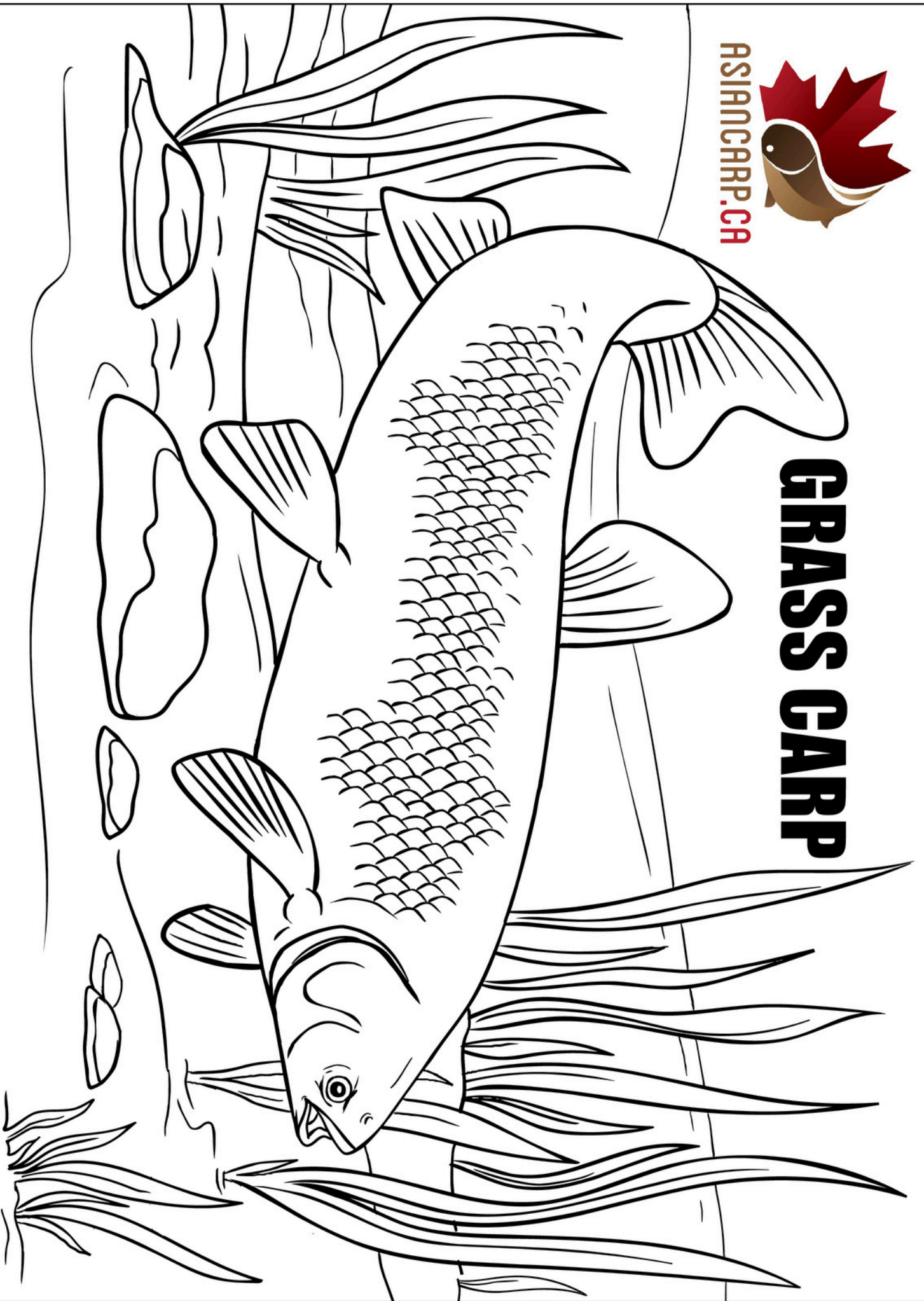




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GRASS CARP





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BLACK CARP



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BIGHEAD CARP



• □ Invading Characters □ •

PURPOSE: *Students are challenged to read a paragraph about biodiversity with progressively more letters replaced with typographical characters in each version. The activity illustrates how an ecosystem (represented by the paragraph) can be disturbed by invaders (represented by characters), and introduces concepts of native species and biodiversity. Use this activity as a warm up for Lesson 1: Graffiti Gallery.*

TIME:

20 minutes

MATERIALS:

Flipchart/pen, Overhead projector, **BLM 1, 2 & 3:** Invading Characters #1, #2, #3 (copied on to overhead slides)

PROCEDURE:

1. Make a Biodiversity KWL chart. As a class fill in the K (prior knowledge) and W (want to know) columns. Post the chart for students to see as they complete the “Invading Characters” activity.
2. Ask for three volunteers who are comfortable reading aloud and ready for a challenge.
3. Put the first overhead slide up and explain that each letter in the paragraph represents a species in an ecosystem. Biodiversity is the variety of life on Earth; invading species threaten biodiversity by out-competing native species. Ask volunteer #1 to read the paragraph aloud, then have the whole class read it aloud.
4. With their elbow partner, have students use Think-Pair-Share to talk about what the paragraph means to them.
 - What do we mean by “natural controls”? (e.g., climate)
 - What could some of the devastating effects be?
5. Put up slide #2 and ask volunteer #2 to read it aloud, followed by the whole class reading aloud. Ask students:
 - What is different about this slide?
 - Who are the invaders?
(It is the same paragraph with # added after every “a” and * added before every “d” throughout).

- How did the invaders affect your ability to read the paragraph?
(Adding just two symbols (# and *) really changes the paragraph. Unfortunately, invading species don't just confuse an ecosystem by adding to it. They compete with other species for limited resources such as nutrients, space, sunlight, and clean water. Invading species often have no natural predators or controls so they are able to consume more resources and produce more offspring than native species. Before long, the native species disappear from the ecosystem.)
6. Put up slide #3 and ask volunteer #3 to read it aloud, followed by the whole class.
- Using Think-Pair-Share, ask students what is different about this slide? Try to find the pattern. What might be going on to allow this to happen?
(The invading characters are doubled because the conditions are just right for them; the letters "c" and "e" are deleted throughout because the invaders have the same needs and have displaced them.)
 - How do the changes represent what happens in nature?
(Invaders can take over and push out native species. The paragraph illustrates how loss of diversity creates change (ie. the look of the paragraph is changed which makes it difficult to read).
7. Return to the KWL chart from step 1. As a class complete the "L" (learned) column and note any subsequent questions to be explored throughout the unit.

TRY THIS IDEA ...

Instead of using the overhead projector, print the paragraphs on large posters to use in a gallery walk around the classroom or use a smart board.

EXTENSION

Have students use the information they have on biodiversity up to this point to create their own paragraph; share student-written paragraphs in small groups or with the whole class.

Provide new text in an already invaded format, showing how difficult it is to put things right when the reader is unsure of the original text.

Adapted with permission from Hilltop Garden & Nature Centre:

http://www.indiana.edu/~tandlpub/story.php?story_id=39

Invading Characters Overhead #1

Biodiversity is the variety of life on earth, from microbes to plants and animals. Invading species are one of the greatest threats to the biodiversity of Ontario's waters, wetlands, and woodlands. Coming from other regions of the world, and without their natural predators and controls, invading species affect biodiversity by taking over habitats and ecosystems, and reducing the numbers of native species.

Invading Characters

Overhead #2

Bio*diversity is the va#riety of life on ea#rth, from microbes to pla#nts an*d a#nima#ls. Inva#*ding species a#re one of the grea#test thre#ats to the bio*diversity of Onta#rio's wa#ters, wetla#n*ds, a#n*d woo*dla#n*ds. Coming from other regions of the worl*d, a#n*d without their na#tura#l pre*da#tors a#n*d controls, inva#*ding species a#ffect bio*diversity by ta#king over ha#bita#ts a#n*d ecosystems, a#n*d re*ducing the numbers of na#tive species.

Invading Characters

Overhead #3

Biodiversity is the variety of life on earth, from microbes to plants and animals.

Invading species are one of the greatest threats to the biodiversity of Ontario's waters, wetlands, and

woodlands. Coming from other regions of the world, and without their natural predators and controls, invading species affect biodiversity by taking over habitats and systems, and reducing the numbers of native species.

The Ultimate Species

PURPOSE Each student will create their own aquatic species designing adaptations that will determine how it eats, how it moves, where it lives and how it stays safe. On completion, students will compare their species, collectively identifying those with adaptations that indicate their potential to be invasive.

SUBJECT / STRAND:
Grade 4 Science –
Life Systems, Language
(Optional: Art)

DURATION:
2 - 3 x 50 minutes

GROUP SIZE:
Class and groups

SETTING:
Classroom

EXPECTED OUTCOMES: Students will demonstrate their understanding of what an adaptation is and how it relates to species' life within its community and habitat. In Part 1 of the activity students will create their own ultimate species, which they will document in a written summary accompanied by a labelled illustration. In Part 2, students will gather in habitat groups, presenting and comparing their species in order to identify those with adaptations that identify their potential to be invasive.

MATERIALS: 11" x 17" paper, drawing utensils (pencil crayons, etc.), Blackline Master: *Cottage Country's Most Unwanted*, chart paper, markers

ENDURING UNDERSTANDINGS: Understanding concepts related to healthy habitats and communities; recognizing our role in maintaining healthy habitats and communities (*stewardship*).

EXPECTATIONS: 4s1, 4s2, 4s3, 4s7, 4s8, 4s10, 4s16, 4s18, 4e1, 4e2, 4e5, 4a31

PROCESSES OF SCIENCE: Inferring, classifying, communicating, constructing models

Lesson Sequence

Prior:

Day #1:

1. Write on the board:

- What I Eat (Food/Energy)
- How I Move
- How I Stay Safe
- Where I Live

2. Write on the board, with room for brainstorming: lake, stream and wetland.

Day #2:

1. As a heading, write the following aquatic habitats on a piece of chart paper: wetland, stream or lake. Post these three habitat sheets around the classroom.

2. Photocopy Blackline Master: *Cottage Country's Most Unwanted* (2x), cut and separate into habitat groups.

Procedure:

Day #1

1. Ask: *What does "ultimate" mean? If we were*

to make up the term, "ultimate species", what would it mean to you?

2. Ask students to brainstorm on plants or wild animals that seem to be able to live in many different habitats. Some examples may be: gulls, ducks, mosquitoes or raccoons.

3. Choose one of these species and draw it on the board. Discuss and label its key **adaptations** – characteristics that make it successful in specific habitats. Remind students that adaptations have a purpose (For example, a frog has spots to help it camouflage itself). Refer to the generated brainstorming list on the board and explain that different adaptations can help an animal eat a particular type of food, move faster, be safer (avoid predators) or live in a particular type of home.

For example: Raccoons are not fussy about what they eat, they have hands that can pick up and tear apart any type object to get at food (from shells to garbage cans), they can live on the ground or in a tree, and their coat keeps them warm in winter and camouflaged when moving around at night.

4. Tell students that they will be using what they have learned about **habitats, communities** and the **adaptations** to create their own ultimate species! The organism they create must have extraordinary adaptations enabling them to live very well in an Ontario aquatic habitat (lake, stream, wetland). Tell students to use their imagination to create their ultimate species as long as they can explain why they chose their particular adaptations for aquatic environments.

5. Brainstorm a few characteristics of each aquatic **habitat** to get students started on what is required to live in them. Note them on the appropriate habitat sheets posted around the room.

Note: Differences between different types of aquatic habitats can seem subtle. Here are some examples to share with your students:

- A plant or animal living in a wetland may have to survive changing water levels over the seasons. Wetlands can be very wet or quite dry if there is a drought.
- Some streams have fast moving water while lake water moves slowly.
- Shallow lakes tend to have warm temperatures in the summer that are good for fish like bass, while deep lakes tend to remain cool in the summer which is good for fish like trout.

Explain that the specific plant and animal **community** a species lives with also influences its adaptations. (For example: A pointy beak allows the woodpecker to bore underneath bark to reach its food, tree-dwelling insects; an otter's webbed

feet allow them to swim more effectively; a beaver's tail helps propel them through the water.)

6. Hand out 11" x 17" paper and ask students to fold it in half lengthwise. One side will be used to draw and label their ultimate species, while the other side will be used to describe their species in writing.

7. Ask students to choose a habitat (stream, lake or wetland) and print it on the top of their Ultimate Species sheet. Then, referring to the four headings written on the chalkboard, ask them to write a short paragraph indicating the adaptations that make their species well adapted to its habitat and community:

- How and What I Eat

What does your ultimate species eat? How does its mouth, hands, feet, tail or fins help it capture and eat its food? Or is your species a photosynthesizing producer?

- How I Move

How does your ultimate species move through the habitat? Does it move quickly? How? Or is it attached to a rock or rooted in the sediment? Does it have seeds that spread by floating?

- How I Stay Safe

Can your ultimate species move fast to avoid being eaten? Can it camouflage itself? Can it hide away from predators? Does it have a hard shell that protects it? Sharp spines?

- Where I Live

What kind of area does your ultimate species like to live in? Deep water? On a log? In rapids?

8. Once students have determined their species' adaptations, they can draw their creature in its habitat. Provide students with enough time to finish their Ultimate Species.

Day #2

1. Once projects are complete, review the term **adaptation** with the students. Ask: *Can you give me an example of an adaptation in an animal that is familiar to all of us?* (For example, ducks have webbed feet that they use like paddles to move fast in water; mosquitoes have wings that allow them to fly in many directions, thus avoiding the "swat").

2. Explain that **aquatic invasive species** are species that come from somewhere else and have been accidentally introduced by humans into Ontario's aquatic habitats.

Invasive species have **adaptations** that give them an advantage over native species. Their "super power" adaptations can include:

- a. the ability to eat a wide variety of foods,
- b. the ability to live in and adapt to a wide variety of habitats and/or conditions (ex. warm or cold temperatures, murky water, etc.),
- c. the ability to grow quickly (often faster than native species),
- d. the ability to avoid being eaten in their new community, as they are often not recognized as food by native species,
- e. having special protective adaptations (such as extra hard spikes on fish or a hard shell on a crayfish),
- f. some plants have the ability to make new plants from a small piece of themselves or can produce millions of seeds

3. Ask: *What could happen to a community of species and its aquatic habitat when a new "ultimate" invasive species moves in?*

4. Provide examples of invasive species from the Blackline Master: *Cottage Country's Most Unwanted*. (Good examples to use are: the rusty crayfish, purple loosestrife and the zebra mussel).

5. Drawing their attention to the habitat signs around the room, ask students to take their ultimate species project and go to their species' habitat area (wetland, stream or lake). (Students will be discussing their ultimate species with their habitat group. If some groups are too large break them up into 2 or 3 smaller groups.) Assign a group facilitator and secretary.

6. Within their habitat group ask each student to present their Ultimate Species, sharing 2 - 3 adaptations related to its habitat, movement, safety, and food source. Ask students to write these on the chart paper provided.

NOTES FOR TEACHER:

There are many non-native species living in the habitats around us. Evolving in a foreign environment, non- native species have adaptations suited to meet the resources of a community and habitat different from the one in which they are introduced. These species become invasive when they take away habitat and food from native species to an extent where they do harm to the environment and economy. The adaptations of invasive species are particularly competitive as they may:

- Have few natural predators, disease or parasites to keep their numbers in balance,
- Reproduce quickly and often,
- Adapt to many conditions,
- Be able to migrate (and therefore spread) easily,
- Be *generalists*; they can eat a variety of foods and live in a variety of habitats; and
- Often defend themselves well or are particularly aggressive predators.

Invasive species are harming lakes and rivers of Ontario, at times seriously affecting native species and their habitat. By taking action to prevent the spread of invasive species (see *Actions to Stop Species Invasion*,

Background Information), we can ensure that aquatic



Closure/Checks for Understanding:

To each group distribute samples (from *Cottage Country's Most Unwanted*) of an invasive species that lives within the group's specified habitat. Have students discuss the adaptations listed on the samples, comparing them to their own. Provide the group secretary with chart paper and markers to make notes of the group's observations. Ask:

- *What does their ultimate species and the invasive species have in common?*
- *What is different?*
- *Does your group have any ultimate species that could be considered invasive due to the impact it could have on their community and habitat? Explain.*

Ask students from each group to share their group's discussion with the whole class.

habitats and communities remain healthy and vibrant for all to enjoy.

Report sightings or obtain more information on invading species by calling the Invading Species Hotline at 1-800-563-7711 or visiting www.invadingspecies.com

EVALUATION:

Teachers can use the rubric provided to evaluate the ultimate species activity based on Science, Language and Art requirements.

ACCOMMODATIONS:

Prior to creating their ultimate species, have students brainstorm with a partner to ensure they understand the task.

For the ultimate species activity, students that are challenged by writing tasks may work in pairs or focus on getting their ideas across through their drawing. Have students help each other with labeling and supply a list of key descriptive words on the blackboard.

EXTENSIONS:

Students may be more inclined to choose an animal over a plant when creating an ultimate species. Encourage students who would like a challenge to consider choosing a plant.

Ask students to write a paragraph explaining how their ultimate species and habitat will be doing in 10

years time. Will it still be living where they originally thought it would? Has it found new food sources? Is it the only organism at its level in the food chain (i.e. the only plant, the only herbivore, the only carnivore)? What will its habitat look like?

Changing Chains

PURPOSE Students will create food chains from familiar animal and plant species then examine the impacts on these food chains when environmental problems and invasive species disrupt them.

SUBJECT / STRAND: Grade 4 Science – Life Systems	DURATION: 2 x 50 minutes	GROUP SIZE: 4 -6 students	SETTING: Classroom
<p>EXPECTED OUTCOMES: Building on their knowledge of nature and the animal world, student groups will create their own food chains. This will demonstrate their understanding of the necessary progression of a food chain and the interdependence of the species within it. Students will then explore how this relationship is affected when outside influences disrupt the food chain. The activity wraps up with a class discussion on stewardship, followed by a descriptive article prepared by each student. MATERIALS: Cue cards (~100), chart paper, markers, tape ENDURING UNDERSTANDINGS: Understanding concepts related to healthy habitats; recognizing our role in maintaining healthy habitats (<i>stewardship</i>); tools for maintaining healthy habitats and protecting against invasive species. EXPECTATIONS: 4s1, 4s2, 4s3, 4s5, 4s6, 4s17, 4s19 PROCESSES OF SCIENCE: Classifying, communicating, inferring, identifying and controlling variables, interpreting data</p>			

Lesson Sequence

Prior:

1. Draw the following table on chart paper and post for student reference.

HEALTHY HABITATS	(List Healthy Food Chains)	Notes:
HABITAT PROBLEM:	(List Disturbed Food Chains)	Notes:
I N V A S I V E S P E C I E S:	(List Invaded Food Chains)	Notes:

- Review the following terms with students: **producer, consumer, herbivore, carnivore, omnivore** and **foodchain**. (See Glossary.) Ensure students have an understanding of how a food chain works.

Procedure:

- Divide your class into groups of 4 – 6.
- Ask each group to brainstorm on what plants and animals can be found in *and* around a local pond. (Be sure they include smaller organisms – such as algae, worms, snails, and mosquitoes – and humans.)
- Provide 12 cue cards to each group and ask them to label and draw one plant or animal species per card.
- Ask groups to indicate on each cue card whether the animal is a producer, consumer, herbivore, omnivore or carnivore. Some species may have more than one label (ex. carnivore and consumer).
- Provide each group with one piece of chart paper on which they will draw a table like the one displayed.
- Using the cards as a guide, ask each group to create as many food chains as they can and record them in the square beside the title, “Healthy Habitats”. Species cards can be used more than once. Ask students to write any observations they have of their healthy habitat food chains in the adjacent “Notes” box.
- As a class, brainstorm different types of disturbances that could happen to their local pond habitat. Discuss how these disturbances might impact the species living there. Together pick one disturbance and determine what species may disappear from the habitat and ultimately their food chain/s. (Examples: spraying for mosquitoes; building a busy new building that may scare off shy mammals living around the pond; dumping garbage into the pond, building a busy road that requires part of the pond to be drained).
- Ask students to remove the affected species from their set of cards. Ask students to record the type of disturbance, new chains and observations on their chart paper.
- Students should then return the removed cards to their sets.
- Explain to the class that you will now be introducing the invasive fish species, round goby, to the pond habitat. It is not native to this habitat. *What is an invasive species?* Explain or re-iterate that invasive species have few natural predators in their new habitat and that they often have adaptations that make them highly successful. Share the adaptations of round goby, the type of environment it lives in and the impact it has on ponds.
- Ask: How do you think it got into our local pond?* Explain to the students that invasive species are introduced to habitats through human error. In this case, we’ll say it was when someone was using round goby as bait and dumped them into the local pond. Considering the impacts of this species, determine together which plants and animals will be affected. Students should remove these from their sets.
- Ask students to make as many food chains as they can with their new set, record them on the chart and make notes.
- Discuss:
 - How many food chains did you make in each scenario? Were there differences between the food chains of each scenario? What were they?*

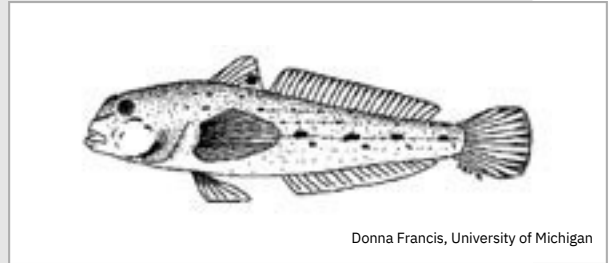
A Bit About... ROUND GOBY

The round goby is a spotty brown fish that lives on lake and river bottoms. Their unique adaptation, a suction-cup-like fin on the bottom of their belly, helps them stay put in fast moving currents!

Round goby were brought accidentally to the Great Lakes in the ballast water of ships from Eastern Europe.

It is believed they have also spread by anglers who mistakenly used them as bait and released them into un-invaded waters after fishing. (Using round goby as bait is illegal!)

Round goby are aggressive; they compete with native fish for food (including insects) and eat their fry (baby fish) and eggs! They can also spawn several times in one season so that wherever they're found, they can quickly become the most abundant fish in the area. (For example in Lake Erie round goby can reach densities of over 125/cubic metre—that's like having over 100 round goby in your bathtub!)



Donna Francis, University of Michigan

- *What other observations did you make?*
 - *Is there a problem with removing a few species from a habitat?*
 - *Which scenario could humans have helped to avoid?*
- Explain how seemingly innocent actions, such as dumping bait into the pond, can have as drastic an effect as building a bridge. This is because when you add an invasive species to a habitat, you can alter the existing food chains, affecting many plants and animals.
- *Which type of species do you think would find it easier to survive: Producer? Consumer? Omnivore? Herbivore? Carnivore? Why?*
 - *Explore whether there could have been solutions to the habitat problem that may have protected the food chain.*
 - *Explore other ways invasive species can get into an aquatic habitat and how this can be avoided.*

Closure/Checks for Understanding:

Ask students to write a descriptive article of what happened to their local park habitat. Encourage them to include:

- A description of the original healthy habitat
- An explanation of the habitat problem and the impact on local species
- The introduction of an invasive species and its impact on the habitat
- The role of humans both in *creating* and *solving* both situations.

NOTES FOR TEACHER:

The round goby is an invasive aquatic species that is originally from Eastern Europe. This mottled brown fish has a feature unique to its species. On the underside of the goby, the pelvic fins join to form a suction-cup like disk. This appendage allows them to stay on a river or lake bottom in fast current. Round goby feed on insects, small fish, fish eggs and other small organisms. The round goby was introduced to the St. Clair River via ballast water in the late 1980s. It is now found in all of the Great Lakes and have recently been discovered in inland waters of Ontario. Where they have been introduced, round goby have become very abundant. The aggressive round goby can spawn several times a year, grow up to 25 cm and compete with native bottom-dwelling fish species. These characteristics indicate the potential for impact on native fish species.

It is important to prevent or slow the spread of round gobies into Ontario's inland waters. The following preventative measures can help to reduce the spread of round goby and other invasive species:

- Remove any visible plants or animals from boats, trailers and boating equipment before leaving any body of water. Once you've left the boat launch, ensure you either: rinse the boat and equipment with hot water; or hose it down with a high pressure spray; or dry the equipment for at least 5 days before using it again.
- Drain water from the motor, live well and bilge before leaving the body of water.
- Empty bait buckets on land or in the garbage. It is illegal to release baitfish from one body of water into another or to use round goby as bait.

Report sightings or obtain more information on invading species by calling the Invading Species Hotline at 1-800-563-7711 or visiting www.invadingspecies.com

EVALUATION:

Teachers can evaluate group work while students are working together on their food chains and tables. Further evaluation can be done on the student articles.

ACCOMMODATIONS:

Ensure student groups are balanced for behaviour and tasks. Consider assigning students to roles that either support their learning style (i.e. drawing species pictures) and confidence, or challenge them if appropriate. Use of chain cards provides for kinesthetic and visual learners, group discussions accommodate auditory learners. Article writing can be supported as required.

EXTENSIONS:

Visit a local pond or aquatic habitat prior to the lesson. Ask students to see how many different plant and animal species they can identify in and around the pond. Take along a local naturalist to help identify some of the species present and determine their role(s). Are any of these invasive species? Do they see any disturbances affecting the pond habitat?

Students could create a classroom field guide for the local pond. Using a digital camera, students could take photos of a chosen species, research it and create a page or two for the class book. Students would indicate characteristics and adaptations, and identifying whether the species was a: consumer or producer, and carnivore, herbivore or omnivore.