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Invasive Species

Grouping
Sequence:

Pairs, groups
of 5, whole
class

Smokey fondly remembers Nayetsy, whom he taught in sixth grade a couple of years ago:

“One day she came up to me, kind of out of the blue, and asked: ‘Do you know that there have only ever been five species of tigers in the world?’

Taken a little aback, I replied, honestly, ‘No, I really didn’t know that.’

Nayetsy went on, ‘And two of those species are already extinct.’ By the time she finished that sentence, her eyes had filled with tears.”

All kids, from elementary through high school (and maybe all people), have a lingering curiosity about animals. Maybe we’re not all as intense as Nayetsy, but it’s one of those topics that everyone cares about and has opinions about. Of course, in elementary school, little kids get to learn about all the cute and cuddly critters—jungle animals, farm animals, our finny friends under the sea. But with the bigger kids, we like to study some problem creatures, some animal “delinquents” instead.

Invasive alien species are becoming a huge problem all around the world. In this lesson, we provide examples of a mollusk, a fish, a snake, two insects, and a mammal, all of which have become destructive in their newly adopted homes. Despite the differences in their phyla, all of these critters had to achieve the same underlying processes: they had to somehow arrive, survive, and thrive in a new habitat. This highly conceptual lesson is designed to help kids deduce from five examples what conditions favor the takeover of habitats by non-native species.

TEXTS IN ORDER OF USE

“Outback Steakhouse” (for the think-aloud)

“Scientists Fear Spread of Exotic Snakes” (easier)

“Fire Ants” (easier)

“Killer Bees”

“Zebra Mussels”

“Asian Carp and the Great Lakes”

CURRICULUM CONNECTIONS

Science: Biology, zoology, ecosystems, biomes, evolution.

Social Studies: Geography, transportation.

Math: Calculating population densities and growth rates.

Literature: *The World Without Us* (what would happen if the world's most invasive species—humans—suddenly disappeared).

English Language Arts: Draw inferences from text, analyze multiple articles on related topics, practice discussion skills, utilize note-taking strategies.

STRATEGIES USED

Think Aloud, Turn and Talk, Text Coding, Jigsaw



MATERIALS NEEDED

One set of all five articles for each group; projectable images of species, if desired, from www.images.google.com or other site (suggested links are on the website); large chart paper (for Step 11).

Steps and Teaching Language

Strategy 8: **THINK ALOUD**

Strategy 1: **TURN AND TALK**

STEP 1 Introduce the topic Often with text sets, we like to lead off with a captivating news item that allows us to build engagement and get kids eager to read. Here's how we might do this with alien species:

I read the most amazing article this weekend. I couldn't believe it. Let me ask you something: Where do you think camels live? In the Middle East, right, in desert countries? Uh-huh. Well, guess what? There are more than a million camels running loose in Australia. Australia! Who knew?

STEP 2 Think aloud a section of the article

Let me read you a little of this article from Atlantic magazine.

Read the first three paragraphs of "Outback Steakhouse" aloud, stopping to share your reactions, connections, and questions as you go. If possible, project a picture of the Ozzie feral camels while you read this. Search on "camels Australia," and you'll find abundant images.

STEP 3 Kids read and talk Hand out copies of "Outback Steakhouse" and let kids read the rest of the article silently; then invite pairs to talk and react. Encourage discussion and speculation about how camels were used in Australia, why people would even consider shooting them now, how hunters would dispose of the bodies—whatever catches the kids' attention.

STEP 4 Reconvene the whole class and offer more information The opportunity to define invasive alien species should arise naturally from the kids' pair conversations.

According to *InvasiveSpecies.org* (and they should know): “an invasive species is one that does not naturally occur in a specific area and whose introduction does or is likely to cause economic or environmental harm or harm to human health.”

OK, so some organisms become destructive when they move from their homes (or native range) to new habitats. Camels aren’t native to Australia, but as we just learned, they were brought there in the 1840s as a means of desert transportation in the arid outback. But eventually they were replaced by trucks and trains, turned loose, and have now become a huge environmental problem.

STEP 5 **Get kids questioning**

So let’s think about this. When a species somehow gets to some other habitat, what happens? It might immediately die out. But some species make a happy home. What’s the difference between the two? What favors a species taking hold? Let’s read about it.

STEP 6 **Kids choose articles** Arrange kids in groups of five and hand each group a stack of the five different articles. *Today, you’re each going to get a chance to specialize in one particular species. In a minute you’ll read an article about one of five different creatures: Burmese pythons, zebra mussels, killer bees, fire ants, or Asian carp. I am giving each group one copy of each article and you can decide who wants to read about which one. Go ahead and decide that now.* Assign articles to any slowpokes.

STEP 7 **Explain coding**

Strategy 4: **TEXT CODING**

So to help you read these articles, I’m going to suggest a special version of our text coding strategy. To become invasive, an alien species must do three things: arrive, survive, and thrive.

First, they have to get to a new location; they have to somehow **arrive** there to even have a chance of invading. Then, they have to **survive**. They have to find a place to live, find something to eat, and be able to keep living. Think about this: you could theoretically “arrive” on Mars, but you could not survive for one minute unless you had oxygen, food, and shelter, right? And finally, to become invasive, an alien species needs to **thrive**—which means it has to take over a niche, reproduce effectively, and perhaps come to dominate or drive out other species.

So as you read, if you come across something that tells how the critter arrived, code that with an **A** in the margin. Then if your article explains how the species survived, mark that information with an **S**. Finally, when you see information about how one of these species has come to really take over a habitat, mark that section with a **T** for thrive. OK? Happy reading, everyone.

STEP 8 **Monitor and coach** Help kids to apply the codes to their articles. There is plenty of information about arrival, survival, and “thrival” in each piece, so this should be doable.

Strategy 23: **JIGSAW****STEP 9 Invite discussion**

OK, now your teams can meet for six or seven minutes. Your job is to look at these three stages of invasiveness, and talk about how each of your creatures accomplished those stages. Pool your information. You may find things they did in common and things they did differently. Start by comparing notes on how each different creature arrived, then move on to how they survived, and finally about how each one came to thrive, if it did.

Visit and confer as kids work, making sure that they mark information in all three categories.

STEP 10 Add a second question

*OK, hang onto your thoughts about how species arrive, survive, and thrive. Now let's look at invasiveness from a slightly different angle. What are the **conditions that favor the success** of what we might call a "wannabe invasive species"? It might be something about the critter itself, or its behaviors, or about the new habitat, that make it more likely to eventually thrive. Make a list of those factors, and we'll compare notes in a few minutes.*

Allow three or four more minutes for talking and listing.

STEP 11 Share with the whole class Back as a whole class, have groups contribute their information, and make a large chart of findings as the discussion unfolds. By layering on information from the two stages of discussion, you'll get a rich picture of the invasion process, including the huge part that we hapless and reckless humans too often play in the process. One class's chart included these factors:

**What Helps Alien Species Thrive**

- people bring you there
- arriving at a place over and over
- being highly aggressive
- having a high reproduction rate
- not being picky about temperature, humidity, etc.
- not having any predators in the new location
- lots of food
- good weather
- feels like home
- not much competition for food or homes

Tips and Variations

- **USE EXPERT GROUPS** This takes a little extra time but is so worth it. After Step 8, have everyone stand up and go meet with a few other students who have read the same article. This stage allows kids to confirm the most important aspects of their creature, compare notes on the article, and return to their heterogeneous groups with refined expertise for the discussions.
- **INCLUDE REGIONAL SPECIES** If there is a local invasive species that kids might know about, replace one of our articles with one about a more familiar invader. While developing this lesson, we worked in some schools in North Dakota where Japanese beetles (similar to ladybugs) were imported to eat the aphids off soybean crops. The trouble was, they became a rampaging nuisance that overwintered in people's houses and emerged in spring to—guess what—bite people! Some ladybugs.
- **SHOW KIDS SOME VIDEO FROM YOUTUBE.** Nothing drives home the overwhelming nature of alien species like seeing hundreds of Asian carp leaping out of the water or thousands of Africanized honey bees on a stinging rampage.
- **ONE MORE STEP** Here's a great final proposition to debate (or even use as a research topic): "Human beings are the most destructive invasive species on the planet." Discuss that! (And perhaps have kids read segments of Alan Wiseman's excellent book, *The World Without Us*.)
- **REPLICATE THE STRUCTURE** This lesson can be applied to countless other topics: it simply offers several different examples of a phenomenon, system, or paradigm, and lets students deduce from a few examples what the common features are for *all* versions.

the Atlantic

Outback Steakhouse

*Australia's bush meat is tasty, healthy, and enviro-friendly.
But can you get people to eat it?*

Marina Kamenev, April 2010

Garry Dann nudged the steak in the rusty electric frying pan at his meat store in Alice Springs, a town in central Australia far from everything except desert. He pushed aside the bottle of canola oil next to the pan. "It's a great cut. You don't need to add anything, just cook it in its own fat," he said.

It tasted like a juicier version of beef. But the meat in question was camel—freshly slaughtered at Dann's abattoir, Centralian Gold, which he has been running, off and on, since 1986. In that time, the population of Australian camels has escalated to plague proportions, and Dann believes that selling their meat could become a multimillion-dollar industry.

Camels were first brought to Australia from the Canary Islands in the 1840s as beasts of burden. They carried goods across the harsh, Martian-red desert. As roads were built, they were gradually released into the wild. Now Australian camels make up the largest wild herd in the world, numbering about a million. With no natural predators, they are expected to double in population every decade.

Like most foreign species introduced into Australia's delicate ecosystem, camels have

wreaked havoc. They feed on roughly 80 percent of Australia's plant species, and have pushed some to the brink of extinction. In their search for water, they soil Aboriginal drinking holes, destroy everything from fences to air conditioners, and cause more than \$12 million worth of damage each year. In response, the Australian government plans to cull 349,000 of them, at a cost of \$17 million.

**"It's a good
meat, low in
cholesterol.
I would hate
to see it go to
the worms."**

Dann thinks this is a waste of potentially valuable meat. He concedes that camel is still a novelty in Australia, but he sees a lucrative market in the Middle East, where it's widely accepted. If he wins government approval to export, he aims to up the number of animals he slaughters each week

from 20 to 300. "It's a good meat, low in cholesterol," he said. "I would hate to see it go to the worms."

The camel-meat sector faces its own economic challenges. The market price of the meat is too low to support the cost of transporting it across the country, according to Gordon Grigg of Queensland University. And many camels roam in remote locations accessible only by air, which makes them costly to herd for slaughter.

San Francisco Chronicle

Scientists Fear Spread of Exotic Snakes

United Press International, Feb. 24, 2008

WASHINGTON—Scientists fear that Burmese pythons, already known to be breeding in South Florida, could spread through much of the southern United States.

According to the new US Geological Survey report, the python would find about one-third of the United States—including much of California—to be comfortable for its expansion. “Although other factors, such as type of food available and suitable shelter, also play a role, Burmese pythons and other giant constrictor snakes have shown themselves to be highly adaptable to new environments,” the report says.

The snakes weigh up to 250 pounds and slither at a rate of 20 miles per month, according to USGS zoologist Gordon Rodda. They are not staying put. One of them has already slithered about 100 miles westward from its breeding colony in Arkansas. “We have not yet identified something that would stop their spreading all the way to San Francisco,” Rodda said. If pet pythons were introduced into the wild in California by irresponsible pet owners, as happened in Florida, they could become established here even faster, without need of a cross-country journey.

What could stop the huge snakes? They’d have to get past Florida’s alligators first,

The snakes weigh
up to 250 pounds
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They are not
staying put.

although it’s a complicated relationship—while alligators do eat pythons, pythons can also eat alligators. But once out of Florida, there aren’t any free-roaming African lions and tigers between Florida and San

Francisco. So the absence of major predators outside Florida could help the snakes on their journey west.

While there are no recorded attacks on humans by Burmese pythons in the wild, they have killed children in their native range, Southeast Asia. Pet pythons sometimes kill their owners, probably because they have mistaken the human for food and are unable to stop their instinctive reaction to coil and squeeze. In Florida, they eat bobcats, deer, alligators, raccoons, cats, rats, rabbits, muskrats, possum, mice, ducks, egrets, herons and song birds. They grab with their mouth to anchor the prey, then coil around the animal and crush it to death before eating it whole.

Fire Ants

Red Fire Ants Information, www.fireant.net

Who Are These Fiends?

Fire ants are known for their lively and aggressive behavior, swarming over anyone or anything that disturbs their nest, often attacking wild animals, pets or people, in some instances, even killing them. 20 million people a year are stung by fire ants.

When these pesky critters invade an area, they come in enormous numbers, which can dramatically reduce populations of native ants, other insects, and even ground-nesting wildlife. They invade homes, school yards, athletic fields, golf courses, and parks. They will damage crops and electrical equipment, costing humans huge amounts of money each year in repairs and eradication.

Red Imported Fire Ant

The red fire ant was accidentally introduced into the United States in 1929, when a cargo ship that had used soil as ballast arrived in Mobile, Alabama, from South America. In recent years, the fire ant has spread as far west as California and as far north as Kansas and Maryland, covering 300 million acres and growing all the time. Although fire ants keep marching farther and farther, northerners don't have to worry because fire ants cannot survive in areas where soil temperatures drop to near freezing for more than 2 to 3 weeks.

Facts About Fire Ants

Fire ants are not picky eaters. They are omnivores and will eat almost any plant or animal material, including other insects, ground-nesting animals, mice, turtles, snakes, and other vertebrates, young trees, seedlings, plant bulbs, saplings, fruit and grass.

Fire ants are extremely organized. With an anthill population of 100,000–500,000, they need to be. Young fire ants help the queen deliver her eggs and tend to the larvae. Tunnel diggers dig new tunnels as the population grows, making room for increased traffic and new rooms for eggs and larvae. Guard fire ants stay near the entrance of the mound, blocking strangers from entering. Winged male and female fire ants go on mating flights in the spring and summer and start new colonies. Shortly after mating, the male dies and the female becomes a queen. She flies anywhere from 100 feet to 10 miles to start a new colony. And the foragers, the oldest of the colony, constantly search for food.

Smithsonian Institution

Science

News

Politics

Killer Bees

Department of Systemic Biology, National Museum of Natural History, Smithsonian Institution

Description: The general appearance of killer bees (Africanized bees) is the same as common honey bees, but there are some distinctive physical differences between the two. To analyze the differences, a laboratory has to measure and compare some 20 different structures. Another way to check is to analyze the specimen's DNA and enzymes.

Distribution: Honey bees are not native to the Western Hemisphere. European settlers brought most honey bees to the Americas approximately 400 years ago. In 1956, some colonies of African honey bees were imported into Brazil, with the idea of cross-breeding them with local populations of honey bees to increase honey production. In 1957, twenty-six African queens, along with swarms of European worker bees, escaped from an experimental apiary about 100 miles south of Sao Paulo. They've been spreading ever since. These African bee escapees have since formed hybrid populations with European honey bees, both feral and from commercial hives. They have gradually spread northward through South America, Central America, and eastern Mexico, progressing some 100 to 200 miles per year. In 1990, killer bees reached southern Texas, appeared in Arizona in 1993, and found their way to California in 1995. They are expected to form colonies in parts of the southern United States.

Damage done: Africanized honey bees (killer bees) are dangerous because they attack intruders in numbers much greater than European honey bees. Since their introduction into Brazil, they have killed some 1,000 humans, with victims receiving ten times as many stings as from the European strain. They react to disturbances ten times faster than European honey bees, and will chase a person a quarter of a mile. Africanized honey bees will attack when unprovoked, and they respond rapidly and in large numbers to disturbances that European honey bees would ignore. Both types of bee die shortly after leaving their stings and ends of their abdomen in their victim.

Other concerns with Africanized honey bees are the effects on the honey industry (with an annual value of 140 million dollars) and general pollination of orchards and field crops (with an annual value of 10 billion dollars). Interbred colonies of European and Africanized honey bees may differ in pollination efforts, be more aggressive, excessively abandon the nest, and not survive the winters.

Control: Two primary solutions have been considered. The first is termed drone-flooding, which involves maintaining large numbers of common honey bees (originally from Europe) in areas where commercially reared queen bees mate. This process would limit the mating possibilities between Africanized drones and European queens. The second strategy is requeening frequently, where the beekeeper replaces the queen of the colony, thus assuring that the queens are European honey bees and that mating has also occurred with European drones.

Zebra Mussels

Wikipedia, http://en.wikipedia.org/wiki/Zebra_mussel

The **Zebra mussel**, *Dreissena polymorpha*, is a bivalve mussel native to freshwater lakes of southeast Russia. Zebra mussels are filter feeders. When in the water, they open their shells to admit food. Zebra mussels get their name from the striped pattern on their shells, though not all shells bear this pattern. They are usually about the size of a fingernail, but can grow to a maximum length of nearly two inches. Its native distribution is the Black Sea and Caspian Sea. Zebra mussels are considered an invasive species in North America, Great Britain, Ireland, Italy, Spain, and Sweden.

Scientific Classification

Kingdom:	Animalia
Phylum:	Mollusca
Class:	Bivalvia
Subclass:	Heterodonta
Order:	Veneroida
Superfamily:	Dreissenoidea
Family:	Dreissenidae
Genus:	Dreissena
Species:	<i>D. polymorpha</i>

Effects: Zebra mussels are a great nuisance to people. Since colonizing the Great Lakes, they have covered the undersides of docks, boats, and anchors. They can grow so densely that they block pipelines, clogging water intakes of municipal water supplies and hydroelectric companies.

They also cleanse the waters of inland lakes, resulting in increased sunlight penetration and growth of native algae at greater depths. This proves beneficial for fish most of the time, helping the fish live in better conditions. They may also decrease the recreational value of inland lakes because once the mussels have devoured all the microorganisms in the water, weeds proliferate.

Reproduction: An adult female zebra mussel is one of the most reproductive organisms in the world. It may produce between 30,000 and 1 million eggs per year.

Spread: In the U.S., they were first detected in the Great Lakes in 1988. It is believed they were inadvertently introduced into the lakes in the ballast water of ocean-going ships traversing the St. Lawrence Seaway. Since adult zebra mussels can survive out of water for several days or weeks if the temperature is low and humidity is high, boats provide temporary refuge for clusters of adult mussels that could easily be released when transoceanic ships drop anchor in freshwater ports.

From their first appearance in American waters in 1988 zebra mussels have spread to a large number of waterways, disrupting the ecosystems, killing any local mussels (primarily by outcompeting native species for food, and damaging harbors, boats, and power plants). The cost of fighting the pests at power plants and other water-consuming facilities is \$500 million a year in the U.S., according to the Center for Invasive Species Research at the University of California, Riverside.

A common inference made by scientists predicts that the zebra mussel will continue spreading passively, by ship and by pleasure craft, to more rivers in North America. Since no predator or combination of predators has been shown to significantly reduce zebra mussel numbers, such spread would most likely result in permanent establishment of zebra mussels in many North American waterways.

Asian Carp and the Great Lakes

U.S. Environmental Protection Agency, www.epa.gov/glnpo/invasive/asiancarp

Asian carp are a significant threat to the Great Lakes because they are large, extremely prolific, and consume vast amounts of food. They can weigh up to 100 pounds, and can grow to a length of more than four feet.

Asian carp have been found in the Illinois River, which connects the Mississippi River to Lake Michigan. Due to their large size and rapid rate of reproduction, these fish could pose a significant risk to the Great Lakes Ecosystem.

To prevent the carp from entering the Great Lakes, the U.S. Army Corps of Engineers, U.S. EPA, the State of Illinois, the International Joint Commission, the Great Lakes Fishery Commission, and the U.S. Fish and Wildlife Service are working together to install and maintain a permanent electric barrier between the fish and Lake Michigan.

The Chicago Sanitary and Ship Canal, where the barrier is being constructed, connects the Mississippi River to the Great Lakes via the Illinois River. Recent monitoring shows the carp to be in the Illinois River within 1 mile of Lake Michigan.

How did Asian carp get so close to the Great Lakes?

Two species of Asian carp—the bighead and silver—were imported by catfish farmers in the 1970's to remove algae and suspended matter out of their ponds. During large floods in the early 1990s, many of the catfish farm ponds overflowed their banks, and the Asian carp were released into local waterways in the Mississippi River basin.

The carp have steadily made their way northward up the Mississippi, becoming the most abundant species in some areas of the River. They outcompete native fish, and have caused severe hardship to the people who fish there. When approached by a powerboat, these fish often jump in the air, and can seriously injure boat occupants. The carp have little economic value, as most Americans consider them inedible.

What effects might Asian carp have on the Great Lakes?

Asian carp are a significant threat to the Great Lakes because they are large, extremely prolific, and consume vast amounts of food. They can weigh up to 100 pounds, and can grow to a length of more than four feet. They are well-suited to the climate of the Great Lakes region, which is similar to their native Asian habitats.

Researchers expect that Asian carp would disrupt the food chain that supports the native fish of the Great Lakes. Due to their large size, ravenous appetites, and rapid rate of reproduction, these fish could pose a significant risk to the Great Lakes Ecosystem. Eventually, they could become a dominant species in the Great Lakes.