NEW YORK STATE OF OPPORTUNITY | Hudson River Estuary Program
A Program of the New York State Department of Environmental Conservation

Lamont-Doherty Earth Observatory
COLUMBIA UNIVERSITY | EARTH INSTITUTE

Day in the Life on the Hudson River and Harbor

Linking to NYSSLS including the Overarching Phenomena

PHYSICAL SCIENCE: DITL Physical River

Phenomena:

1. *Why does the river flow both ways?*
2. *How do the currents move the opposite direction from the tides?*

Students who demonstrate understanding can:

- **P-PS2-1: Use tools and materials to design and build a device that causes an object to move faster with a push or pull***
  - Emphasis should be on developing and interest in investigating forces (pushes or pulls). Example: Tossing an orange and measuring current push and pull

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
• **Asking Question and Defining Problems**: builds on prior experiences and progresses to simple descriptive questions that can be tested. Ask questions based on observations to find more information about the designed world. • **Planning and Carrying Out Investigations:** to answer questions or test solutions to problems; builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions. With guidance, plan and conduct and investigation in collaboration with	• **PS2.A: Forces and Motion**: Pushes and pulls can have different strengths and directions. Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it. *DITL EXAMPLE: Measuring tide and currents* • **PS2.C: Relationship Between Energy and Forces**: A push or a pull may cause stationary objects to move, and a stronger push or pull in the same or opposite direction makes an object in motion speed up or slow down more quickly. *DITL EXAMPLE: Tides and currents*	• **Patterns:** Patterns in the natural and human designed world can be observed and used as evidence. *DITL EXAMPLE: Discovering patterns between the currents and tides, and uncovering when are those patterns broken. Patterns of high and low tides throughout the day.* • **Cause and Effect:** Simple tests can be designed to gather evidence to support or refute student ideas about causes. *DITL EXAMPLE: Using an orange to see the effects the currents have on a floating object.*

peers. • **Analyzing and Interpreting Data:** Builds on prior experiences and progress to collecting, recording, and sharing observations: Record information (observations, thoughts, ideas); analyze data from tests of an object or tool to determine if it works as intended.		

LIFE SCIENCE: DITL Biological River

Phenomena:

1. *Why are certain fish only found in particular sections of the river?*
2. *Why/How can some fish adapt to live in different parts of the river outside their typical home range?*
3. *How does a fish's anatomical structure determine its role/function in the Hudson River ecosystem?*
4. *Why do fishes have varying morphologies if they all live in the same ecosystem (i.e. sizes, shapes, number of fins, fin shapes, color…)?*
5. *Why do some juvenile fish look completely different than when they are adults?*
6. *Why do some male species of fish look different than the same female species?*

Students who demonstrate understanding can:

- **P-LS1-1: Observe familiar plants and animals (including humans) and describe what they need to survive.**
  - Emphasis should be on determining what a variety of living organisms need to live and grow.
- **P-LS1-2: Plan and conduct and investigation to determine how familiar plants and animals use their external parts to help them survive in the environment**
  - Emphasis should be on the relationships between the physical and living environment
- **P-LS3-1: Develop a Model to describe that some young plants and animals are similar to, but not exactly like their parents**

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts

• **Developing and Using Models**
  ○
	• **LS1.A: Structure and Function**
	  ○ Biological station: fish anatomy
	• **LS1.C: Organization for Matter and Energy Flow in Organisms**
	  ○ Different species of fish have different environmental requirements to survive
	• **LS1.D: Information Processing**
	• **LS3.A: Inheritance of Traits**
	  ○ Identification differences adults vs juveniles
	• **LS3.B: Variation of Traits**
	  ○ Identification differences male vs females, mutations
		• **Patterns**- Dive into past data to identify trends in 1. Fish abundance vs time, 2. Fish diversity or abundance vs location, 3. Fish diversity vs water conditions…
		• **Cause and Effect-** The biology that you catch is dependent on the impact from 1. Tides and Weather, 2. Rain and water run-off, 3. Water quality
		• **Systems and System Models**: Fish species play a different role in the greater Hudson River ecosystem.
		• **Structure and Function**: Different fish species are structured to live and function in different environments of the estuary.
		• **Scale, Proportion and Quantity**- Fish abundance during different times of year. Species abundance could increase/decrease depending on a variety of factors (i.e. fishing rules and regulations for species protection; overfishing; competition with invasive species)
		• **Energy and Matter**- The flow of energy in the Hudson River estuary begins with the primary producers and decomposing detritus in the system. The zooplankton play and important role in linking energy to the tertiary predators in the system.