others live far upstream near Albany. Other fish, like American shad, adapt to living in both salt and fresh water as they **migrate** between the Atlantic Ocean and the Hudson.



*American shad*



*spatterdock  
at high tide*

When it comes to dealing with the Hudson's tides, plants have special challenges. A plant is rooted in one place, after all. At high tide, it may be completely underwater. At low tide it might be completely exposed to the air. Where a plant grows along the Hudson depends on how well it can survive being flooded at high tide or being out in the air at low tide.



*spatterdock  
at low tide*

Spatterdock plants, for instance, can survive being covered with water at high tide and exposed to the air at low tide. Cattail plants live where the high tide comes partway up their stems but does not flood their leaves. Most trees live on land that is rarely covered with water.

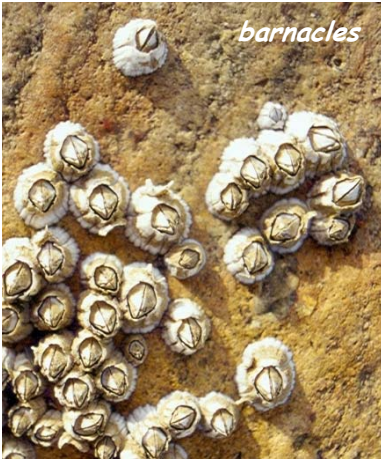


*trees*

*cattail*

*spatterdock*

The part of the estuary that is flooded at high tide and uncovered at low tide is called the **intertidal zone**. Like the plants described above, animals living here must adapt to the tides.



*barnacles*

Barnacles feed and breathe underwater. At low tide, they shut their shells to keep water inside.

The fiddler crab breathes air and lives in a **burrow** in the mud. The crab enters the burrow and plugs the entrance with mud as the tide rises. This traps air in the burrow, allowing the crab to breathe during high tide.



*fiddler crabs*

Habitats in the Hudson estuary change with the seasons, and plants and animals have adaptations to survive winter's cold and ice. The leaves and stems of most plants that live in the Hudson turn brown and break off, but the roots survive, buried in the mud. Some animals burrow deep into the mud too. Others migrate to avoid the harsh conditions of winter.



*blue crab*

Adult blue crabs migrate down the Hudson to New York Harbor, where ice seldom forms in winter. The osprey also migrates south in fall so that it can dive to catch fish without hitting ice.



*osprey*

Conditions in estuary habitats change a lot, but also allow many kinds of plants and animals to find homes in the Hudson. When exploring the Hudson, you never know what unusual fish you might catch or what rare bird might fly by.



1. This article is **mostly about**
  - a. plants of the Hudson River
  - b. how animals and plants adapt to habitats in the Hudson estuary
  - c. the tides in the Hudson River
  - d. fish migration
2. Which of the following cause conditions in Hudson River **habitats** to change?
  - a. tides
  - b. seasons
  - c. salty seawater entering the estuary
  - d. all of the above
3. Fill in the blank to complete the following sentences.
  - a. Barnacles close their shells to keep water inside when the tide is \_\_\_\_\_.
  - b. Yellow perch live in \_\_\_\_\_ water.
  - c. The osprey \_\_\_\_\_ south when winter comes to the Hudson.
  - d. \_\_\_\_\_ plants can survive being covered with water at high tide and exposed to the air at low tide.
4. According to the article, why do plants grow where they do in the Hudson?

5. **Challenge questions.** Extend what you learned from the article to answer questions about the Hudson River animals pictured below. Explain your answers.



- a. Where does the map turtle spend the winter?



- b. The pearly mussel breathes underwater. How does it survive being exposed to the air at low tide?



- c. The green heron eats fish and frogs. When winter comes, what does it do to survive?



Read the following article and answer the questions.

## Alien Invasion!

They are black. They are **spiny**. Thousands lie in wait on the Hudson's beaches. Be careful there; the sharp spines will stab your feet. In summer, these so-called "devil's heads" transform into a green mat that spreads over shallow waters.

These hard nuts are seeds of the water chestnut, an **alien** plant from Europe and Asia. People brought it to Schenectady in 1884. It escaped to the Mohawk River and reached the Hudson **estuary** in the 1930s. Now it grows in quiet shallows throughout the freshwater part of the estuary.

Water chestnut leaves float on the surface. Its stems reach down to the bottom. Where many plants grow together, their leaves and stems form tangled mats covering the water. Small boats find it difficult to move through these mats.



Because the water chestnut's leaves block sunlight, other plants cannot grow underneath the floating mats - it's too dark. In this way the water chestnut has invaded habitats used by water plants **native** to the Hudson and **displaced** them.

Like other green plants, water chestnut produces **oxygen** by **photosynthesis**. However, its leaves release oxygen into the air, not into the water. Since other plants can't grow in the darkness below the leaves, river water beneath large mats of water chestnut often lacks oxygen. Fish can't survive there.

This **invasive** plant does have some good qualities. Many different **invertebrate** creatures (insects, crustaceans, and worms, for example) live on water chestnut, and there are lots of them. Fish hang out at the edge of the water chestnut mats, gobbling down creatures that wander or are washed out.



It is too late to **repel** this invader. It has become - for better or worse - a **permanent** part of the Hudson River estuary community.

1. This article is **mostly about**
  - a. aliens from outer space.
  - b. an invasive plant.
  - c. animals that live in water chestnut mats.
  - d. the dangers of water chestnut seeds.
2. What does it mean to be an **alien species**?
  - a. one that damages the environment.
  - b. one that lives in Europe or Asia.
  - c. one that is invasive.
  - d. One that grows in a place where it didn't live until people brought it there.
3. Water chestnut is an **invasive** species because
  - a. it displaces native plants that grow in shallow waters of the Hudson.
  - b. the spines of the water chestnut seed can stab people's feet.
  - c. it comes from Europe and Asia.
  - d. its leaves float on the surface of the water.
4. According to the article, which of these statements are true?
  - a. It is dark beneath thick mats of water chestnut leaves. \_\_\_\_\_
  - b. Many insects, crustaceans, and worms live on water chestnut. \_\_\_\_\_
  - c. Water chestnut is found in salt water. \_\_\_\_\_
  - d. "Devil's heads" are the seeds of the water chestnut plant. \_\_\_\_\_



*Water chestnut mats can make boating and swimming difficult.  
People sometimes remove the plants by hand or using machines.*