Lesson Plans

1. Know Me, Know My Adaptations

By playing a “Who Am I?” type game, students will learn to identify animal adaptations and explore how these may relate to survival in specific habitats and communities. In addition, students will be introduced to the concept of invasive species.

2. Sun Block

In this active game, students will emulate the transfer of food energy in a lake habitat. They will gain an understanding of how both non-living factors (sunlight) and other living creatures (producers and consumers) affect an animal’s ability to survive. Students will predict outcomes, and compare scenarios between a healthy habitat and one disrupted by an invasive plant species.

3. Changing Chains

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

4. Aquarium Ownership is an Art

Students will learn that when they release aquatic pets and plants into local waterways there can be subsequent impacts on habitats and communities. Students will take action by creating educational posters to put in pet shops and city aquariums that remind the public of their responsibilities as pet owners. As an art activity, this project will be used to explore tint, shade and texture.

5. Musical Mussels

In this version of Musical Chairs, students will role-play aquatic animals to discover adaptations and factors that enable invasive species (zebra mussels) to spread throughout the Great Lakes and Ontario’s inland waters.

6. Tough Ruffe

In this active simulation, students will demonstrate the struggle for survival as experienced by yellow perch in a lake habitat. Students will predict outcomes, and compare scenarios between a healthy habitat and one disrupted by an invasive species, the Eurasian ruffe.

7. Stow-Aways and Crafty Ways

Students will learn how the Great Lakes and other waterways are linked. Using an atlas to identify various locations where the invasive species, the round goby, have been sighted, students will both determine the possible routes members of these species have used to get to their present location, and predict future spread.

8. The Ultimate Species

By creating their own ultimate species, students will demonstrate their understanding of animal and plant adaptations as influenced by their habitat and community, and determine what types of adaptations make a species invasive.

L1. Know Me, Know My Adaptations

PURPOSE: By playing a "Who Am I?" type game, students will learn to identify animal **adaptations** and explore how these may relate to survival in specific **habitats** and **communities**. In addition, students will be introduced to the concept of **invasive species**.

SUBJECT / STRAND: Grade 4 Science – Life Systems	**DURATION:** 70 minutes	**GROUP SIZE:** Class to groups	**SETTING:** Classroom (desks moved to side, if possible)

EXPECTED OUTCOMES: This activity culminates in group work and a presentation in which students display their understanding of species adaptations and how they contribute to species survival. In addition, students explore the concept of invasive species as it relates to specific adaptations.

MATERIALS: Blackline Master: *Who Am I?*, masking tape, Blackline Master: P*redator, Plant and Prey*, chart paper, markers, Blackline Master: My Adaptation Checklist

ENDURING UNDERSTANDINGS: Understanding concepts related to healthy habitats

EXPECTATIONS: For the full expectations listing, please see page 75.

PROCESSES OF SCIENCE: Classifying, communicating, inferring

Lesson Sequence

Prior:

1. In a prior class, prepare students for *Know Me, Know My Adaptations* by:

• Ensuring they understand the following terms: **habitat, community, adaptation, predator and prey** (see Glossary).

• Explaining that they will enter the next lesson under an *oath of silence* and will have an animal species taped to their back by the teacher as they enter.

2. Make 3 - 4 photocopies of Blackline Master: *Who Am I?* Cut into cards – one for every student. Ensure there are 3 – 5 students per species group.

3. Photocopy the Blackline Master: *My Adaptation Checklist*. One for every student.

4. On a the chalkboard, write the following:

Goal #1: Discover your species' adaptations.
Goal #2: Find all members of your species.
Goal #3: As a group, link your adaptations to your habitat and community.

5. Prepare the Blackline Master: *Predator, Plant and Prey* as appropriate. (For example, make an overhead for students to refer to, photocopy for students to reference, or simply explain this version of Rock, Paper, Scissors through a demonstration.)

Procedure:

1. Part I: As students walk into the classroom, tape a "Who Am I?" sign to their back. Ensure students maintain their oath of silence except when following the question part of the activity.

2. Explain the rules:

• Students will circulate around the room and meet up with a fellow student. Once together in a pair, the students will play one round of **Predator, Plant and Prey**, to determine who gets to ask an adaptation question. (This is a version of Rock, Paper, Scissors – see the Blackline Master: *Predator, Plant and Prey.*)

• Using the Blackline Master: *My Adaptation Checklist*, the winner of **Predator, Plant and Prey** creates a question for the other student. For example, "Do I have strong teeth?" As they go around the room, students will fill out the checklist.

• Students can only ask one question per encounter, then they must move on to another student to discover their next adaptation. Encourage students to ask questions from the checklist in random order.

• Each student has 4 adaptations they must uncover (**Goal #1**). These are the clues to their identity. As they move about the room, students must not share the identities of the other species they see. The only thing spoken is an adaptation question, and a yes or no.

• When students think they know all of their adaptations they must sit down. They must not interact with any other students at this time.

• Only when there are two people left are these two allowed to continue asking each other questions until they have determined their adaptations.

3. Run activity. Once everyone is sitting, ask students to remove the signs from their backs and put them in a safe place (like a pocket, for example) where they can refer to them if needed. Proceed with second part of lesson.

4. Part II: Students must walk around the classroom in silence and find all the members of their species by miming and gesturing their adaptations (**Goal #2**). When students have found all members of their species group and maintaining their oath of silence, they must sit down collectively to indicate that they have found one another. (Note: Let students know how many group members they should expect to find. This will depend on the class size. *For example, "There will be 6 groups of 4 and 2 groups of 5."*)

5. Choose a facilitator and a recorder for each group. Hand out chart paper and markers.

6. In their species groups, ask students to discuss and record how they think the adaptations of their animal relates to its habitat and/or community. (For example, if their species has strong teeth, how does this help them in their habitat and community?) This is **Goal #3**.

ADAPTATIONS	HOW OUR ADAPTATIONS HELP US SURVIVE IN OUR HABITAT OR COMMUNITY
Strong teeth	Our strong teeth help us take down large trees to build our dams and lodges, and they help us to eat shoots and small trees.

Closure/Checks for Understanding:

Once the species groups have completed the posters (example above), representatives can present their species to the class. The representative will explain how their group interprets their species' adaptations in relation to its habitat and community. Class discussions can be encouraged as to whether the group adaptation interpretations are appropriate.

At the end of the activity, introduce the concept of **invasive species** in general terms: that they are not originally from the habitat, which can mean that they lack predators, and that they have adaptations that enable them to survive at a higher rate than a habitat's native species. Explain that **3** of the **9** species in the classroom are invasive (sea lamprey, rusty crayfish and round goby). In a discussion, determine with the students which species they think these are based on the adaptations they've listed and the descriptions given.

NOTES FOR TEACHER:

Just like you and I, an animal or plant needs a comfortable place to live. This place, called a **habitat** (it begins with an "h" like *house and home*), provides a species with the things it needs to survive: food, shelter and water, for example. A group of plants and animals that live together as a group of interdependent organisms, inhabiting the same region and interacting with each other, is called a community. This **community**, along with the habitats and the non-living things around it, like air, water, soil and rock, are called an **ecosystem**.

Habitats and ecosystems have very specific conditions that influence what types of food, shelter and water are available to living things. These conditions are not necessarily suitable for all species. The needs met by the conditions of a desert, for example, are vastly different from those that are available in your local pond.

Species and communities that have come to survive in specific habitats and ecosystems have traits that are suitable to their surroundings. These are called **adaptations**. These **adaptations** greatly help in their **struggle for survival**, that is, in finding food energy, keeping safe from predators and reproducing. Examples of adaptations include: a colouring that enables a species to hide from enemies; claws that help them open a particular type of available shell or nut; webbed feet that can propel them quickly through water; a colourful plumage that lures a potential mate; and sharp spikes or a bad taste that protect from predators.

Native species are those plants and animals whose origins are in the particular habitat they are residing in. They have adapted over many thousands of years to specific conditions, developing and maintaining a healthy balance with the other animals and plants that share the habitat (community). **Non-native species** are those that did not originate in the habitat it has been introduced to. These species have been brought to their new habitat mainly through human-related activity. Non-native species that have very robust adaptations, that is, adaptations that give them a survival advantage over native species, do harm to native species and their ecosystems, and have an economical impact are considered **invasive species**. These species are often able to live in many types of habitats; their adaptations ensure their survival and growth rates are generally greater than those of other species. Their exceptional survival and reproductive rate often causes a negative change to the entire habitat. (See also: Background Materials and Glossary.)

EVALUATION:

Teachers, using a checklist, can evaluate group interactions, presentations and class discussions for student understanding of adaptation, species survival, **community** and **habitat**.

ACCOMMODATIONS:

This activity meets the needs of visual and kinesthetic learners through movement; species card support and supplemental blackboard work. Students who need to write their adaptations down while circulating, can do so on a scrap piece of paper. Those that need further assistance can be paired with a stronger student at the beginning of the activity. Also to note, as students will ultimately form groups based on which card they are assigned, teachers can identify and determine appropriate group membership as required.

EXTENSIONS:

For homework or in-class reflection assign students to write a short paragraph about their species using the listed adaptations. Students can then defend why they believe their species is invasive or non-invasive.

For teachers wishing to add a research component, students can create a species brochure for habitat visitors. If their species is invasive, they can refer to **www.invadingspecies.com** to get more information.

L2. Sun Block

PURPOSE: In this active game, students will emulate the **transfer of food energy** in a lake habitat. Through emulating the transfer of food energy in a lake habitat, students will gain an understanding of how both non-living factors (sunlight) and other living creatures (**producers and consumers**) affect an animal's ability to survive. Students will predict outcomes, and compare scenarios between a healthy habitat and one disrupted by an invasive plant species.

SUBJECT / STRAND: Grade 4 Science – Life Systems	**DURATION:** 50 minutes	**GROUP SIZE:** Class	**SETTING:** Gym or field

MATERIALS: 3-6 pinnies (pinafore aprons) of one colour, 1 pinny of a different colour, 4 pylons, 500 craft (Popsicle) sticks, 4 hula-hoops, whistle, clipboard, pencil, paper, one poster labelled "Sun" and another labelled "Algae" (optional)

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

EXPECTATIONS: For the full expectations listing, please see page 75.

PROCESSES OF SCIENCE: Constructing models, identifying and controlling variables, predicting

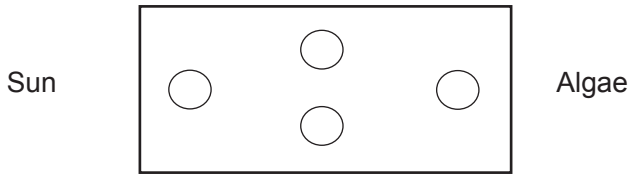
Lesson Sequence

Prior:

1. Mark off a basketball court-sized rectangle with a pylon at each corner. This area will be your lake.

2. Place the "Sun" sign and a hula-hoop at one end of the rectangle. This is the surface of the lake. Put 500 craft sticks, representing the sun's energy, inside this hoop.

3. At the other end of the rectangle, the bottom of the lake, place the "Algae" sign and another hula-hoop.



4. In the middle of the rectangle lake, place 2 hula-hoops 3 m apart. These will represent 2 fish stomachs.

Procedure:

IN CLASS (Optional). Introduce the plant species, European frogbit. Show students a picture of the plant as found on the Blackline Master: *Cottage Country's Most Unwanted* or in the background materials available with this kit.

Tell students they will be role-playing to model:

- a healthy **food chain**, and
- a **food chain** invaded by European frogbit

GYM/FIELD

1. Gather the class and explain that they will be modeling a healthy **food chain**. Assign 3 – 6 students (depending on group size) to be the **fish** (provide them with pinnies) while the remaining students will be **sunrays**.

2. Explain that the job of the sunrays will be to transfer the sun's energy, one craft stick at a time, from the "Sun" to the "Algae". *The algae convert the sunlight energy into food energy that fish can eat*.

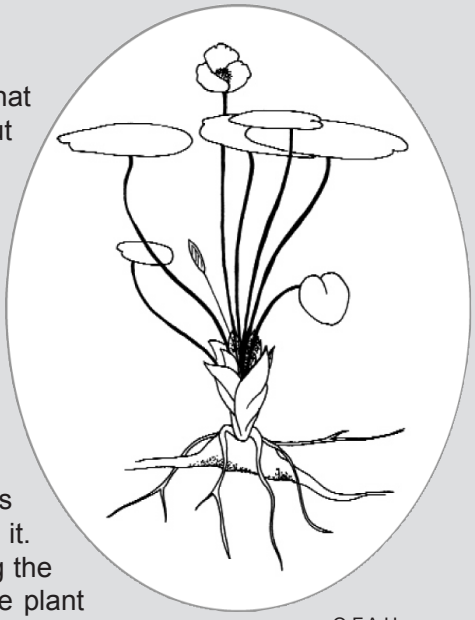
3. The fish will eat the algae. They will do this by taking *one craft stick at a time*, from the "Algae" to a fish stomach. (NOTE: Fish cannot get food - craft sticks - directly from the sun, as they do not **photosynthesize**.)

4. With sunrays starting at the sun hoop, and fish starting at the algae hoop, whistle to begin. Run the game until all the sticks have been taken from the sun. This will indicate that the sun has set for Day #1. Ask: What is the significance of the sticks that are left in the algae hoop?

5. Record the number of sticks in the plant and fish stomach hoops. Return all the sticks to the sun hoop for Day #2.

6. Gather the class again and explain that this time the food chain will be disrupted by an invasive species called **European frogbit**. It got into our lake accidentally. Ask: Does anyone know how it may have gotten there? (*See A Bit About…*)

A Bit About… EUROPEAN FROGBIT



O.F.A.H.

European frogbit (*Hydrocharis morsus-ranae*) is a floating aquatic plant that looks like a miniature water lily. It has heart-shaped leaves averaging about three centimeters in diameter and small white flowers with a yellow centre. It can be found in wetlands or quiet, shallow, lake bays in southern Ontario, Quebec, New York and Vermont.

European frogbit harms lakes by floating on the top of the water and blocking out needed sunlight. The sunlight is food energy for the algae (**producers** in the food chain) that grow below the water's surface. Without energy, the algae don't grow and the fish (the **consumers** in the lake) are left with less food energy.

European frogbit can get into healthy habitats due to human mistakes. Boaters can bring it into healthy waters on their boats and motors without realizing it. Anglers may introduce it unknowingly if they empty a bait bucket containing the plant into the aquatic habitats they are fishing in. Hobbyists may dump the plant from their aquariums and water gardens into local waters without realizing the harm this may cause. Being careful while enjoying our lakes, streams and wetlands can go a long way towards keeping them healthy.

7. Select one sunray to take on the role of European frogbit (provide with pinny).

8. Explain:

• Frogbit can tag sunrays and take their energy (craft stick). (See: *A Bit About…*)

• Because the frogbit lives at the top of the lake, it must catch only sunrays that are between the sun and the fish stomachs. Sunrays cannot be tagged when they are between the fish stomachs and the bottom of the lake.

• Once sunrays are tagged, they will become part of the European frogbit by linking arms or joining hands. *This new sunray energy has allowed the frogbit to grow!* (If the students have difficulty catching the sunrays, have the sunrays run in a straight line only – from the top of the field to the bottom.)

• If sunrays step outside the lake boundaries they automatically become part of the frogbit.

• When the frogbit chain has 4 people, it breaks up into pairs. *This is one way European frogbit reproduces. When one plant gets too big, segments from it break off and form a new independent plant.*

• European frogbit plants continue to tag sunrays, breaking off when a foursome is created.

• Sunrays continue to bring food from the sun to the algae at the lake bottom. They cannot stop or stay waiting in the bottom half of the lake due to their fear of being caught by the frogbit. Fish continue to collect food from the algae and put it into their stomachs.

9. Ask students to predict what will happen. *Will the fish collect more food or less?*

10. Start Day #2 and run until there is no energy left to transfer.

Closure/Checks for Understanding:

Return to the classroom. Post the results:

	DAY 1 No European Frogbit	**DAY 2** European Frogbit
Amount of food in plant (algae)		
Amount of food in fish stomachs		

Have students interpret the data and reflect on their experiences by answering the following questions (orally or in writing in science workbooks or journals):

- On which day did the algae in the lake get the most energy from the sun?
- On which day did the fish get the most food?
- Do you think fish and algae can survive in a lake with European Frogbit? Why or why not?
- In a real lake what could you do to stop European Frogbit from affecting other species?

When discussing the last point, consider:

The sun cannot stop giving off sunlight energy and will continue to feed all plants, including European frogbit. Therefore frogbit, an invasive species, must either be removed, or, better yet, prevented, from entering lakes.

What we can do! Learn what European frogbit looks like and make efforts to ensure that it doesn't get into healthy lake ecosystems. Individuals can make sure boats, motors and boat trailers are thoroughly cleaned and all plant matter is removed; any plants found should be put into the garbage. Drain all water from boats and never dump plants from one lake into another. In addition, we must be careful not to purchase frogbit inadvertently from garden stores and or use it in water gardens as sometimes garden plants may be transferred into the wild. If you have a water garden, it is always a good idea to buy native aquatic plants to prevent an accidental release of exotic species. If you do buy exotics, over-winter your plants indoors or dispose of them in the garbage at the end of the season.

Make Waves! **Everyone can help keep our aquatic habitats healthy!**

NOTES FOR TEACHER:

European frogbit is a free-floating aquatic plant native to Europe and Asia and originally introduced to Ontario when it escaped from the Central Experimental Farm in Ottawa in the mid 1930s. It is now found in several lakes and watersheds in southern Ontario and has spread to southern Quebec and northern New York and Vermont. It looks like a miniature water lily with heart-shaped leaves and small white flowers with a yellow centre. European frogbit floats on the surface of wetlands or the quiet bays of lakes. It reproduces quickly, forming dense mats of plants at the surface of affected waters. The mats of frogbit hinder recreational boating and swimming, and disrupt the food chain by preventing sunlight from getting to plants and algae growing deeper down in the water.

Algae - also known as phytoplankton – are microscopic plants that serve as a base for the food chain. In this very important role, they support a wide variety of consumers, including fish. Algae are usually used as indicators of aquatic health because of their high sensitivity to change in environmental factors, such as light, nutrients and temperature. Like land plants, algae fix carbon through photosynthesis. By hindering algae growth, frogbit reduces the amount of vital energy to higher levels of the food chain.

In the autumn, European frogbit can change the composition of a lake by removing necessary oxygen. During the fall months, frogbit breaks apart and decomposes, dropping to the lake bottom. When huge amounts of vegetation decompose all at once, dissolved oxygen levels in the water are depleted. If there is not enough oxygen, fish and other aquatic organisms can die.

European frogbit can be spread to new water bodies on propellers and other aquatic equipment. It can also be transferred to the wild from aquarium and garden ponds, as it is one of the many exotic species of aquatic plants that are sold in the water garden trade. Presently, there are few ways to control frogbit; removal by hand has been only a temporary solution.

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:

Students design a storyboard illustrating and explaining what happens in a lake when European frogbit is introduced. Include a story box that shows how to prevent European frogbit from taking over a lake.

ACCOMMODATIONS:

Have several students volunteer to act out the game before it begins so students have a visual example of what to do.

EXTENSIONS:

Students may want to adapt the game so that they are measuring the amount of food in the plant and the fish stomachs every 30 seconds or by altering the number of fish and/or European Frogbit. The data can then be graphed and compared.

L3. 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:	DURATION:	GROUP SIZE:	SETTING:
Grade 4 Science - Life Systems	2 x 50 min.	4 - 6 students	Classroom

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 (stewardship); tools for maintaining healthy habitats and protecting against invasive species.

EXPECTATIONS: For the full expectations listing, please see page 75.

PROCESSES OF SCIENCE: Classifying, communicating, inferring, identifying and controlling variables, interpreting data

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
INVASIVE SPECIES	(List Invaded Food Chains)	Notes

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

Procedure:

1. Divide your class into groups of 4 - 6.

2. 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.)

3. Provide 12 cue cards to each group and ask them to label and draw one plant or animal species per card.

4. 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).

5. Provide each group with one piece of chart paper on which they will draw a table like the one displayed.

6. 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.

7. As a class, brainstorm different types of disturbances that could happen to their local pond habitat. Discuss how theses 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).

8. 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.

9. Students should then return the removed cards to their sets.

10. 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.

11. 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.

12. Ask students to make as many food chains as they can with their new set, record them on the chart and make notes.

13. Discuss:

- How many food chains did you make in each scenario? Were there differences between the food chains of each scenario? What were they?

- 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?

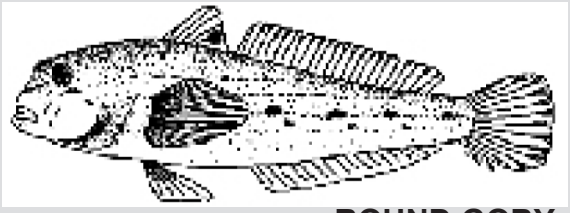
Explain how seemingly innocent actions, such as dumping bait into the pond, can have as drastic an effect as building a bridge. This is because when you add an invasive species to a habitat, you can alter the existing food chains, affecting many plants and animals.

- 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.

A Bit About… ROUND GOBY



ROUND GOBY
Donna Francis, University of Michigan

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!)

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 kinaesthetic 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.

L4. Aquarium Ownership is an Art

PURPOSE: Through the creation and distribution of educational posters, students will demonstrate their understanding of responsible pet ownership and the importance of being an active community member.

SUBJECT / STRAND:	DURATION:	GROUP SIZE:	SETTING:
Grade 4 The Arts - Visual Arts Science - Life Systems	2 x 50 min.	Class	Classroom

EXPECTED OUTCOMES: Students will learn that when they release aquatic pets and plants into local waterways there can be subsequent impacts on habitats and communities. With this knowledge, students will then create and distribute posters that educate the public on their responsibilities as pet owners. As an art activity, this project will allow students to express tint, shade and texture.

MATERIALS: White paper for painting, tempera paint, sand, 1 cardboard square or plastic palette per student, brushes, water, scrap paper, pencils, rulers, examples of public information posters, Blackline Master: Pet Shop Poster Messages (overhead or photocopy), overhead projector as needed. (Optional: additional art materials to explore texture such as wool, glitter, tissue paper, pipe cleaners, etc.)

ENDURING UNDERSTANDINGS: Understand concepts related to healthy habitats and communities; recognize our role in maintaining healthy habitats and communities (stewardship); learn of tools for maintaining healthy habitats and communities, and protecting against invasive species.

EXPECTATIONS: For the full expectations listing, please see page 75.

PROCESSES OF SCIENCE: Communicating

Lesson Sequence

Prior:

1. Write the following definitions on the board:
   Tint: adding white to a colour to create a lighter hue
   Shade: adding black to a colour to create a darker hue

2. Write the following poster requirements on the board and cover until ready to view:

Pet shop posters will:
- Include a large aquarium or pond in tints and shades of blue

- Explore texture with brush strokes and sand

- Communicate a message to the public about aquarium pet stewardship

3. Make an overhead of or photocopy Blackline Master: *Pet Shop Poster Messages*.

Procedure:

1. *Ask: Who has or has had an aquarium?* An aquarium is a very simple, contained and created **habitat**, while the animals and plants that live in it (along with its human host) are a **community**. To class: *Describe the aquarium food chain. Could this habitat survive without human interaction?*

2. Ask: *What would you do if you had to move far away and couldn't look after your aquarium anymore? Why might someone think it would be good to empty an aquarium into a local water system? Why could this be a bad idea?* Explain that plant and animal species sold in pet shops are very often non-native species. *What would happen if they were dumped into a pond?* If they are potentially **invasive species,** like the banded mystery snail, fanwort (an aquatic plant) or goldfish, they:

- Have few natural enemies or predators!
- Reproduce quickly and often!
- Adapt to many conditions!
- Out-compete native species for food and habitat!
- Can eat many types of food!

(Note that some aquarium species like turtles such as the red-eared slider or fish like piranha may not be invasive but could have disease or parasites that could infect our native species.)

Ask: *How does this compare to their life (role in the food chain) in the aquarium?*

3. In two separate columns on the chalkboard, brainstorm the following questions:

i. *How can aquarium owners best care for their pets and plants when they can no longer look after them?* (E.g. donate to schools or seniors homes, give back to pet stores, give to responsible friends, dry the plants out in the sun.)

ii. *How as a class can we let people know about careful aquarium care?* (Prompt: "create posters for pet shops", if needed.)

4. Explain to students that they will be creating a special poster for pet shops that will educate citizens on the importance of being a responsible aquarium owner. Explain that it must contain one message from the Blackline Master: *Pet Shop Poster Messages*. (Have on overhead ready or hand photocopy out to students – these can be collected later for re-use.) Go over the messages together to ensure that students understand them.

5. Ask students to close their eyes and imagine they are swimming underwater in a pond or aquarium. *What do you see?* Now swim down to the bottom. *Is it lighter or darker there? Why?* Tell students that they will adjust the lightness and darkness of the blue water in their painting using white paint and black paint. Referencing the chalkboard, define **shade** and **tint** for the students. (Suggest they start by painting the middle of the pond or aquarium in plain blue.)

6. Ask: *Describe the different textures in the water you were swimming in*. Explain that there are many things in a pond or aquarium that aren't smooth. *What can we do in our paintings to show different **textures**?* Discuss (and demonstrate, if able) brush technique and the addition of sand to paint (mix it into the paint on the palette before applying) to create textures for pond and aquarium bottoms, plants and fish. (Optional: Students can also use materials like glitter for fish scales and wool for aquatic plants.)

7. Ask students to choose a poster message and using shade, tint and texture, create a picture depicting it (Refer to the poster requirements listed in PRIOR #3). (NOTE: Students should ensure there is message space on the top or bottom of their poster by marking it out ahead of time with a ruler. Messages can be written in when the painting is finished with marker or pencil crayon.)

Closure/Checks for Understanding:

Once posters are complete, have students present to the class explaining how the message they've chosen is depicted in their poster. Ask them to also address the art techniques they used.

Determine a method for delivering the posters to local pet shops. Please inform our program of your efforts so that we can track where posters are being displayed. We would be grateful, if you would consider sending some of your students' posters to the Invading Species Awareness Program to help us develop educational materials.

Invading Species Awareness Program
4601 Guthrie Drive
P.O. Box 2800
Peterborough, ON K9J 8L5
1-800-563-7711
invasivespecies@ofah.org
www.invadingspecies.com

NOTES FOR TEACHER:

Most aquarium fish, plants and invertebrates are not native to Ontario waters. By releasing them into open waterways, these species could establish beyond their native range and have notable consequences on the environment.

An example is that of the **red-eared slider**, a popular turtle species sold in pet stores. Red-eared sliders look cute and irresistible when they're babies but can grow to dinner plate size as adults. All turtles require a lot of care and investment when kept as pets to ensure that they do not get stressed and suffer from disease or infections. When released into Ontario's aquatic habitats, red-eared sliders may compete with native and endangered turtles for food and nesting areas. They are also carriers of Salmonella, a bacterium that can be easily transferred up the food chain.

Fanwort is a popular, aquatic plant sold at pet stores. Though its origin is sub-tropical, it can survive in our climate. If released into the water supply (even in tiny pieces) it can re-establish itself, taking over aquatic habitats. Fanwort can form dense stands of plant matter that crowds out native plants and interferes with boating and swimming. By crowding out native plants, fanwort can alter fish communities, disrupting food chains in shallow lakes and streams.

Exotic, tropical fish species such as the **pacu**, **oscar**, and **piranha** have been discovered in provincial waters. Contrary to popular belief, these fish can adapt to cold water. Warm water outflows from factories are thought to increase their chance of survival in winter.

You are responsible for your aquarium pets and plants. The release of aquarium pets into Ontario waters is illegal. You can help prevent the spread of non-native aquatic species by doing the following:

- Never release or flush unwanted aquarium pets or aquarium water into natural waters, drainage ditches or sewers;
- Drain aquarium water on dry land;
- Return or donate unwanted aquarium fish, reptiles, snails and plants to a pet store or a school; and
- Contact a local aquarium club or the Canadian Association of Aquarium Clubs, at (905) 682-2991 (www.caoac.on.ca) and ask about a fish rescue program for unwanted aquarium pets, or contact the **Invading Species Hotline at 1-800-563-7711**.

EVALUATION:

Posters can be evaluated for art concepts (tint, shade and texture) while presentations will indicate whether students recognize the need for human action to protect against the impact of invasive species. Students should be able to make connections to healthy habitats and communities discussed in previous activities and provide specific examples of what aquarium owners can do to protect local habitats.

ACCOMMODATIONS:

In this lesson, students challenged by language can relay their science knowledge through art. Chalkboard definitions, the Blackline Master and a painting demonstration by the teacher will support visual learners and learners with special needs.

EXTENSIONS:

This lesson can lead into a monochromatic painting lesson (paintings that are all one colour using tints and shades) as required by the Grade 4 Visual Arts curriculum.

Instead of creating posters, some students can be put in groups of 5 with each member assigned to a specific message. Together the group can compile a pet store "cash register" book – student brochures that can be read by customers while in line. Students can then research specific pet stores in their area and write them a letter requesting the display of their book.

L5. Musical Mussels*

PURPOSE: In this version of Musical Chairs, students will compete as aquatic species to show how basic needs are met. This activity will highlight how certain adaptations enable invasive species to out compete native species to attain water, food, shelter and room to grow.

SUBJECT / STRAND:	**DURATION:**	**GROUP SIZE:**	**SETTING:**
Grade 4 Science - Life Systems, Health and Physical Education	50 - 70 min.	Class	Classroom

EXPECTED OUTCOMES: In this demonstration activity, students will show how an animal's adaptations can provide an advantage in its goal to meet basic needs. Engaged participation by students is necessary to gain the experience required to complete a write-up that describes the game's outcome and includes the words: community, habitat, adaptations, basic needs, native species and invasive species.

MATERIALS: 10 chairs, Blackline Master: *Musical Mussels*, mailing labels, music

ENDURING UNDERSTANDINGS: Understand concepts related to healthy habitats and communities.

EXPECTATIONS: For the full expectations listing, please see page 75.

PROCESSES OF SCIENCE: Observing, inferring, predicting, classifying, communicating, constructing models.

Lesson Sequence

Prior:

1. Photocopy and cut: Blackline Master: *Musical Mussels* into 10 card-sized pieces.

2. With a marker draw stripes on ~16 mailing labels.

3. Print a "**P**" (for predator) on 2 labels.

4. Assemble chairs in two rows of 5 chairs, back to back.

5. Select music to play during the game. Optional: Choose an aquatic theme - for example tunes from The Little Mermaid or Finding Nemo.

Procedure:

1. Introduce or review the concept of **basic needs** such as food, water, shelter, and room to grow. Indicate that all animals, including humans, must meet these needs to survive.

2. Ask students to imagine being unable to get something that was a basic need (like having no water while playing soccer on a hot summer day, or not being able to get undercover during a rainstorm). Ask: *Can you think of a situation where a human or animal has gone without getting a basic need?*

3. **GAME I**: Explain to students that they will experience the struggle for survival through a version of Musical Chairs. Each of the chairs will represent *all* of an aquatic animal's basic needs (food, clean water, shelter and room to grow). Therefore, students that find a seat when the music stops are able to meet all their needs.

4. Choose 5 students to be native fish (such as trout or yellow perch) in a lake. Play one round of Musical Chairs as you normally would with students walking slowly around the 10 chairs and finding seats once the music stops.

5. Explain that due to their success at meeting their basic needs, these 5 students are able to reproduce. Add 5 more students and play again.

6. Explain that again, due to the success of the fish meeting their basic needs, reproduction occurs and five more students are added to the game due to reproduction. After this round, not all of the fish are able to meet their needs. Five must leave to find food elsewhere or perish.

7. Play several more rounds, allowing students who have not played yet to participate. Ask questions throughout to prompt their understanding of the simulation. For example: *What are the basic needs? What happens to those that don't meet their basic needs? What happens to those that do?*

8. Place a *Musical Mussel* card on three chairs face down. Play a round and ask those landing on a card to share it with the class.

9. Explain: Zebra Mussels are a non-native (new to the area) species accidentally brought to the lake. They compete for the same basic needs as the fish do. If a player gets a card that shows that a zebra mussel has taken a basic need, they must leave the lake along with the others who couldn't meet their basic needs.

10. Retrieve all cards and shuffle. Explain that the zebra mussels have got enough basic needs to reproduce, this time place a card down on 6 chairs. Play the round again and note that reproduction in fish is not occurring due to dwindling basic needs. Again, those with zebra mussel cards on their seats must leave the game.

11. Retrieve all mussel cards, shuffle and place 9 cards down on chairs. Play the round.

12. Retrieve all mussel cards, shuffle and place 10 cards down on chairs. Play the round. Ask remaining student(s): *How are you feeling? Are you worried? Ask the class: What do you think would happen next? Do you think this could really happen in nature? How do you feel about zebra mussels taking over your lake?*

13. **GAME II:** Ask: *Why might it be easier for zebra mussels to reproduce and take over a habitat (and therefore gain access to basic needs) compared to the fish?* List all answers on the board. Explain that the next two rounds will give insight into some of the reasons zebra mussels can out compete native species.

14. **ROUND I**: From the class group, choose 10 students to take on the role of a native aquatic species, 1 zebra mussel (identified with striped mailing labels) and 2 predators ("P" labels). Explain: during this round of Musical Chairs, predators will **walk** around and try to tag the native species **only**. This is because predators don't like to eat zebra mussels. When a predator tags a native species, that student must leave the game. Therefore, natives species must try to both dodge the predators and get their basic needs met. (Note: As predators don't compete with the native species and zebra mussels for the same basic needs they will not try and get a seat when the music stops.) Play one round.

15. **ROUND II**: Add two mussels – representing successful reproduction – for every seat-finding mussel or try again with a new mussel if the one playing doesn't make it.

16. Play again, doubling the number of successful mussels from the last round.

17. Play again, allowing 2 mussels to share one seat if all others are taken. Explain that zebra mussels have small space requirements and live in colonies attached to one another by sticky threads they produce to stay on hard surfaces. Continue until most or all of the basic needs (seats) are taken by zebra mussels.

Closure/Checks for Understanding:

Discuss game observations with students. Ask: *What happened to the native species competing with the zebra mussels? Why were the zebra mussels so successful?* (They are not sought by predators, they need less space to live, and they produce many offspring.)

Explain that zebra mussels (and other invasive species) have adaptations that make them very successful in nature and enable them to expand throughout Ontario's waterways. Ask: *How do you think zebra mussels affect humans?* (Because their populations grow quickly, they take food away from native fish. This decreases fish stock and impacts humans. In addition, they clog water pipes and cling to boat hulls, ruin beaches and cut swimmer's feet with their sharp edges.) *How do you think we can manage them and prevent their spread?* (Take care to ensure they don't get into new habitats.)

Ask students to answer the following in writing:

- Explain how the ability of the native aquatic species to fulfill their basic needs (food, shelter, room to grow and safety) was affected once the zebra mussels came along. (Review cards if necessary.);

- List and explain 2 reasons why zebra mussels can survive more easily than native species; and

- Include the words: community, adaptation, habitat, basic needs, native species and invasive species.

NOTES FOR TEACHER:

Zebra mussels are fingernail-sized mussels with a yellow-striped brown and cream shell that live an average of 2 – 3 years. They originate from the Black and Caspian Sea area of Asia. It is believed that they were brought to the Great Lakes in the ballast of ships in the early to mid 1980s.

Female zebra mussels can produce up to one million eggs per season. The tiny offspring called velligers, spread by floating in water currents or by being inadvertently transported by humans to other waterbodies. When they are about 3 weeks old the zebra mussels settle down onto a firm surface. They eat by filtering phytoplankton (algae) out of the water at great rates. Phytoplankton is a primary food source for young fish and zooplankton. The filtering changes the habitat by allowing more sunlight to penetrate deeper which can force light sensitive fish such as walleye into deeper water and can also encourage the growth of aquatic plants. Therefore, by entering a native food web, zebra mussels can have a great impact on a species community.

Zebra mussels have all the adaptations to make it a highly successful invasive species. As well as producing a great many offspring, zebra mussels require very little space to grow, are able to survive in a wide range of environmental conditions and have few predators.

As well as negatively impacting native habitats, zebra mussels clog water pipes and canals, slowing or stopping water flow. They harm swimmers' feet because of the razor-sharp edge of their shells. They can infect predators such as duck and fish species with contaminants that may be present in their body after filtering contaminated water. (This contamination can subsequently make its way up the food chain if these species are in turn consumed by a higher predator.) Often fish cannot spawn in areas covered with zebra mussels. Buoys covered with zebra mussels can get so heavy they sink.

Once zebra mussels are in a lake, there is no way to control or eradicate them so preventing their introduction is critical. To prevent the spread of invasive species such as zebra mussels it is important to:

- Remove all aquatic plants, mussels or other visible organisms and put them in the garbage;
- Drain the water from your boat, including the motor, live well, and bilge;
- Do not release live bait! Empty your bait bucket on land, or freeze or salt for later use;
- Remove organisms you can't see on your boat by;
- Rinsing with hot water; or
- Spraying with high-pressure water; or
- Drying it in the sun for 5 days.

EVALUATION:

Teachers can evaluate written statements to determine student understanding of the:

- ability of native aquatic species to meet their basic needs;
- influence of zebra mussels on the ability of native aquatic species to meet their needs; and
- how the adaptations of the zebra mussels benefit them in their struggle for survival.

Students can also be evaluated for their understanding of: community, adaptation, habitat, basic needs, the struggle for survival, native species and invasive species.

ACCOMMODATIONS:

Students unable to easily participate in the game can operate the CD/tape player or put cards on the seats for students. The teacher can familiarize students by reading aloud and explaining each of the cards before using them in the game. Children can be chosen to participate together based on similar physical abilities.

EXTENSIONS:
Ask students what they can do to control and prevent zebra mussels from spreading. Change the game by adding cards that reflect these ideas. Discuss why they work or don't work.

Have students research what humans can do to prevent the spread of zebra mussels. They can start by reviewing the information they find on: www.invadingspecies.com. In groups or pairs, students can then list on a large piece of chart paper, steps to invasion prevention. They can then decorate their list and send it to a local marina, sport shop or bait dealer for display.

L6. Tough Ruffe

PURPOSE: In this active simulation, students will demonstrate the struggle for survival as experienced by yellow perch in a lake habitat. Students will predict outcomes, and compare scenarios between a healthy habitat and one disrupted by an invasive species, the Eurasian ruffe.

SUBJECT / STRAND:	DURATION:	GROUP SIZE:	SETTING:
Grade 4 Science - Life Systems, Health and Physical Education	45 min.	Class	Gym or schoolyard

EXPECTED OUTCOMES: In this activity, students will demonstrate, analyze and compare the variables that affect the struggle for survival of a native and invasive species. Students will then, in discussion and/or in a written assignment consider strategies species may use when disadvantaged within their habitat. Further investigation will provide an opportunity for students to consider whether they believe this type of scenario could play out in a real life setting.

MATERIALS: 5 hula hoops, 4 same colour pinnies, 1 pinny of a different colour (with optional cardboard spine attached), 4 pylons (if outside), Blackline Master: Tough Ruffe Game Cards, whistle

ENDURING UNDERSTANDINGS: Understanding concepts related to healthy habitats.

EXPECTATIONS: For the full expectations listing, please see page 75.

PROCESSES OF SCIENCE: Constructing models, predicting, inferring, communicating.

Lesson Sequence

Prior:

1. Photocopy Blackline Master: *Tough Ruffe Game Cards* (1x) and cut into game pieces.

2. Distribute 4 hula-hoops randomly throughout the play area. (If playing in the schoolyard, mark off boundaries with pylons.)

Procedure:

1. Gather the class for a discussion and an explanation of the activity rules.

2. Ask: *Have you ever been in a race where there were kids who were faster than you? What happened? What was your reaction? What if the prize was a slice of pizza and you hadn't had dinner? How would you feel physically?*

3. **ROUND I** Explain: In the first part of this simulation participants will experience the **struggle for survival** for a fish called the **yellow perch**. Yellow perch live in Ontario lakes. Like all species, they have to find enough food to provide them with the energy to move and mature. They must also ensure they have clean water, enough room to grow and shelter from predators and bad conditions.

4. Give the following instructions:

- Four students will represent yellow perch while the remaining students will represent elements in their habitat and community.

- The yellow perch, each starting in one of the hula-hoops, will circulate in the "habitat" and collect as many cards as they can until the whistle blows. To survive, each yellow perch must have 2 cards representing each essential item: food, clean water, shelter and room to grow.

- The students making up the habitat and community will each have two cards. Each card will represent an essential item the yellow perch needs for survival. These students will walk around the playing area slowly, holding their cards so that they can't be read.

- When a yellow perch arrives at an element, s/he must come to a complete stop and ask, "What do you have to help me survive?" The element then quickly reveals his or her card(s), face down or empty hands. If the element-holding student has more than one card, the yellow perch can choose which one to take (without seeing it first). If the yellow perch cannot use the card, s/he must move on and leave the card behind.

- Once a needed card is found, the yellow perch must take it back to his or her hula-hoop before searching for more cards. Only one card can be transported at one time.

- In their struggle for survival, the yellow perch may come across a wildcard. Review wildcards with students (Caught! Slimed! Jackpot! Eaten!).

- The whistle will be blown after 3 minutes.

5. Select 4 students to be yellow perch and have them each stand in a hula-hoop.

6. Distribute the cards to the rest of the students. Ask them to start walking slowly around the playing area.

7. Run the game. Give participants a "30 seconds to finish" warning and provide a 10 second countdown to the end.

8. Briefly review the results of the game:

- *How many yellow perch survived?*
- *What were the biggest challenges participants faced during the game (discuss the wild cards if necessary)?*
- *How is the game similar or different from the experiences of fish in a real lake? (Time permitting, the game can be run again with different students in the role of yellow perch.)*

9. **ROUND II**. Explain: An invasive species called a ruffe (rhymes with "tough") has entered our lake.

10. Gather and redistribute the game cards. Place the fifth hula-hoop on the playing area. Select one student to be the ruffe and wear the other colour pinny. Have him or her stand in the empty hula-hoop.

11. Give the following instructions:

- In this next round of the game the ruffe will play by the same rules as the yellow perch in that they too need 2 cards of each item to survive.

- However due to their competitive advantage, s/he can collect up to two cards from each element and s/he is not affected by the wildcards: *Eaten! or Caught!*

12. Before blowing the whistle, ask students to predict what will happen in this version of the game.

- *Which fish will have enough food to survive?*

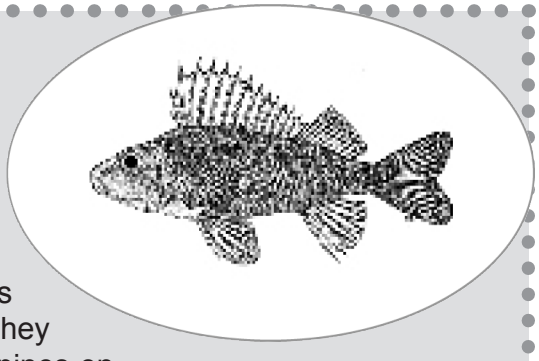
- Identify some new strategies that might be used in this game (e.g. perch could communicate with each other about where certain cards are).

13. Run the game. (Time permitting, run the game again, with different students in the yellow perch and ruffe roles).

14. Compare the first round to the second round:

- How many fish survived?
- What were their challenges and experiences?

A Bit About… THE RUFFE



RUFFE
Minisota Sea Grant

The ruffe, an invasive fish species, now lives in Lake Superior, Michigan and Huron in the same habitat as the yellow perch and eats similar food. Ruffe were brought to Ontario waters unknowingly in ship ballast (the ballast is the water contained in a ship that helps to maintain its stability). Ruffe have adaptations that give them a competitive advantage over native species. They can see their prey in poorly lit conditions and they have sharp spines on their gills and fins that make them less desirable to predators and competitors.

Closure/Checks for Understanding:

Answer the following questions as a group or in writing:

- Describe the struggle for survival when only the yellow perch was seeking food.

- *How was the struggle for survival different when played with the ruffe?*

- Ask students if this game is a good way to show what happens in real habitats? Why or why not?

- *What strategies could perch have used to get food? How would those affect their survival? Could this happen in their habitat?*

NOTES FOR TEACHER:

Yellow perch are a small (10-24 cm) fish that generally live near lakeshores at shallow depths. Yellow perch feed in the morning and evening on benthic insects (insects that live underwater in and around lake bottom sediment), worms, crayfish and other small fish. They are a popular catch with anglers.

Ruffe are a small fish, first discovered in North America in Lake Superior near Duluth, Minnesota and now found in Thunder Bay. Ruffe feed heavily on many foods that are also eaten by yellow perch, trout-perch and other native benthic-feeding fish. They also eat the eggs and young of whitefish and perch and out-compete those species in their search for food by being able to see prey under poorly lit conditions. In areas near Thunder Bay and Duluth they have become the most abundant species. This is compounded by the fact that ruffe have no value to commercial and recreational fisheries.

EVALUATION:

Evaluation can be done on student written responses to questions in the Checks for Understanding section.

ACCOMMODATIONS:

Ensure students with similar physical abilities compete against each other. Have students who are challenged by verbal instructions participate in the game after the first round so they can see other players in action.

EXTENSIONS:

Have students write a creative piece reflecting the experience of the perch. Have students create a report that compares the food source, shelter, life cycles of the yellow perch to ruffe.

L7. Stow-Aways and Crafty Ways

PURPOSE: In this mapping and prediction activity, students will explore the various ways invasive species can migrate throughout the waters of Ontario and how humans contribute to this destructive migration.

SUBJECT / STRAND:	DURATION:	GROUP SIZE:	SETTING:
Grade 4 Science - Life Systems, Social Studies	70 min.	Class	Classroom

EXPECTED OUTCOMES: Using research data that identifies where invasive species have been sighted, students will both infer how these creatures have spread throughout Ontario waters and predict their future movement. This activity will demonstrate the ability to interpret and label maps while an accompanying written report will indicate compilation and reporting skills.

MATERIALS: Blackline Master: *Map of Ontario*, atlases, Blackline Master: *Round Goby Investigation – Background*, a map of Canada and the World for teacher, pencil crayons or markers, notebook or piece of paper per student, large plastic pop bottle, basin, water, duct tape, 4 x $2 coins.

ENDURING UNDERSTANDINGS: Understanding concepts related to healthy habitats.

EXPECTATIONS: For the full expectations listing, please see page 75.

PROCESSES OF SCIENCE: Predicting, hypothesizing, interpreting data, inferring.

Lesson Sequence

Prior:

1. Cut a large 2 litre plastic pop bottle in half lengthwise so that it looks something like a ship's hull with the bow at the lid end. Keep the lid on the bottle or duct tape over the end so that water will not fill the bottle through the neck. Duct tape 4 x $2 coins ("toonies ") onto the bottom end opposite the cap area. (As well as balancing the bottle's weight, the coins will act as a keel).

2. Fill a plastic basin full of water.

3. Photocopy the following Blackline masters – one for each student:
   - Blackline Master: *Map of Ontario*
   - Blackline Master: *Round Goby Investigation Background*

4. (Optional) Write the following on the board:
released from a ship's ballast;
following natural waterways;
as pets released into the wild;
accidental bait release;
on a boat; and,
released from a market.

Procedure:

1. Brainstorm on how people, different food products or wildlife get to and around Canada. Focus on less obvious methods, for example: *How could people with little or no money move about this country? How could food, not transported by truck, get around Canada?* Allow students to be creative in their answers.

2. Ask: *How do you think a foreign aquatic species would get into the Great Lakes from Europe?*

3. Ask students to come around the basin. Place the empty plastic pop bottle in the water and explain that it will represent a ship. Demonstrate how easy it is to upset the ship.

4. Fill the half bottle with approximately 3 cm of water. Show that it is now more difficult to upset the boat. Ask: W*hy is this the case?* Explain that ballast is needed to help stabilize ships in rough and stormy seas (see A Bit About…).

5. Ask: *How might ballast play a role in transporting foreign species?* Explain that the introduction of many non-native species has been linked to ships dumping their ballast water taken from far away ports into Ontario waters. Once in the Great Lakes, these ships may travel from port to port within the Great Lakes further taking on or dumping ballast water into these areas and thus continuing the spread of exotic species.

6. On the world map, ask a student to show a ship's route from a port in Europe across the Atlantic Ocean to Lake Ontario.

7. Explain to the class that the spread of round goby, a foreign, invasive species, can be traced to the dumping of ballast water into the St. Clair River in Ontario (show river's location relative to the Great Lakes) in 1990 from European ships. Today, the species is now found throughout the Great Lakes system and some inland locations.

8. Distribute an atlas, a Round Goby Investigation Background sheet and a Map of Ontario to each student.

9. Tell students that in this mapping project they will take on the role of an **investigative ecologist**. Their challenge is to determine how round goby may have spread from the site they were originally released (the St. Clair River) to places they, as **investigative ecologists**, have discovered them at later dates (refer to Reported Sightings table). In addition, they must use their skills to predict where the round goby will be in the future.

10. Referring to the table, explain that students must determine the path the species took over time to get to each of the listed locations.

11. As an example, ask students to use their atlases to find Reported Sighting #1. Ask students to label this location on their map of Ontario and include:

a. a small **fish symbo**l indicating where the Reported Sighting was, and

b. the **year of the reported sighting**.

12. Once done, ask students to find the location of Reported Sighting #2. Again label the body of water and put the year of the sighting.

13. Have students find Reported Sighting #3, label and date it all the while considering how it may have arrived at this location. Repeat this process until all reported sightings have been completed.

14. Instruct students to draw a pathway that the round goby might have taken from Reported Sighting #1 to Reported Sighting #2. Explain to students that round goby must either travel through natural waterways or across land with help from humans (see Notes to Teacher and refer to the provided list).

15. Have students predict where round goby will be located in 2010 and 2015 by labelling future sightings and possible pathways. (A different colour may be used with a reference in the legend). Remind students that round goby can spread from any of the locations where they have already been sighted. There are no wrong answers.

16. Tell students they will now write up their INVESTIGATIVE ECOLOGIST REPORT. Decide together what the report headings will be.

Ensure students include:

- How and where the round goby first came to Canada;
- What route they took and how they traveled over the years; and
- Predict where the round goby will be by 2010 and 2015 and how it traveled there.

Closure/Checks for Understanding:

Have students share highlights and predictions from their reports and allow a discussion to take place as appropriate.

A Bit About… BALLAST

There have been sightings of exotic species in Lake Ontario since the 1830s! In fact, over the last 180 years, scientists have identified over 180 exotic or non-native species in the Great Lakes! These species have entered the Great Lakes primarily through the release of ship ballast water and to a lesser extent from species migration through shipping canals that connect the Great Lakes to each other and to the Atlantic Ocean. Some of these exotic species have also entered the Great Lakes when released intentionally by people.

Ballast water refers to the water carried by large, ocean-going vessels to stabilize them on rough waters during their ocean journey. This water – along with the small plants and organisms living in it – is sucked into the bottom of boats while in their home ports. Many of the species within the ballast water are able to survive the ocean journey. On the ship's arrival to the Great Lakes, the water is emptied. The species will continue to survive if the weather and environment is similar to where they originated. These same species can continue to be transported within the Great Lakes as ships continue to fill up and empty ballast water as they move from port to port. With the increase in global trade has come an increase in non-native species "hitch-hiking" their way into and around the Great Lakes basin.

The introduction of aquatic invasive species into the Great Lakes basin has also been the result of the building of shipping canals over the last two centuries. Sea lamprey, for example, was first observed in Lake Ontario in the 1830s. Niagara Falls acted as a natural barrier preventing species from invading lakes Erie, Huron, Michigan and Superior. However when the Welland Canal was deepened in 1919, this allowed species such as the sea lamprey to gain access to the rest of the Great Lakes (not to mention larger, ocean-going vessels). As more canals were built, including the Trent-Severn Waterway and the Rideau Canal, more pathways were provided for non-native species to travel into other Ontario lakes and waterways.

NOTES FOR TEACHER:

For information on the round goby, see lesson “Changing Chains”.

Foreign animal and plant species have spread throughout Ontario in a number of different ways:

- **In a Ship’s Ballast**
  See A Bit About…

- **By Following Natural Water Routes**
  Exotic species have followed natural waterways when the habitat they have ventured into has supported their basic needs.

- **As Pets and Plants Released into the Wild**
  Some animal and plant species, sold for aquariums or water gardens, have caused great harm when owners have released them into the wild.

- **As Bait Released from One Water Body to Another**
  Many people don’t realize that releasing live bait after fishing into lakes and rivers is a way of introducing potentially harmful species to new habitats.

- **Stocking Fish in a Lake Without a Licence or a Great Escape**
  Some species that are native to Ontario but not native to a particular area can have the potential to become invasive and alter ecosystem functions. This can happen when people naively think they improve a fishery by releasing species such as rock bass, black crappie or even pike. Escapes can also happen from aquaculture facilities with the potential for introducing potentially harmful species to new habitats. You should always consult the MNR before stocking or raising fish in the wild.

- **On a Boat**
  Invasive species can find their way into other waters by clinging to boats, trailers or equipment or hiding out in areas like motors, bilge, or live-wells in commercial and recreational boats.

- **From the Marketplace**
  Exotic food species are meant to be eaten, not to be released. Some are aggressively invasive and when set free into Ontario’s aquatic habitats, will cause harm.

(See Background Materials for more information.)

** Although the round goby was not spread by all these methods throughout Ontario waterways, it is important that students recognize these methods of transmission and explore their possibility in the mapping project.

EVALUATION:

Teachers can evaluate student knowledge of Ontario waters, mapping vocabulary (province, latitude, longitude, etc.), cardinal and intermediate directions, and pictorial symbols and use of colour in legends. Additional assessment can be performed on prediction and communication skills.

ACCOMMODATIONS:

For students with learning challenges consider limiting the Report Sightings to an appropriate number. Pre-labelled maps can be used to further assist students.

L8. 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:	DURATION:	GROUP SIZE:	SETTING:
Grade 4 Science - Life Systems, Social Studies	70 min.	Class	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: For the full expectations listing, please see page 75.

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.

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); and
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.

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.

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); and

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.

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.

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 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 labelling 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?

Ultimate Species Rubric Name:_____

Criteria/Levels	1	2	3	4
Creativity and Effort	• Few original ideas • Incomplete	• Some original ideas and creativity • Some effort is shown	• Ideas are original and creative • Solid effort is shown	• Very original and unique ideas • Extra care and effort are apparent
Content How and what I eat How I move How I stay safe Where I live	• Adaptations don't help the creature eat, move, stay safe and find shelter • Creature does not suit habitat and community • Incomplete	• Some suitable adaptations are present • Creature's adaptations are somewhat suit it's habitat and community	• At least 4 suitable adaptations are clearly identified • Creature is well suited to its habitat and community	• 6 or more suitable adaptations well identified • Adaptations are very well suited to the creature's habitat and community
Communication	• Not enough detail is given • Sentences are incomplete	• Written description somewhat detailed • Contains some sentences	• Uses suitable words to describe adaptations • Full sentences used • Well expressed	• Uses a variety of words to describe adaptations • Full sentences used; well structured in paragraph form • Superior expression
Drawing	• Drawing doesn't show what is in written description • Incomplete	• Drawing shows some details of the written description	• Drawing shows the details of the written description	• Drawing clearly and creatively shows the details of the written description
Comparison Chart (shared group mark)	• Does not explain what adaptations the invasive species and the ultimate species share and don't share • Incomplete	• Shows the differences between the invasive species adaptations and ultimate species adaptations	• Clearly compares invasive species adaptations and ultimate species adaptations • Tells of important habitat and community characteristics that affect the ultimate species	• Expertly shows what invasive species share and don't share with the ultimate species (adaptations) • Clearly explains the role of the invasive species and ultimate species in the community and habitat

Overall Level: 1 2 3 4 Comments: