ROYAL BC MUSEUM


# Space Invaders: Alien adventures in our own backyard

HSBC School Visits Programs

## Teachers' Guide

Grade 4

# Space Invaders: Alien adventures in our own backyard

**Program Level:** Grade 4
**Program Length:** 90 minutes

## Tour Description

Do you know what's growing and living in your backyard? Is it native to British Columbia, or was it introduced from another place by human beings?

### Does it matter?

Students will journey through the *Natural History* gallery, exploring the wet and wild habitats of our province, learning which species are newcomers, and what effect their presence has on the ecological balance.

This Space Invaders tour is created to inspire students to look more closely at their natural surroundings, to discover what plants and animals share their environs, and to become aware of how human activity affects- intentionally or not- the living organisms in our world.

Understanding that the impacts from alien species can be profoundly harmful or beneficial may even inspire students to become active agents in conservation efforts.

After the visit, students are invited to continue exploring beyond the museum walls, both in the schoolyard and their own backyard. The Royal BC Museum's *Aliens Among Us* website will allow students and teachers to ask museum curators questions about what they have found in the field. Students will also be able to help track new sightings of introduced plants and animals with the website's interactive map.

Aliens (not the kind from outer space) are among us, in the ocean, in our estuaries and in our forests. The question is: do they come in peace?

http://alienspecies.royalbcmuseum.bc.ca

## Program Itinerary

### Prescribed Learning Outcomes

| Grade | Prescribed Learning Outcome | Vocabulary and Skills |
|---|---|---|
| 4 | Life Science: Habitats and Communities<br>• Compare the structures and behaviours of local animals and plants in different habitats and communities.<br>• Determine how personal choices and actions have environmental consequences.<br>• Appreciate the impact an introduced species can have on a native habitat or community. | • Habitat, adaptation, population, predator, prey, conservation, threatened, extinct.<br>• Observe animals and plants sharing a habitat.<br>• Record observations using a journal.<br>• Infer why particular plants and animals are able to share a habitat.<br>• Suggest possible actions that would improve your environment. |

## Pre-Visit Instructions

**The students must be divided into 4 groups before arriving at the museum.** They should also wear nametags, if possible.

Volunteer docents will guide the students through the different sections of the *Natural History* gallery. Each group will visit four stations: the coastal forest, seashore and delta dioramas, and a specially created BioBlitz discovery room. Each station will illustrate the effects of particular introduced species on habitats and communities. Students will not necessarily go through each station in the order presented below, but may start at any station and proceed through each of them until they have completed all four.

## Introduction

Upon arrival, students will be divided into their groups and escorted to the *Natural History* gallery by their assigned docent (a trained museum volunteer). During the introduction, docents will introduce some of the concepts that will be covered during the tour. This includes: defining what is a species, what is a native and non-native species, what does it mean for a species to be invasive, what is the role that humans play in transporting species, intentionally or unintentionally, from one space to another, and what are the consequences of an invasive non-native species on local habitats and communities.

## Station One – Coastal Forest Diorama

During this station, students will be introduced to the European Starling and Spurge Laurel. The starling is a bird that has caused headaches to countless farmers, not to mention native birds, over the years. The European Starling was first introduced to this continent at the end of the 19th century. At that time, the New York based American Acclimatization Society attempted to bring every bird mentioned in Shakespeare's plays to the United States. While other species of birds did not survive during this effort, the starling, though only mentioned once in Shakespeare's plays, has survived and thrived. The 60 introduced starlings have multiplied through the decades to more than 200 million birds. Issues around economic impact will be a focus of this section of the station. Students will also create a puppet show with a nod toward the theatrical history of the starling's introduction.

In addition, this station will focus on the invasive plant called Spurge Laurel, also known as Daphne. This plant can spread with the help of song birds like starlings and can take over the forest floor if not properly kept in check. Spurge Laurel looks like a Rhododendron and was mostly likely brought over from Europe as an ornamental shrub. As sometimes happens, the seeds of garden plants spread into the wild. Spurge Laurel grows berries, and the seeds get dispersed by rodents and birds. The plant also has lateral roots, which aids in the spreading within a particular area. Spurge Laurel is poisonous to humans. This section of the station will also address the role of non-native plant species in our everyday lives (dinner would be rather boring if we only ate native plants and vegetables), as well as the danger of unchecked invasive weeds.

## Station Two – Seashore Diorama

This station will introduce students to the Pacific Oyster and the Manila Clam. The Pacific Oyster was intentionally brought to BC from Japan at the beginning of the 20th century to boost the oyster production in commercial aquaculture. But with the Pacific Oysters came many other species unknowingly hitchhiking along. One of these was the Manila Clam. Though not intentionally introduced, Manila Clams are now one of the most commonly farmed clams on BC's coast.

At this station, students will examine specimens of both species, as well as their native counterparts. Particular attention will be given to how similarities and differences of native and non-native species can affect the sustainability and growth of their populations.

Students will also learn how ballast water in ships function as the primary method of unintentional marine transfer of species. Students will have an opportunity to discuss the conflicting dynamic of certain species providing potential benefit for humans, while at the same time negatively affecting native species.

## Station Three – Delta Diorama

This station will introduce students to the Green Crab and the American Bullfrog. While most of the species highlighted during this tour were introduced many decades ago, the Green Crab is a more recent arrival. It arrived in the late 1980s coming to San Francisco Bay by way of ballast water. Over the last few decades, the Green Crab's larvae have been dispersed by the ocean current up to Vancouver Island. Researchers are unsure of its ultimate impact and range.

On the other hand, the impact of the American Bullfrog is well known. Bullfrogs were introduced to British Columbia in a failed attempt to provide meat to restaurants that served frog legs. Those bullfrogs were then released into the wild. Garden supply companies have also promoted bullfrogs, and as a result some of those bullfrogs have escaped from their backyard ponds. And yes, even schools have

played a part in this introduction story. Schools can order bullfrogs and tadpoles from biology supply companies, which then sometimes (not by your school of course) get released into the wild. American Bullfrogs are not kind to native frogs – they can either eat them or push them out of their habitat.

This station will address the role of co-evolutionary process, and how introduced species can disturb habitats that have existed for a long time in a relatively functional balance. Introduced species can often be at a clear advantage after entering into a new habitat if they have few natural predators or serious competition.

## Station Four – BioBlitz Discovery Room

This station is an activity room where students will have a chance to explore a constructed habitat, complete with correctly scaled images of native and non-native flora and fauna of British Columbia. Students will conduct a BioBlitz, where they will be asked to record everything they see over a short period of time. Not knowing the exact species, students will write down details or draw pictures of the different plants and animals they encounter. They will then be able to refer to the museum's Aliens Among Us website with a provided tablet, where they can identify some of the species they observed "In the field". This will give students a chance to learn about the interactive website, as well as how to do a BioBlitz. Classes will be encouraged to do their own BioBlitz back at their school as part of a post-visit activity.

## Pre-visit Activitiy

### Create a map of your school grounds and identify and plot the trees within the boundaries of the map

As a class, create one or more maps of the school grounds on a large piece of paper. Leave plenty of room for a legend.

http://education.usgs.gov/schoolyard/MapSketch.html

The website above provides a step-by-step process for creating a map from an aerial photograph. But the class can also create the map by observation and using free-hand drawing. Buildings can be indicated on the map, but the areas of interest are the outside areas.

Once the map or maps are completed, do a walking tour of the school grounds and try to identify as many trees as you can. Your class can refer to the website below to help in making accurate identification. Do the best you can. Plot on the map the location of trees and, using the legend, what species they are.

http://www.geog.ubc.ca/biodiversity/eflora/E-FloraTreesofBritishColumbia.html

Pick one species of tree that is growing in your schoolyard and research its history as it relates to British Columbia. This concept of history of species within a particular geographical area will provide a good foundation for the tour.

The map or maps will be used as well for a post-visit activity explained below.

## Post-Visit Follow Up Activities

### BioBlitz your school yard.

A BioBlitz is a biological inventory of a particular area. Scientists use this method of observation to identify and record every living species in a designated area over the course of a defined period of time. Generally this period is 24 hours, but it could be an hour for this activity. Each scientist/student is given their own area to record everything they see that's living (i.e., plants, insects, mammals, birds, etc.) by way of written descriptions or drawings. Students should also record where and when they found each living organism. Cameras can be used to collect data.

The website below provides some curricular connections while conducting a BioBlitz, and during the tour the class will also be given a BioBlitz booklet that explains different components of the acitivity.

http://www.k12academics.com/articles/wanted-bioblitz-participants

Once the BioBlitz period of observation is over, the class can then try to find out what species they observed. Those species that are identified can be added to the map created during the pre-visit activity. A separate legend and document can be created for organisms that cannot be identified.

Once the map is completed, special attention can be given to what are native and non-native species in the school grounds. If there are non-native species, an action plan can be created to address whether the species needs to be removed.

### Post a question to a curator at the Royal BC Museum

If, while doing the BioBlitz, there are certain species that are not identifiable, then contact a curator. The Royal BC Museum website *Aliens Among Us* will be used during the tour, and a communication function of that website will allow your class to ask questions to the museum curators. The aim of this post-visit activity, beyond the practical purpose of answering questions, is to convey to students that the museum is an open institution that seeks to exchange ideas and information between the public and staff. In this way, the tour is only the beginning of conversation about issues related to the natural history of British Columbia.

### Radio debate

Have the class listen to a relevant portion of the audio link below. The audio link is a segment of the CBC radio program *The Current* about Invasive species (20 minutes in total). In it, two experts debate the importance of focusing on eradicating non-native species. The debate, which starts at 6:30 in the segment, is spirited and provides an opportunity to see both sides of this issue.

http://www.cbc.ca/thecurrent/episode/2011/08/04/biological-bias/

Discuss with the class what they heard. Ask the students what the debate consisted of and what side was more convincing and why? Was it about the content of what was said, or how it was presented?

Using the Pacific Oyster (a species addressed during the tour) as a topic for discussion, have the class create the script for your own radio program. Create a name for the program, a name for the host and a name for the experts and where they are from. Have the host give a short introduction about Pacific Oysters and introduce the guests. One guest feels that Pacific Oysters are important (and perhaps tasty) and the other feels that Olympia Oysters are in danger because of Pacific Oysters.

Once the script is created, have students act out the radio program. An extension exercise is to create an added script where listeners call in and give their opinion of what they heard. Then the script can be read again with the added callers, each student having a role in the program.

This activity is a playful way to address the debate around the role of invasive species in habitats and communities.

## General Tour Content Information

### Aliens are not just big, green monsters from outer space.

Alien species are plants, animals or microorganisms that live right here on Earth - maybe even in your neighbourhood. In British Columbia, there are over 4000 alien species that have made their way here with help from us, and the number is continually growing. Some species don't survive. Some adapt and fit in well. Others cause harm and disrupt habitats and native species already living in the area.

### What is an invasive species?

Alien species are newcomers that arrive from somewhere else. They make their way slowly – or quickly – around the continent. They come from countries overseas and from other places in North America, hitching rides on ships or planes, or even from the garden store down the street. Aliens, also known as exotic species, are plants, animals, fungi or microorganisms that have crossed our borders with the help of humans. Regrettably, many of these exotics have flourished, sometimes to the detriment of native species.

All species are alien to some degree; even native species migrated here if you reflect far enough back in time. Most native species arrived after the continental glaciers melted about 14,000 years ago, whereas most alien species arrived after the time of the first European settlers about 160 years ago. Some of our native species are considered aliens in other parts of the world.

Aliens can become established in a new home if:

- there is an agreeable climate
- there are no or few natural predators, parasites or diseases
- there are lots of habitat and nutrients
- they are able to reproduce
- they are able to out-compete native species

Invasive species are the ones that we have to watch out for - these are the more aggressive aliens that are capable of causing significant harm to our environment, our economy or our communities. We've heard about them in the news: the American Bullfrog that pushes native frogs from their habitat (or just eats native frogs), Scotch Broom that infests the fragile Garry Oak ecosystems, or the Smallmouth Bass that eats everything it can fit in its mouth.

## How did they arrive?

Aliens have arrived in British Columbia hitchhiking on boats from Asia or RVs from Alberta. They have been intentionally planted in gardens or backyard ponds, released to feed other species or humans, or let loose in the wild as unwanted pets. Intentional or not, all aliens have arrived with the help of humans, and many alien species required our help to become established.

Most accidental aliens are rarely discovered unless they become invasive and spread. In the right conditions, and if they like their new homes, invasives can proliferate very quickly.

There are four main ways that alien species arrive in British Columbia:

1. **Intentional and authorized releases**

These are aliens that have been intentionally introduced. Occasionally, the introduced species will have unintended consequences on the environment.

A good example is the Opossum Shrimp that was introduced to interior lakes to provide food for Kokanee, a popular freshwater form of the Sockeye Salmon. Instead of fattening the fish, the shrimp stayed out of sight during the day, and at night, the shrimp emerged and ate the same prey that the Kokanee dined on. Instead of boosting the Kokanee population, the Opossum Shrimp became competitors with far-larger Kokanee.

2. **Intentional and illegal releases**

Species that are introduced either through ignorance or disregard fall under this category. These include pets that were released into the wild, non-native invasive plants used to landscape a garden, or bait dumped into a river. Our most recently discovered exotic fish is the Weather Loach from Eurasia, which was probably dumped from a private aquarium or released to start a local culture for human consumption.

3. **Escapees**

These are the species that got away – fish escaping from aquaculture pens, oyster larvae drifting in currents, a pet bird flying out a window, and perhaps also ornamental plants that are not normally invasive, spreading beyond a garden.

4. **Passive transfers and unassisted dispersals**

These are the aliens that stow away in planes, boats, trains and trucks, concealed in packing material, unprocessed logs, produce and nursery stock. Dirty boats transport European Watermilfoil from lake to lake, while dirty fishing waders transmit Didymo (`Rock Snot') into new rivers.

The ballast water carried in the tanks of ocean-going ships is a common home for aquatic aliens; it is estimated that, at any given time, 3,000 species are circulating the planet in ballast water tanks. In the past, soil from Europe and elsewhere used as ballast in sailing ships was dumped along the coast. Many soil and ground dwelling invertebrates and various plants probably arrived in this manner.

Many aliens arrived in BC on their own after being introduced to other parts of North America from overseas. European Starlings and House Sparrows spread quickly westward from the eastern United States, where they were brought from Europe. The Multicolored Asian Lady Beetle has a similar history, although it was originally imported to the southeast US from eastern Asia.

## Why should we be concerned?

### Aliens don't just impact animals

According to the World Conservation Union, the spread of invasive alien species is the second most significant threat to biodiversity, next to habitat loss.

### Environmental Impacts

Native species have settled into their habitat over time, creating a balance, with each species fitting into an ecosystem. Alien species arrive and, if they are able to thrive, they may become overly successful predators or competitors, they can introduce diseases and parasites, and upset this natural balance. When aliens move in, native species often move out, and very seldom is just one native species affected – there is often a chain reaction with surprising outcomes.

### Societal Impacts

It isn't just wildlife that is impacted when an alien moves in. Alien species may be poisonous, they can carry diseases, or even kill people. As well, alien invasives can alter our urban habitat by damaging buildings, increasing the risk of flooding or wild fires, or reducing available land.

### Economic Impacts

Invasive alien species cost Canada about 34.5 billion dollars annually (an estimate from 2006); this number will only increase with climate warming and increased traffic in exotic species for food, pets, and gardens. Control and management of aliens cost money for both industry and the general public -- fishermen and farmers lose catches and crops, management of aliens can slow down the trading of goods, and aliens can even negatively affect housing prices or the recreational potential of a lake.

## What can we do about them?

### Taking action against invasive species.

Only a fraction of alien species that make their way to British Columbia are able to survive without our help, but those that do can have a huge impact on our ecosystems. Prevention is important in stopping the spread of invasive aliens, and is far cheaper and more effective than control after aliens get established. Here are a few simple solutions:

**Know the aliens.** Learn about the invasive species in your community and tell others. Check your property. But before you take action be sure you have correctly identified the species.

**Garden wisely.** Landscape with native plants and avoid introducing invasive species into your garden or pond. Frogs and turtles that are released into ponds rarely stay there.

**Be kind to native species.** Make your yard a better place for indigenous species and less attractive to invasives such as Gray Squirrels, House Sparrows or rats. Put up bird boxes for native species or bee homes for the native Mason Bee.

**Care for pets.** Don't release pets into the wild; your goldfish may have a disease and a couple of bunnies released into a park can reproduce very quickly. Perhaps a local rescue organization or pet shop will take unwanted pets and find them new homes.

**Join the fight.** There are many organizations you can join that are fighting invasive species. They pull Scotch Broom, remove Eurasian Watermilfoil or help stop the spread of Knotweed.

**Clean your camping and fishing equipment.** Check your boat for invasive species carefully, and drain all water from the boat and any equipment before leaving an area - especially when crossing to a new watershed. Carefully clean your fishing waders, camping equipment and outdoor furniture before moving them, and check the RV for any unwanted stowaways - a rattlesnake once arrived on Vancouver island as a stowaway in an RV.

**Report aliens.** If you suspect an invasive species in your community, mark it on the map on this site, or better yet, take a picture and let our curators know.

## Teacher Resources

### Recommended links:

Environment Canada: Invasive Alien Species in Canada
http://www.ec.gc.ca/eee-ias/

Government of British Columbia Ministry of Environment: Alien Species in British Columbia
http://www.env.gov.bc.ca/wld/aliensp/

Government of British Columbia Ministry of Forests and Range: Invasive Alien Plant Program
http://www.for.gov.bc.ca/hra/plants/application.htm

Invasive Species Council of British Columbia
http://www.bcinvasives.ca/

E-Flora BC: Electronic Atlas of the Plants of British Columbia
http://www.geog.ubc.ca/biodiversity/eflora/invasives.html

E-Fauna BC: Electronic Atlas of the Wildlife of British Columbia -
http://www.geog.ubc.ca/biodiversity/efauna/invasive_species.html