



Modeling Trophic Cascades

OVERVIEW

In this activity, students model trophic cascades using cards of organisms from seven different habitats. The activity is designed to illustrate the species relationships in a food chain and the effect of predators on the trophic levels below.

Trophic cascades have been described in numerous ecosystems, ranging from kelp forests of the Pacific Ocean, to Arctic islands, to Central American jungles, to salt marshes. They occur when predators reduce the abundance or change the activity of their prey, thereby allowing species in the trophic level below to increase in number. These indirect effects by the predator can trickle down (or cascade) to many lower levels of the food chain. In a classic example, sea otters protect kelp forests by controlling the abundance of urchins that graze upon the kelp. In the absence of otters, urchins consume most of the kelp and negatively affect other organisms that live in kelp forests.

This activity complements the concepts explored in other BioInteractive resources, including the [Exploring Trophic Cascades](#) Click & Learn and the short film [Some Animals Are More Equal than Others: Keystone Species and Trophic Cascades](#).

Additional information related to pedagogy and implementation can be found on [this resource's webpage](#), including suggested audience, estimated time, and curriculum connections.

KEY CONCEPTS

- Organisms can have both direct and indirect effects on other members of the ecosystem.
- Indirect effects occur when an organism's activity or behavior (e.g., feeding) affects other organisms with which they do not directly interact.
- When indirect effects are transmitted through a food chain, it is called a trophic cascade.
- Trophic cascades can be found in diverse types of ecosystems.

STUDENT LEARNING TARGETS

- Arrange organisms according to trophic level in a variety of different ecosystems.
- Distinguish between direct and indirect effects of organisms in their environment.

PRIOR KNOWLEDGE

Students should be familiar with:

- trophic levels, including producers and predators
- species interactions

MATERIALS

- copies of the "Habitat and Organism Cards," printed or shared electronically
- (if using printed cards) chart paper or whiteboard and magnets, markers
- (if doing the activity as a competitive game) stopwatch or timer

PROCEDURE

In this activity, students build models of trophic cascades in different environments. It was designed as a competitive game, but it can also be done by focusing on discussion instead of competition.

- Print or electronically share files for the “Habitat and Organism Cards” on the [activity webpage](#).
 - A PDF file, designed to print double-sided, is provided as a printable option.
 - Labeled and unlabeled individual card files are provided as JPGs in ZIP files.
- Separate the cards into the two categories: habitats and organisms.
 - There are seven habitats: African Savanna, Lake, River, Arctic Island, Salt Marsh, Kelp Forest, and Jungle.
 - There are three or four organisms for each habitat.

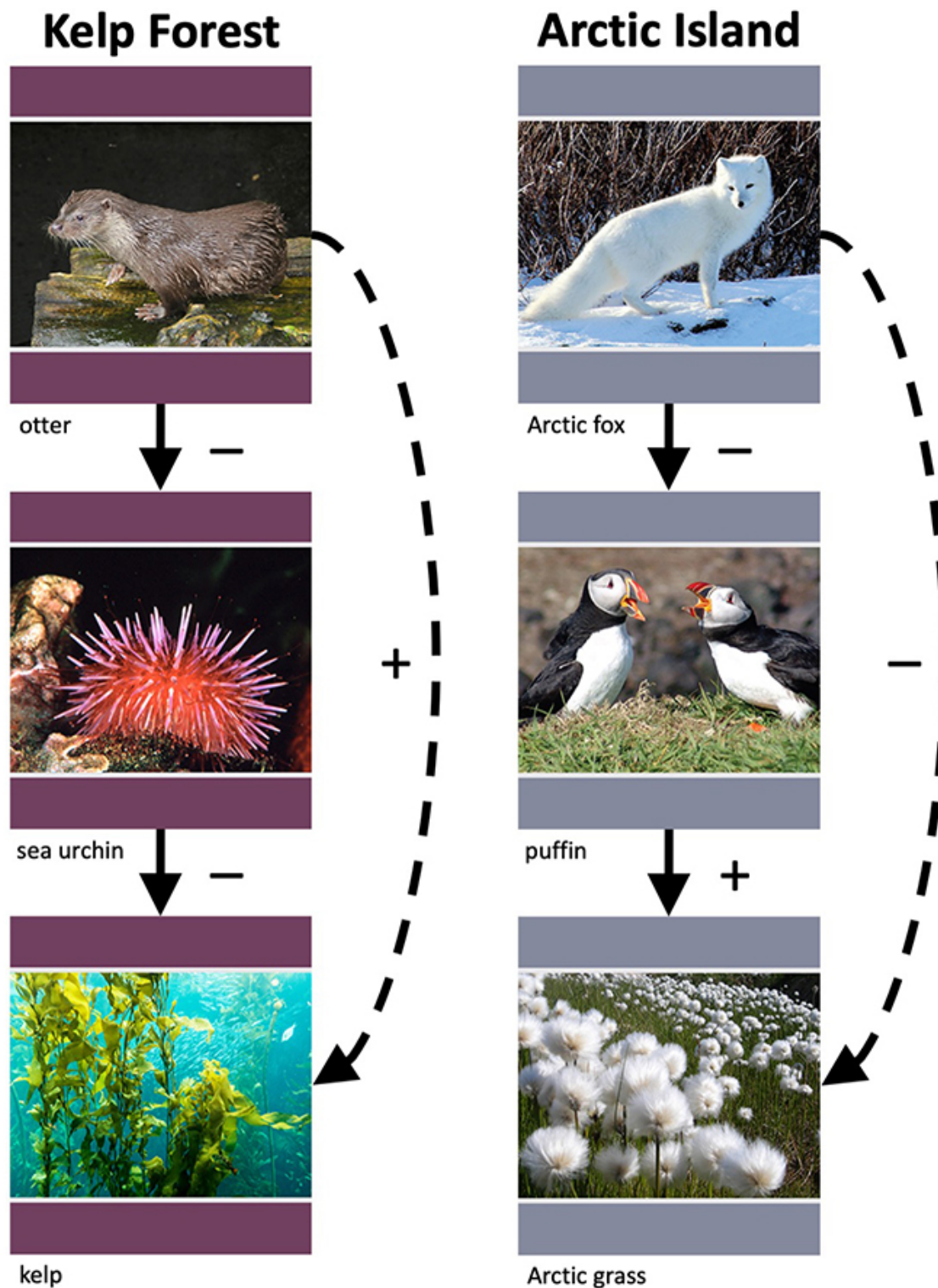
The following instructions are for using the printed cards in an in-person class. Have students:

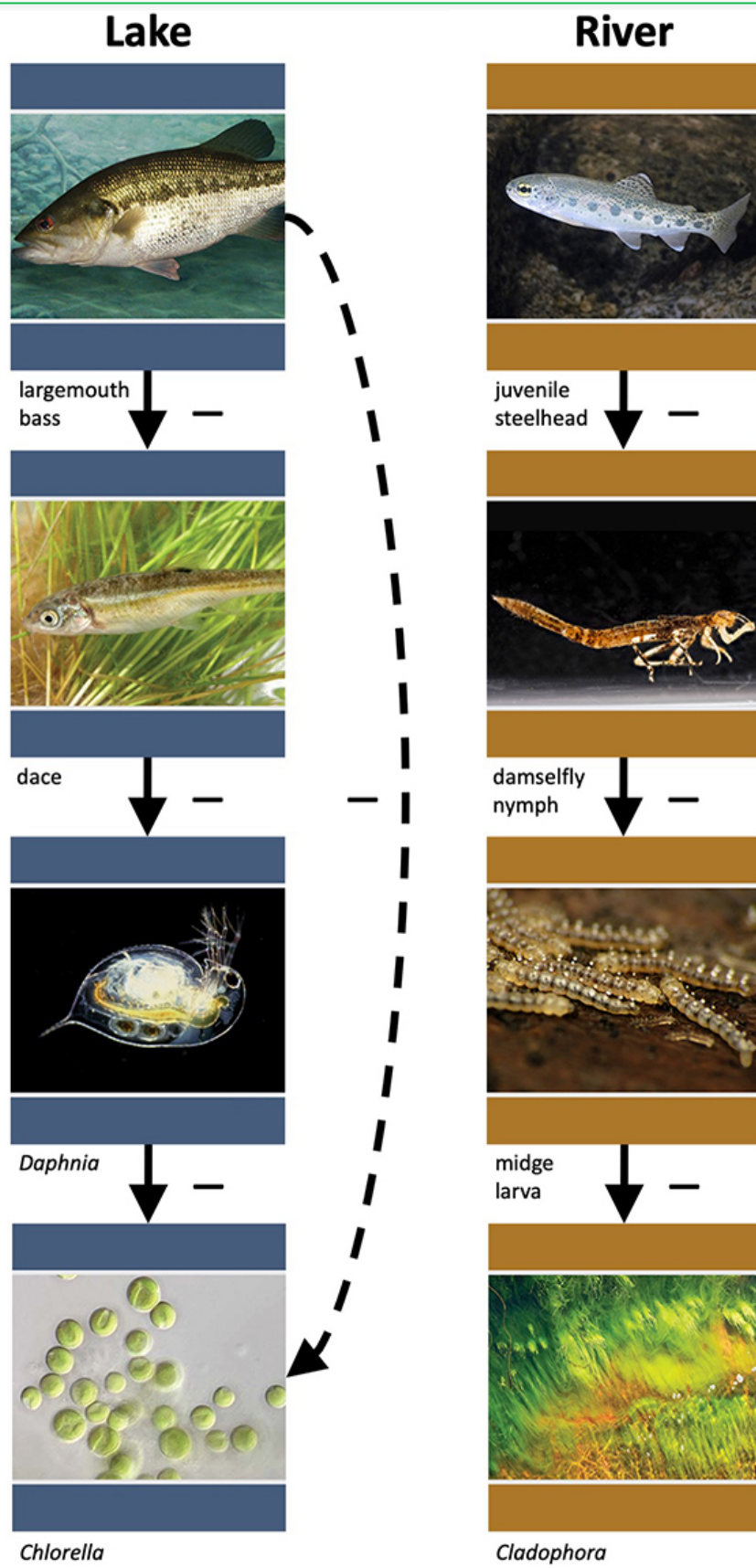
1. Place the cards face-down in two piles: habitats and organisms.
2. Draw a card from the habitat pile. (Alternatively, you may tell students ahead of time which habitat to use.)
3. Find all the organism cards that correspond to that habitat. (If students need a hint, the border on each organism card is color-coded according to the correct habitat.)
4. Arrange the species according to trophic level with the top predator on the top and producer on the bottom.
5. Draw solid arrows between each organism and the one below it, then draw a “+” or “-” to indicate whether the effect is positive or negative. The arrow should be pointed in the direction of the effect, not in the direction of the flow of energy.
6. Draw a dashed line from the top predator to the producer, then draw a “+” or “-” to indicate whether the effect is positive or negative.

TEACHING TIPS

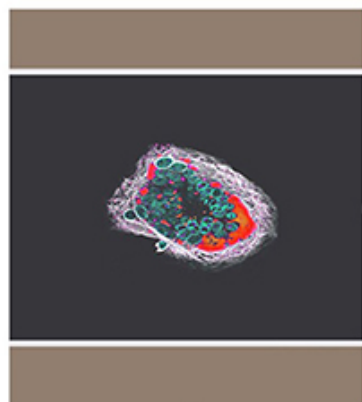
- Students can use their models to predict the effects of predator removal or other disturbances on the food chain.
- To use this activity as a quick “check for understanding,” give students the organism cards for a habitat already bundled.
- Most of the examples in this activity are discussed in greater detail in the [Exploring Trophic Cascades](#) Click & Learn. Consider using this activity as a review or wrap-up for the Click & Learn.
- If you are using printed cards, they can be laminated for repeated use. Attach magnets to the cards to use them on whiteboards.
- If you are using digital cards (individual card JPGs), you can use a virtual whiteboarding or collaboration software (e.g., Google Jamboard, Miro) in which students can move and annotate card images.

ANSWER KEY





African Savanna



rinderpest
virus



wildebeest



grass

Jungle



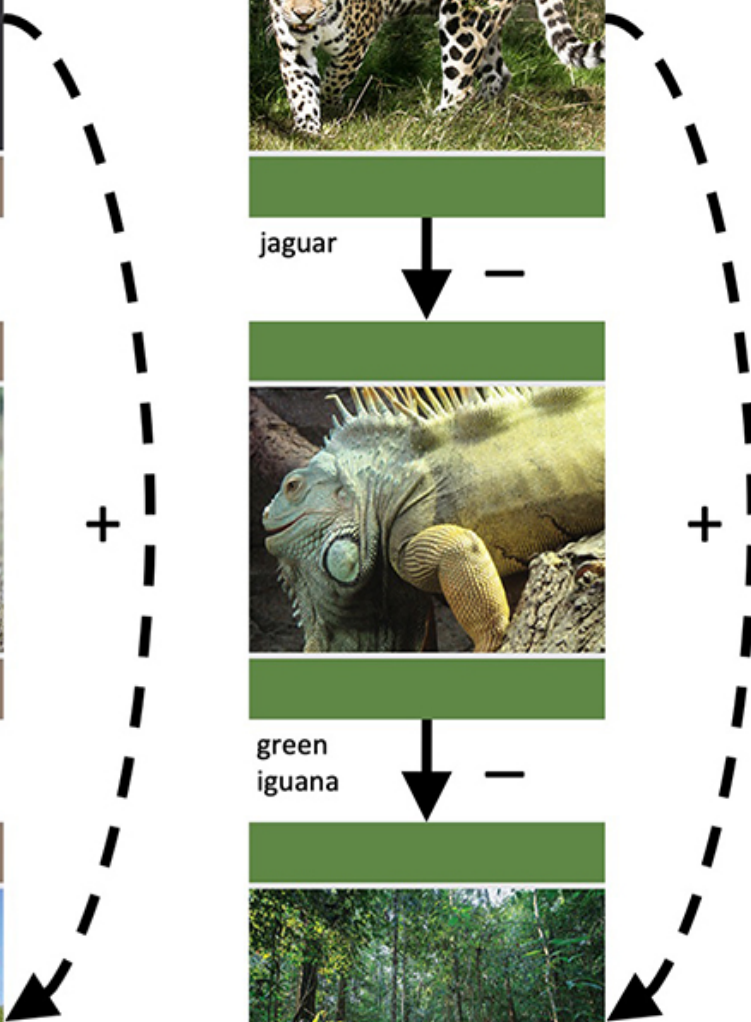
jaguar



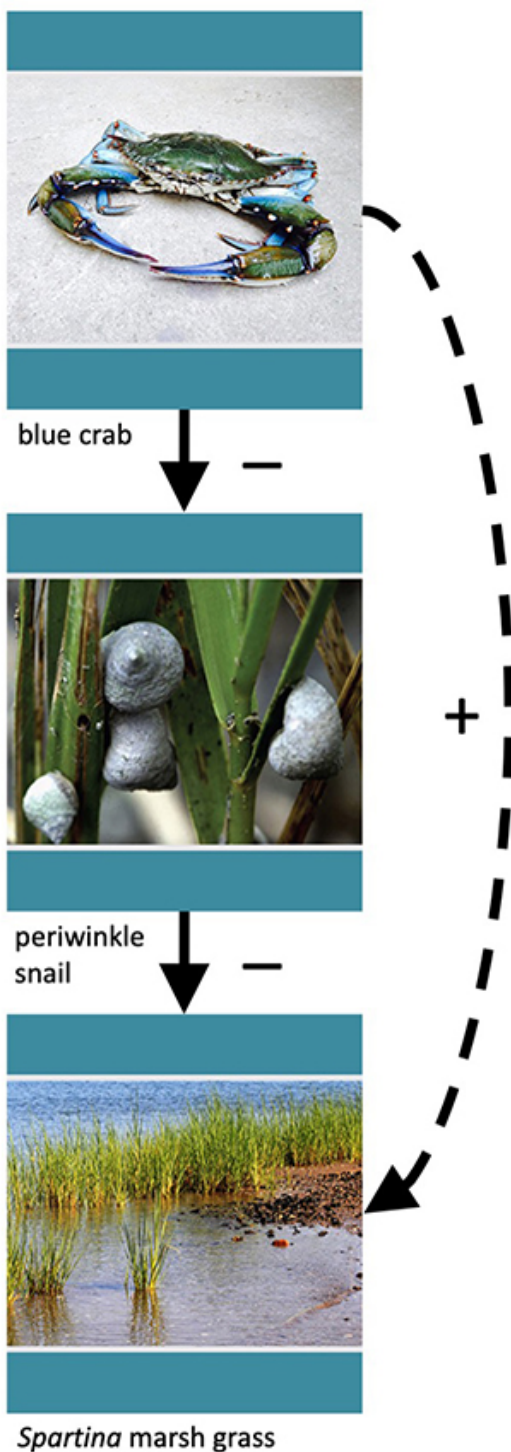
green
iguana



jungle vegetation



Salt Marsh



CREDITS

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