JESS WIEGANDT PRODUCTIONS
CREATIVE CONTENT, ECO-ENGAGED

# From High to Low: Exploring an Ecosystem

**Objective:** Students will be introduced to the impact of introduced species and how they affect an ecosystem, using the example of blue catfish, an introduced species in the Chesapeake Bay watershed.

**Goals:** Students will be able to articulate what an introduced species is and how it can impact an ecosystem (beneficially and negatively) and the surrounding area's economy.

**Materials:**

- Space for students to move around in a group.
- Play cards with labels of shad (1/4 of class), blue catfish (3/4 of class), and bald eagle (2 students)
- Multi-color popsicle sticks
- Ability to establish a boundary area for playing (cones, rope, tape)

**Methods:** Students will discuss introduced species with the background information given below, including the information about blue catfish. They will then play the game "From High to Low," which simulates an introduced species competing within and moving up a food chain. Debrief at the end will allow for students to talk about the difficulty of finding beneficial food, both as a predator and as prey.

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**Applies:** Students' knowledge of the food chain, healthy ecosystems, and relationships between predator, prey, and humans.

**Time:** 20-30 minutes

**Background:** Introduced species are animals or plants that have been introduced to an environment that would not otherwise exist in that region. Common ways introduced species occur is through accidental transfer/release, often by people, but sometimes are intentionally introduced to an environment to combat an alternate problem (such as Cane Toads being introduced as a pest-control in Australia).

Introduced species often out-compete endemic plants and animals within an ecosystem, which can have devastating effects on industries and communities that rely on the area's natural resources.

Accidental transfer of introduced species can be prevented by cleaning hiking and fishing gear, not moving firewood from one ecosystem to another, using fishing bait endemic to the area, cleaning boats when transferring them to a new body of water, and volunteering with removal efforts.

Not all non-endemic species are introduced species that are competitive – to be considered as such, a species must adapt easily to its new environment and be able to reproduce quickly, leading to harm done to the area's endemic plants, animals, and/or economy.

Blue catfish are an introduced species in the Chesapeake Bay. Initially introduced to rivers in Virginia, it was anticipated the fish would remain in freshwater habitats and therefore would remain in the Virginia waters, however, it was soon apparent blue catfish could tolerate higher levels of salinity than expected. The blue catfish swam out into the Chesapeake Bay and made their way upstream into other Bay tributaries.

Blue catfish are targets for fishermen, as they can grow to weigh more than 100 pounds, but the fish are detrimental to the environment they occupy, as they eat a wide variety of food – making it difficult for other fish to find food and have become predators as they eat other fish and blue crabs.

In an effort to control the population, blue catfish has become a menu item in the Bay region, and a public awareness campaign has been launched to encourage people to catch and eat the fish that are below 30 inches in length. Blue catfish that are older are known to have toxins accumulate within their bodies, so the size limitation for human ingestion protects us from eating unhealthy fish.

There are few natural predators for blue catfish in the Chesapeake Bay, but osprey and bald eagles are known to catch and consume the fish.

Blue catfish have serrated spinal barbs located on their dorsal and pectoral fins and the spines have glands that expel harmful toxins, which can enter a predator’s wounds and cause high levels of pain.

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**Activity/Procedures:**

- This activity is a game of tag mixed with foraging.
- Distribute role cards to students, assigning them to play as bald eagles (2 players), shad (1/4 of the class), or blue catfish (3/4 of the class). Have students keep their assignments a secret, except for the two players who are bald eagles. They will be tagging the fish and turning them into food.
- Students who have been assigned as the bald eagles will close their eyes as multi-colored popsicle sticks are scattered on the floor/ground within the play area. While the bald eagles' eyes are still closed, give the students with a blue catfish card a 5 second head start to gather as many popsicle sticks as possible. The popsicle sticks represent sustenance for the fish.
- After 5 seconds, let the remaining fish join the play area to pick up popsicle sticks. Students must have **at least three popsicle sticks** to leave the play area and avoid being tagged by the bald eagles.
- At the same time the remaining fish enter the play area, allow the bald eagles to join the group. Their goal is to tag as many fish as possible within the play area until none are left (either because they are safe with at least three popsicle sticks and have left the play area, or all have been tagged).
- Once tagged, students will sit on the ground/floor and have become food for the bald eagles – they should keep any popsicle sticks they gathered in their hand.

    - Fish with three or more popsicle sticks can leave the play area immediately, but if they are tagged on the way, must sit down, and have become food for the bald eagles.
- At the end of the game, see how many students who were playing as shad made it to safety versus how many blue catfish made it to safety.
    - The number of shad who made it to safety will likely be low, as they had less numbers and less access to food, simulating the environment in which endemic species are competing against introduced species.
- See how many fish were caught by the bald eagles and became food. See how many **blue catfish that were caught** are holding a popsicle stick that is green (color can change if you play multiple rounds). If more than half of the captured blue catfish have a green popsicle stick, the bald eagles were wounded by the blue catfish's serrated spinal barbs and toxins, and therefore have not won the game.

**Extension Activities/Discussion:**

- OPTIONAL BONUS FOR GAME: Regardless of species, see how many "safe" fish are holding a yellow popsicle stick (again, the color can change depending on how many rounds are played). If the players are holding more than one yellow stick in their collection of gathered sticks, they had been harboring chemical toxins in their fatty tissue as they grew older and have now died (introduces human impact on an ecosystem, can discuss legacy chemicals/pollutants).

- Discuss: What can be the economic impacts of introduced species such as blue catfish in an environment?
    - Positive: Blue catfish can be a popular source of recreational and commercial fishing, which can draw in tourists who would spend their dollars in the area on food, lodging, gas, guides, and gear rental. They can also be an important food source for those relying on fish as a main staple in their diet.
    - Negative: The increase in this introduced species has resulted in a dominance of blue catfish, which has caused the decline of other species in waters that are tributaries of the Chesapeake Bay. This monopoly on the environment results in an imbalance in the ecosystem, which can eventually harm the ecotourism industry, restaurant/grocery markets, and the overall health of the river systems.

A Note on Language:

This lesson features the use of “endemic” and “introduced” when discussing species in an environment. This is done in an effort to acknowledge and change language that historically has been conflated in reference to members of Indigenous nations.