

Estuaries

Topics: Hudson River Estuary, tides



Department of
Environmental
Conservation

GRADE LEVEL: 4-5

Big Ideas:

- The Hudson River is unique.
- There is a difference between salt, fresh and brackish water
- The Hudson River begins in the Adirondack Mountains and empties into the Atlantic Ocean.
- The Hudson River is an estuary.

Learning Objectives: *students will be able to...*

- Identify important characteristics of the Hudson River.
- Identify an estuary.
- Compare and contrast the three types of water in the Hudson River.
- Examine how tides change water levels along the estuary.
- Observe patterns of change in salinity along the estuary.

New York State Science Learning Standards:

4-PS4-1. Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move

4-ESS2-2. Analyze and interpret data from maps to describe patterns of Earth's features.

5-ESS2-2. Describe and graph the amounts of saltwater and freshwater in various reservoirs to provide evidence about the distribution of water on Earth.

5-PS2-1. Support an argument that the gravitational force exerted by Earth on objects is directed down.

Key Understandings:

- Maps are used to show the shapes and types of landforms and water in an area.
- Maps help locate the different landforms and water features areas of Earth.
- Water transports material through the Hudson River watershed and estuary.
- Water is made up of particles whose properties determine its observable characteristics.
- An estuary is a unique habitat with fresh, brackish and salt water.
- Salt water is denser than fresh water.
- The mixing of salt water from the sea and fresh water from a river's watershed create ideal environments for a variety of living organisms.
- The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center.

Essential Questions:

- What is an estuary?
- What are the characteristics of estuaries that make them so important to living organisms?
- What different types of water can be found in the Hudson River?
- How is the Hudson different from other rivers?
- What are the differences between salt water, fresh water, and brackish water?

Students will know...

- Key vocabulary terms.

Vocabulary:

- Brackish water: mixture of fresh and saltwater.

- The difference between fresh, brackish, and saltwater.
- What an estuary is, and the characteristics that make them important.
- The forms water takes in the three states of matter and discuss how water transitions between these states.
- Where water is found on earth, and how they can access water for their daily needs including drinking and washing.
- Estuary: a body of water in which fresh and salt water meet.
- Fresh water: water that is not salty.
- Salt water: seawater or other water that contains salt.
- Watershed: the area of land from which water drains into a body of water.
- Salt front: the leading edge of seawater entering an estuary.
- Tidal cycle: the repetitive rise and fall of the ocean's surface over a 24-hour period.
- Tides: the alternating rise and fall of the surface of the ocean and bodies of water closely linked to it.
- High tide: highest water level in the tidal cycle.
- Low tide: lowest water level in the tidal cycle.
- Sea level: the average height of the ocean.

Learning Plan: We recommend doing these lessons in sequential order; however, they can be done as individual lessons. Lessons have multiple links (videos, songs, diagrams, activities) that can be used at the teacher's discretion depending on class time.

Pre-assess: What makes the Hudson River so unique? Use K-W-L to assess students' prior knowledge, have students write or draw in response to the essential questions.

Progress Monitoring: Formative assessment and teacher feedback should be ongoing throughout the lessons. Teachers should develop assessments based on their individual class needs. Think-pair share, exit tickets, interactive discussions, questions and listening, informal observations, quizzes and student work samples can all be used.

Lesson 1: Meet the Hudson River- Students watch a video about the Hudson then read a short article, interpret and label a New York State relief map, and listen to a story about the River.

- Video: [Source to Sea](#)
- From Mountains to the Sea [Student Reading](#)
- Rivers Run Through It Mapping [Student Activity](#) and [Teacher Section](#)
- River Storytime: Video recording of the book [River](#)
- [Puzzle Video](#): Hudson River Estuary; Habitat; Navigation
- [Watershed Map](#)
- Conservationist for Kids Magazine: [Explore the Hudson River](#)
- Optional: [Introduction to the Hudson: Journey down the river](#)

Lesson 2: River Waters- Students will watch a video on estuaries and watch an estuary demonstration, then conduct a STEM experiment and analyze three types of water that are found on Earth: salt, fresh and brackish.

- Video: [What is an Estuary.](#)
- Video: [Estuary Water Demonstration](#)
- STEM Activity: [Brackish Water Density](#) & [Spanish Version](#)
- [River Waters Lesson](#) (lesson 2 in packet, p.15)
- Extension activity to do at home: [Exploring and Estuary in your Kitchen](#) & [Spanish Version](#)

Lesson 3: Explore the Hudson River- Students watch live footage collected in three geographic areas of the Hudson River estuary and use the accompanying worksheets to explore the Hudson. Students can follow along with data collection and take a deeper dive with a guest scientist. Watch one or all three.

- [New York Harbor: Day in the Life of the Hudson and Harbor](#) and [Data Sheet](#)
- [Lower Estuary: Day in the Life of the Hudson and Harbor](#) and [Data Sheet](#)
- [Upper Estuary: Day in the Life of the Hudson and Harbor](#) and [Data Sheet](#)
- Extension: Which Fish Where [Student Activity](#) & [Teacher Section](#)

Lesson 4: The Hudson's Ups and Downs- Students watch a video on tides, then examine how tides change water levels along the Hudson River estuary and explore how weather can affect water levels and tides.

- Video(s): [Tide Finder & Measuring the Tide](#)
- The Hudson's Ups and Downs [Student Activity](#) & [Teacher Section](#)

Lesson 5: Tracking the Salt Front- Students watch a video, then use Hudson River salinity data to track movements of the salt front in response to storms and other weather-related events.

- Video: [Turbidity and Salinity of the Hudson River Estuary.](#)
- Tracking the Salt Front [Student Activity](#) (pg. 21)
- Extension: Finding the Salt Front [Student Activity](#) & [Teacher Section.](#)

Teachers: Would you like to visit us at Norrie Point environmental education center, or have an educator visit your classroom in-person or virtually? Contact us to schedule a program: hrteach@dec.ny.gov

Resources:

Children's books:

- [Rain Rain Rivers](#) by Uri Shulevitz
- [River](#) by Elisha Cooper
- [Where the River Begins](#) by Thomas Lochner
- [Riparia's River](#) by Michael J. Caduto
- [Song of the River](#) by Joy Cowley & Kimberly Andrews
- [Over in a River flowing out to the Sea](#) by Mairanne Berkes
- [River Story](#) by Meredith Hooper
- [River of Dreams: The story of the Hudson](#) by Hudson Talbott
- [Voyage of the Half Moon](#) by Tracey West
- [Hudson River: An Adventure From the Mountains to the Sea](#) by Peter Lourie

Websites:

- [Estuaries Tutorial NOAA](#)
- [Hudson River Park Environmental Education](#)
- [Sarah Lawrence College Center For the Urban River at Beczak Educational Resources](#)

- [River of Words](#) - annual international poetry and art contest for K-12 students.
- [Hudson River Lesson plans](#)
- [Orange County Water Authority Education](#)
- [Education Resources Guide for Parents and Teachers](#)- Hudson River Foundation