



## AQUATIC INVADER INVESTIGATOR

# Hazardous Paths to the Columbia Gorge

### SOLVE THE PATHWAY PUZZLE AND IDENTIFY HAZARDS



*The Columbia River, pictured here, forms the border between Oregon and Washington.*

Photo credit: etliebe.

#### Introduction:

It is rare to find a place along the rivers of the Western United States that hasn't been impacted by human visitors. Whether marveling at the Columbia on the border of Oregon and Washington or the American River in California, the difference in appearance and biotic composition over the past two centuries with Western Expansion is significant. One common factor is the introduction of non-native species.

"When Lewis and Clark navigated the vast waters of the Columbia and Snake Rivers, were they serenaded by the bass chorus of bullfrogs? Did they marvel at the small bronze shells of *Corbicula* clams spread across the shoreline like spilled pennies? Did they paddle through tangled filaments of Eurasian watermilfoil? Did they dine on carp and catfish? They did not – because these species didn't exist in the Columbia Basin 200 years ago!

"Over 80 species have been introduced to the Columbia Basin over the past two centuries, and those are just the ones we know about. Some, like purple loosestrife, hail from foreign lands. Others, like brook trout, came from native populations in other regions in the United States. Species like New Zealand mudsnails arrived as accidental hitchhikers; others, such as walleye and smallmouth bass, were introduced intentionally for human use. With this global mix of organisms, the Columbia River Basin truly contains international waters.

"Are these exotic species all bad? It depends both on biology and social values. Biology can explain why some plants and animals explode in numbers when introduced outside their native range. Such organisms are particularly labeled as invasive, pests, or nuisance species when their exploding populations lead to economic or ecological damage. But many nonnative species provide human benefits as well, and that complicates how we manage them." (Introduction by Paul Heimowitz, Aquatic Invasive Species Coordinator for the US Fish and Wildlife Service.)

One of the important strategies for managing invasive species is prevention. A Hazard Analysis and Critical Control Point (HACCP, pronounced "has-sip") plan is used for managing risks by reducing hazards. An Aquatic Invasive Species (AIS) HACCP plan examines invasive species via human-based pathways and includes all activities in order to determine whether, how, and when a species might be moved. The first HACCP plans were built around the food industry in the 1960s for the space program, to ensure product purity. Natural-resource managers use HACCP to prevent the spread of invasive species by identifying high-risk activities. This tool will engage your critical thinking and logic skills to determine when and where to control the invasive species. First, you will complete a "HACCP Puzzle" by sequencing the HACCP cards into the correct order. This puzzle is based on the actual HACCP plan for fish monitoring using electrofishing that is used in local streams as well as by the Lower Great Lakes

## Hazardous Paths to the Columbia Gorge

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Fisheries Resource Office. (More information available from: <<http://haccp-nrm.org/Plans/NY/Electrof.pdf>>) Following this activity, you will create your own HACCP plan for a different invasion pathway.

### PART 1: THE HACCP PUZZLE

**What is HACCP?** The way an invasive species is transported from one place to another is called an “invasion pathway.” For example, stocking a pond with fish from a hatchery can be a pathway for spreading Asian carps, because the water at the hatchery (drawn from a river) could be contaminated with the invasive carps. Many natural-resource management activities can spread invasive species. One way to slow the spread of invasive species is to remove them from these pathways. Natural-resource managers use the Hazard Analysis and Critical Control Point (HACCP) planning tool to identify when and how an invasive species should be removed from an invasion pathway. The “hazard” is the invasive species, and the “critical control point” is the place and time to remove the species from the pathway. For example, a fish hatchery HACCP plan might determine that the critical control point for the Asian carps (the hazard) occurs just before the fish are loaded onto the distribution trucks. The HACCP planning process includes determining ways or methods for removing the hazard (the invasive species). More information about HACCP is available from: <http://haccp-nrm.org/>

**What is electrofishing?** Electrofishing involves passing an electric current through the water to draw fish to the surface, where they can be captured alive in a dip net. Electrofishing is used as one technique by researchers and resource managers to determine fish populations in a specific water body. Electrofishing can be done with a specialized backpack or from a boat. When conducted from a specially equipped boat, a generator causes the metal boat to act as the cathode, which discharges electrons into the water. The electric current passes through the water and is picked up by positively charged wires (anodes) dangling from booms on the front of the boat. Fish within the current are stunned and orient in the direction of the current flow, swimming toward the anodes.



The main purposes for electrofishing are stock assessment, sampling/health surveys, tagging, catching spawning fish, anaesthetizing, or eliminating species. You will do an exercise designed to help you think critically about AIS pathways and identify critical control points. (Above image courtesy USFWS.)

**Instructions:** Your teacher will review invasive species and HACCP planning using a PowerPoint presentation. After your teacher divides the class into groups, he or she will give each group a set of “HACCP Cards” that include Task, Hazard (vertebrates, invertebrates, plants), Control, and Critical Control Point (STOP) cards. Your teacher will also give you a set of Fact Card, which have information about each invasive species that could be spread. This information will help you decide whether that species can be spread at each step of electrofishing. You will use all your cards to put together the HACCP Puzzle.

## Here's how to put together the HACCP Puzzle:

- 1 Look at the different tasks on the task card and decide what sequence they should go in. Arrange the task cards in a sequential order, connecting the tasks with arrows.
- 2 Identify which tasks have the potential for invasive species to escape, be transported, fall off, or introduced. These tasks may be the critical control points. Place a critical control point card next to these tasks.
- 3 At each critical control point, add the appropriate hazard card (invasive species). Select one or more categories of species that could be spread at that critical control point and place the card next to the control point. Use the fact cards to read about each species' characteristics for clues regarding whether or not it can spread at that point.
- 4 Select the best control measure for that critical control point. Place the appropriate control card next to the critical control point.
- 5 After each group has assembled its puzzle, explain which tasks your group identified as critical control points.

**Discussion:** Does it make sense to control the "hazards" at every possible critical control point?

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## PART 2: CREATE YOUR OWN HACCP PLAN!

Name \_\_\_\_\_ Date \_\_\_\_\_

Create your own HACCP plan. Select from the following list of possible invasive species pathways on the Columbia River, or use your own pathway!

### Instructions:

- 6 Select a pathway from the list below, or use your own pathway. Brainstorm possible steps in that pathway. List the steps on the HACCP Worksheet.
- 7 List the invasive species that could be spread at each of the steps.
- 8 Determine the critical control points. Circle the steps you think are critical control points.
- 9 Suggest a possible control method for each critical control point.

### Possible Pathways

Each of the following activities is a known pathway for invasive species. Can you think of any others?

- **Shipping (ballast water):** Commercial ships and other vessels entering the Columbia River can discharge contaminated ballast water (used to keep ships stable) and nonnative species living on their anchors, hull, and other parts of the vessel.

## Hazardous Paths to the Columbia Gorge

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- **Recreational boating:** Boaters from outside the Columbia Basin may unknowingly introduce aquatic plants and animals traveling in their live-wells and attached to their watercraft and trailers.
- **Fishing:** Many nonnative fish in the Columbia Basin were put there intentionally to enhance fishing opportunities. Other species were unintentionally introduced on gear. Imported live bait is also a source of nonnative species.
- **Outdoor recreation:** Hunters and other outdoor enthusiasts (and associated animals) can inadvertently spread invaders between watersheds with gear and movement of water.
- **Aquariums and water gardens:** From goldfish to yellow flag iris, nonnative plants and animals have found their way from hobbyist tanks and ponds into the Columbia Basin.
- **Aquaculture and live seafood:** When non-native shellfish and other species are disposed of improperly or escape containment, they can become a problem.
- **Research and education:** Scientists and educators working with nonnative species can introduce the species and spread problems during fieldwork.
- **Habitat restoration:** Although carried out with good intentions, moving equipment, plants, and other materials to wetlands and other restoration sites can introduce invaders.
- **Traveling abroad:** Travelers can advertently spread invaders by bringing back plants, animals, food products, and souvenirs that could potentially introduce invaders here in the U.S. and other countries.

### Possible hazards (of aquatic invasive species) to the Columbia River Gorge

Information about the following species is available at [MenaceToTheWest.org](http://MenaceToTheWest.org)

- Red-eared slider
- Asian carp
- Bullfrog
- New Zealand mudsnail
- Red swamp crayfish
- Zebra and quagga mussels
- Hydrilla
- Brazilian elodea
- Nutria
- Knotweed (Japanese, giant, Bohemian)
- Chinese mitten crab

The following species are not yet available on [MenaceToTheWest.org](http://MenaceToTheWest.org)

- Mosquitofish
- Warmwater game fish (brook trout, brown bullhead, bluegill, etc.)
- Yellow flag iris
- Curly leaf pondweed
- Eurasian watermilfoil
- Purple loosestrife
- Reed canarygrass
- Asian clam
- Chinese mystery snail
- Eastern softshell clam
- Siberian prawn
- American shad
- Amur goby

## HACCP PLAN WORKSHEET

Your Team's Pathway \_\_\_\_\_

TASK or STEP in Pathway (It's OK if you don't know all the steps; just do your best)	HAZARDS (Remember, some steps will not have hazards)	CONTROL? (What steps are the most logical for control? Think about efficiency! Be creative in the options you suggest)
Step 1)		
Step 2)		
Step 3)		
Step 4)		
Step 5)		
Step 6)		
Step 7)		
Step 8)		

**Circle the steps you think are critical control points.**

If time allows, create a drawing illustrating your pathway (activity) that can spread invasive species (invasive species pathway) including the steps where you can take action to prevent spread. You may use an additional sheet of paper if needed. We would like to collect and showcase your illustrations! Please contact the WISE program (contact information is on the website [MenaceToTheWest.org](http://MenaceToTheWest.org)).

# Hazardous Paths to the Columbia Gorge

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## PART 3: TEST YOUR KNOWLEDGE!

Name \_\_\_\_\_ Date \_\_\_\_\_

1 What is an invasive species? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

2 What is an "invasion pathway"? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

3 What is Hazard Analysis and Critical Control Point planning? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

4 What is the "hazard" in a HACCP plan? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

5 What is the "critical control point" in a HACCP plan? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

6 In the electrofishing example, in how many steps was it possible to spread invasive species?  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

7 How are the risks in electrofishing similar to recreational fishing activities?  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

8 Is every step where it is possible to remove an invasive species always a Critical Control Point?  
Why or why not? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

9 How important is it to understand the biology of an organism in deciding when and how to control it on an invasion pathway? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

10 Do you have any activities (hobbies, work, transportation, school) that could spread invasive species? What would a HACCP plan for your activity look like?

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11 What do you think you could do as an individual to help stop the spread of invasive species?

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12 In electrofishing, an electrical field is created that causes the fish to be stunned and float to the surface. How is the electrical field created?

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