



## CENTER FOR THE URBAN RIVER AT BECZAK

Explanation for teachers:

This lesson can have anywhere from one to three parts, depending on how deep you want to go with your students. The first part is a [recorded PowerPoint presentation](#), with an educator from CURB introducing the Hudson River in general, and the Hudson River food web more specifically at the end. The second part is this lesson, which is presented in a 5E format, the teacher version of which is below and the student version [at this link](#). This lesson builds on the lecture from the PowerPoint and adds a variety of student activities. There is also a set of [Food Web Information Cards](#) that will help students complete their activities for this lesson. The third part of the lesson is set up as a [game through a PowerPoint presentation](#). It can be done over the internet with the teacher and students playing together, or sent to students to do independently. These lessons are appropriate for students in 4th grade and up. There are some extension activities at various parts throughout this lesson.

### Standards Alignment:

- 5-PS3-1. Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the Sun
- 5-LS2-1. Develop a model to describe the movement of matter among plants (producers), animals (consumers), decomposers, and the environment
- MS-LS1-6. Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms
- MS-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem
- HS-LS2-3. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in ecosystems.

### Engage

The Hudson River is a dynamic system that is host to thousands of organisms, big and small. Similar to land-based ecosystems, the organisms interact with each other in a variety of ways, largely, though not only, through predator and prey relationships. What does it mean to be a predator? What does it mean to be prey? Do all organisms eat other things? What about most plants? What do we call the system of interacting predators and prey? A food web.

### Explore

Who lives in the Hudson River Estuary to make up that food web? Remember, the estuary is the area where saltwater and freshwater meet to make brackish water. A lot of organisms you might know about either live only in the ocean or only in freshwater. What organisms do you know about in the estuary itself? Let's make a list (\*this list is not exhaustive, but makes up a lot of the answers that students report).

- Blue crab
  - Mud crab, hermit crab, horseshoe crab
- Striped bass
- American eel
- White perch
- Diamondback terrapin
- Northern seahorse
- Winter Flounder
- Atlantic sturgeon
- Shrimp
  - Grass shrimp, sand shrimp
- Zooplankton (small planktonic animals, more information below)

These are definitely a lot of the animals that live in the Hudson River. Do other things besides animals live in the estuary? Of course! What kinds of things? Plants. What kinds of plants do you know about?

- Seaweed, algae
- Phytoplankton - plant-like plankton
  - Phytoplankton is just one type of plankton. The word plankton means any organism that cannot swim against the current, so it can be plants and animals, big and small. A tiny microscopic phytoplankton is considered plankton, just as a jellyfish with 20-foot-long tentacles is also considered plankton, because it cannot swim against the current.

What else is missing from this list? How about things that eat dead things? Do you know of any on land that might also live in the water?

- Worms
- bacteria

## EXPLANATION

Now that we have a pretty long list, let's think about how these organisms in the Hudson River get their energy. Let's review our *Food Web Information Cards* as we learn more about this energy transfer.

The sun is the main source of energy for life on Earth.

Plants make their own energy, and are called **producers**. They use the chemical process of photosynthesis to take in sunlight and carbon dioxide, and produce glucose (sugar) and oxygen. (In fact, plants underwater produce up to 50% of the world's oxygen, meaning at least half of the air we breathe is made by them!). Plants make their own food, instead of having to find food to eat, the way we do.

Which organisms in the *Food Web Information Cards* are the **producers**?

Phytoplankton  
Seaweed

So what about everything else? They're mostly **consumers** - organisms that eat other organisms. **Primary consumers** eat the producers, and **secondary consumers** eat those organisms that eat producers, etc.

Which organisms in the *Food Web Information Cards* are the **consumers**?

Zooplankton  
Striped Bass  
Atlantic Silverside  
Softshell clam  
Eastern Oyster  
Blue Crab  
Cormorant  
White Perch  
Mummichog  
Grass shrimp  
Clam worm

There are also some other organisms left in the *Food Web Information Cards* - **decomposers**. Decomposers eat things that have died, and generally live at the bottom of the river where those dead things end up. They are an important part of the food web because a lot of consumers eat them, so they help recycle energy.

Which organisms in the *Food Web Information Cards* are **decomposers**?

Clam worm  
Bacteria

There are other ways that we can categorize these organisms, too. What do we call an organism that only eats plants? **Herbivores**! Organisms that only eat animals are **carnivores**. And if they eat both? They're an **omnivore**. Remember, if they eat dead things, they're called **detrivores**.

Which organisms fit into these categories?

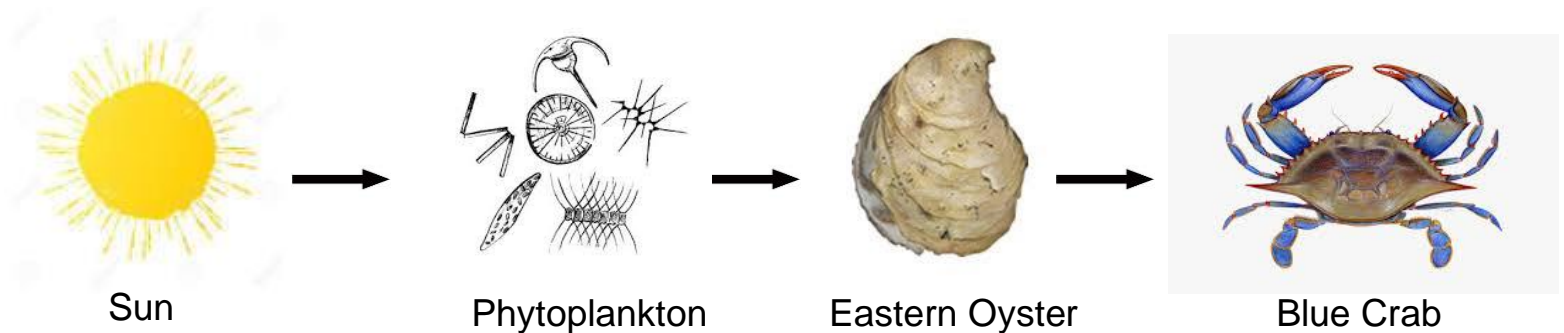
| <b>Herbivore</b>         | <b>Carnivore</b>                                      | <b>Omnivore</b>   | <b>Detrivore</b>      |
|--------------------------|---|---|-----------------------|
| Oyster<br>Softshell clam | Striped bass<br>White perch<br>Cormorant<br>Blue Crab | Mummichog<br>Grass shrimp<br>Atlantic silverside<br>Zooplankton | Clam worm<br>Bacteria |

Extension for older students: Some organisms can fit into multiple categories, and even some not on these cards. For example, dinoflagellates are a type of phytoplankton that do photosynthesis but also can consume food when they can't get enough energy from the sun (similar to the Venus Fly Trap plant in the rainforest). Grass shrimp can be consumers and decomposers. Can you find any other examples of this, in the Hudson River or elsewhere on earth?

## ELABORATION

You're going to make your own food web with organisms from the Hudson River! Before you get started, let's look at a couple of examples.

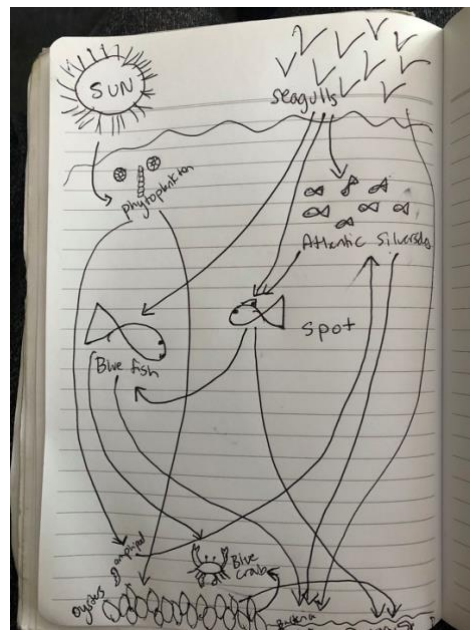
Here is an example of a simple food chain to get you started:



Let's think about how the energy transfers in the example above. It starts with the sun. The phytoplankton then use that energy from the sun through photosynthesis to make their own food. The oyster eats lots of those phytoplankton, and then the blue crab gets its energy by consuming the oyster.

Is it always so simple in nature? Of course not. We tend to think of energy transfer as more of a web than a chain because there are so many different organisms interacting with one another.

Look at the example below to see how much more complicated it can be in nature. And remember, this is just a small example of a few organisms that live in the Hudson River. There are thousands more in the river, and even more in the rest of the oceans and lakes in the world!



## Evaluation

Now your students will create their own food webs using the organisms from the *Food Web Information Cards* and the instructions below. You can evaluate them in whatever way you see fit.

Looking through your lists of producers, consumers, consumers, and decomposers, pick **2 producers, 4 consumers, and 2 decomposers** to use in your food web.

Grab a piece of paper, markers, colored pencils, string, or whatever you have at home to make your food web stand out! If you're feeling artistic, you can draw all of the organisms and label them below. If not, just write the name of the organism and draw a circle around its name.

Because the sun is the main source of energy, you can start your food web there.

From the organisms you've selected, who gets their energy from the sun? Pick one of your producers and draw a line from the sun to it.

Who eats the plant? Pick one of your primary consumers to go next. Keep integrating the organisms you've chosen until you reach your secondary consumer. What happens now? Who would eat an organism that has died? Decomposers!

After you reached the decomposer, start a new chain from the sun until all of your organisms have been added to your web. See how complicated it can be with just a few organisms that live in the Hudson River estuary?

To go the extra mile: color code the energy transfer arrows based on the role of the organism as a producer, consumer, or decomposer. Also, try to explain how the energy transfers from organism to organism on the arrow.

For older students: Try to situate your food web to place the animals in their correct habitat. For instance, if an organism lives in the sediment, or mud, make sure it's reflected in your image. If an organism floats in the water, put it at the top of the image.