UNIT C Living Together (page 180)

SUGGESTED TIMING	MATERIALS	BLACKLINE MASTERS
35–45 min including brainstorming and the Science and Media Link; extra time needed for researching question 4 on page 143 25 min for Try This!	• chart paper and markers	OHT C–1 Interacting Together

Overall Expectations

BLTV.03 – analyse the challenges that arise from organisms living together in communities
SIMV.01 – explain how science-related information is presented in print and electronic media for different purposes and audiences

Diagnostic Assessment

Brainstorming with the class should give you a sense of students' general understanding about organisms living together. Students may already have discussed some concepts in previous science classes. Some things to consider:

- What do students already know?
- How familiar are students with animal and plant interactions?
- How familiar are students with the role that humans play in interactions with plants and animals?
- What human impacts on the environment are students already aware of?

Activity Planning Notes

As a class, read the introductory paragraph. Ask students to identify the interaction between birds and trees (e.g., trees provide shelter for birds) and grass and cow manure (e.g., manure provides plants with nutrients needed to grow). Ask students for other examples of interactions such as: humans socialize with other humans, humans own pets, humans care for plants, animals breathe in oxygen and breathe out carbon dioxide while plants do the opposite, plants are food for some animals, and animals are food for some animals.

Consider having students brainstorm the advantages and disadvantages of animals, including humans, and plants interacting together. Get students started by asking why an organism might interact with another organism. Answers may include food, shelter, protection, reproduction, or companionship.

Students can fill out the mind map on page 180 and then can share them. Consider producing a class mind map using **OHT C–1 Interacting Together**. At the end of Unit C, remind students to fill out the mind map on page 181. Then have students compare the two mind maps to help assess their learning during the unit.

As a class, read the Science and Media Link on page 182. Ask students about the problems that a wild and stray cat population present, according to the article. Ask them to consider how the article presents scientific information (e.g., picture, facts about stray and wild cats, storytelling format) and whether or not they think that it is accurate. Ask who they think is the audience for this article and to explain why.

Have students complete and then discuss the follow-up questions on pages 182 and 183.

Consider using the following overhead transparency:
- **OHT C–1 Interacting Together**

Check Your Understanding Answers (page 182)

1. Look for the idea that an introduced species does not occur naturally in an environment.

2. a) Cats hunt other animals, which reduces the wildlife population.

b) Cats spread diseases such as rabies to humans and other animals.

c) Cats that meet in groups can be noisy and create unclean conditions.

Making Connections Answers (page 183)

3. Answers may vary. Accept any reasonable explanation such as:

- If all the wild and stray cats are eliminated, other cats may move in. Since there would be little competition for food and space, the new arrivals may produce larger litters of kittens. The result might be an increased wild and stray cat population.

4. Answers will vary. Sample answers:

a) zebra mussels; brought to the Great Lakes by boats; clog water intake lines, cover boat hulls, kill clams, and disturb lake ecosystems

b) sea lamprey; moved through the St Lawrence to the Great Lakes; feed on the blood of fish, which die as a result

c) Asian long-horned beetle; came to Canada in infested wood products; attacks and kills healthy trees

Try This! Activity (page 183)

Purpose

- Students survey their classmates about the pets they own.
- Students discuss the responsibilities of pet owners.

Science Background

A pet is an animal kept for companionship, as opposed to farm animals or laboratory animals that are kept for economic or research purposes. Among the many kinds of pets, some are native to Canada while others were introduced.

Birds: Budgerigars (often called budgies) are originally from the grasslands and woods of Central and Southern Australia. These small parrots have been bred in captivity since the 1850s.

Cats: Cats are descended from wild cats of Africa and Southwestern Asia and were domesticated by the Egyptians more than 4000 years ago.

Dogs: Fossil and DNA evidence suggest that the first domesticated dogs came from East Asia, possibly China or Japan.

Goldfish: Goldfish are a domesticated version of a carp native to East Asia. The gold colouring is the result of a genetic mutation. People began to breed goldfish during the Tang Dynasty (618–907) in China. Goldfish were introduced to Europe in the late 1600s.

According to the Humane Society, pet overpopulation results from non-spayed/neutered animals reproducing and people breeding animals. For example, in an average year a fertile cat can produce from 12 to 18 kittens (based on three litters each with four to six kittens). If the female cat and her offspring are not spayed or neutered, they could produce up to 420 000 cats over seven years. In addition to cats and dogs, there are major overpopulation problems with birds and rabbits. Local animal protection organizations urge people to spay or neuter their pets and to adopt animals from shelters instead of purchasing them.

Advance Preparation

WHEN TO BEGIN	WHAT TO DO
1 week in advance	• Book the library or computer lab for research (optional).

Suggested Timing

25 min

Activity Planning Notes

As a class, consider preparing the survey questionnaire in advance. Use chart paper and create a tally chart of common pets. Leave space to add new ones to the list as they come up. You might set up the survey using the following headings:

- Name of species
- Is it introduced or natural?
- Is it spayed or neutered?
- Does pet roam outside?

After the survey, discuss the results. How many pets does the class own? How many pets are introduced or native? How many pets are spayed or neutered? How many pets roam outside?

Discuss the importance of spaying and neutering pets for managing the pet population. Explain that spaying means removing the reproductive organs of female cats and dogs, and neutering means removing the testicles of male cats and dogs. Spaying and neutering pets guarantees fewer unwanted pets from unexpected litters. Additionally, spayed and neutered pets generally have calmer temperaments and are less likely to bite or to roam.

Accommodations

- Pair ESL and LD Learners with students who have stronger language skills.

Activity Wrap-up

- Have students discuss the impact of pets that are allowed to roam freely and the responsibilities of pet owners to protect the environment. You might ask them to find out about any city by-laws in place.

Technology Links

- For information about invasive species in Canada, go to **www.mcgrawhill.ca/books/Se10** and follow the links to Invasive Alien Species.
- For reader-friendly information about pet overpopulation, go to **www.mcgrawhill.ca/books/Se10** and follow the links to Stop the Downpour.
- For information about spaying and neutering pets, go to **www.mcgrawhill.ca/books/Se10** and follow the links to Why You Should Spay or Neuter Your Pet.
- For examples of short video clips about pet overpopulation, go to **www.mcgrawhill.ca/books/Se10** and follow the links to Pet Overpopulation.

Alternative Activity

- Have students preview video clips about pet overpopulation and then analyze them for how they convey scientific information. See the Technology Links.

Activity Preparation for Chapter 9

Activity/Investigation	Advance Preparation	Time Required	Other Considerations
Try This! (page 187) (TR page 216)	• 1 day before – Prepare a container of beans. – Photocopy **BLM 9–2 Using Mass to Estimate a Population**, **Master 1 Narrative Lab Report**, and **Assessment Master 17 Narrative Lab Report Checklist**. • Day of – Set out materials.	• 30–40 min	• Choose beans such as lima, kidney, or fava that are large and have uniform mass. • Consider modelling the concept of using mass to estimate a population using a jar of pennies and a scale.
Find Out: Counting Peas (page 188) (TR page 217)	• 2 to 3 days before – Obtain split peas and cardboard box lids. – Prepare box lids. – If using, photocopy **Assessment Master 2 Co-operative Group Work Rubric**. • Day of – Set out materials.	• 30 min	• Although the lids from photocopy paper boxes are ideal, any lid with sides cut to 5 to 8 cm will work. • Prepare box lids by drawing a 6 by 6 grid (for a total of 36 squares) that takes up the entire space of the inside bottom of each box lid.
Find Out: Counting Populations of Plants (page 189) (TR page 218)	• Several weeks before – Select a study area. – Identify three to five study plant species. • 1 or 2 days before – Gather pegs or nails, metre sticks or measuring tape, and string or twine. – Photocopy **BLM 9–3 Counting Populations of Plants** and any assessment masters you decide to use. • Day of – Set out materials.	• 60–75 min	• In advance, select a study area that is safe and contained. If possible, select an area in which there are a limited number of plant species. • Consider recommending a range of three to five easily identifiable species of plants (e.g., dandelions, clover, bindweed, plantain, creeping charlie, crabgrass, chickweed, fescue). Consider preparing an overhead of each plant as a reference for students' drawings. • Reinforce the importance of using equipment correctly by distributing and reading together **Assessment Master 9 Using Tools and Equipment Checklist**.
What's Going On? Turkeys and Wolves (page 194) (TR page 222)	• 1 day before – Photocopy **Master 3 Centimetre Grid Paper** (optional).	• 30 min	• Review graphing skills. You may wish to have students use **BLM 3–7 Making a Line Graph**. • Students with motor difficulties may need to use **BLM 3–8 Making a Line Graph in Microsoft® Excel**.
Find Out: Survivor (page 197) (TR page 226)	• 2 to 3 days before – Collect dice or make a spinner for each group. • 1 day before – Familiarize yourself with the game by playing a few rounds. – Photocopy **BLM 9–5 Survivor Game Board** and **Assessment Master 2 Co-operative Group Work Rubric**. • Day of – Set out materials.	• 25–45 min	• In advance, prepare spinners if using them.
Test It! What Are the Limits for Brine Shrimp Eggs? (page 200) (TR page 228)	• Several days/weeks before – Order brine shrimp eggs. • 1 to 2 days before – Obtain 1 L of distilled water and let it sit at room temperature for a day or two. • 1 day before – Prepare the brine solution. – Prepare the dropper bottles of vinegar and sodium hydroxide solution. – Photocopy **BLM 9–6 Acid Rain** and any assessment masters you decide to use. • Day of – Set out materials.	• 60–70 min (time to set up, observe 2 to 3 days later, and do the wrap-up) • Science and Literacy Link (includes research time)	• Avoid purchasing eggs that are sterilized or stored for too long in a pet store. • In advance, prepare the brine solution by adding 10 g non-iodized salt to 1 L of distilled water. A pinch of baking soda can be added to buffer the solution. Prepare the sodium hydroxide solution by using 2 g of sodium hydroxide per 250 mL water. • Keep brine shrimp at room temperature and out of direct light. They hatch best in minimum light conditions.

Activity Preparation for Chapter 9

Activity/Investigation	Advance Preparation	Time Required	Other Considerations
What's Going On? How Fast Does Yeast Grow? (page 204) (TR page 233)	• 1 to 2 days before – Buy fresh active dry yeast and light molasses at a grocery store. – Photocopy **BLM 9–8 Show You Know! Microscope Certification, BLM 9–9 How Fast Does Yeast Grow?, Assessment Master 10 Using Tools and Equipment Rubric**, and **Master 3 Centimetre Grid Paper** (optional). • Day of – Set out apparatus and materials.	• 60 min to set up and observe; 15–20 min per observation for 2 days	• Use measuring slides if you have them, or make them in advance by taping two hairs (e.g., rabbit hairs) onto a glass slide to form four squares. • If using tap water, let it stand for a few hours to rid itself of excess chlorine. • Reinforce the importance of handling and using a microscope properly.
Test It! How Does Overcrowding Affect Plants? (page 208) (TR page 234)	• 1 month before – Order seeds from a supplier. • 1 day before – Gather materials. – **Photocopy Assessment Master 6 Scientific Communication Rubric** and **Master 3 Centimetre Grid Paper**. • Day of – Set out materials.	• 30–45 min to set up; 30–45 min for completing the investigation	• Purchase rapid-growing bean or radish seeds. • Organize the activity so that students plant the seeds about two weeks before they make observations. • When seeds germinate, have students remove containers from the bag and keep containers in a sunny or bright area. They will need to be watered occasionally.

Materials Needed for Chapter 9

Activity/Investigation	Apparatus	Materials	Blackline Masters
Try This! (page 187) (TR page 216)	• jar of pennies (optional) • digital scale (1 per group) • calculators	• jar of dry beans such as lima, kidney, or fava (1 per group)	**Recommended** Master 1 Narrative Lab Report BLM 9–2 Using Mass to Estimate a Population Assessment Master 17 Narrative Lab Report Checklist
Find Out: Counting Peas (page 188) (TR page 217)	• 2 dice (per group) • calculators	• split peas in small plastic bag (about 250 peas) (1 bag per group) • prepared cardboard box lid (1 per group)	**Optional** Assessment Master 2 Co-operative Group Work Rubric
Find Out: Counting Populations of Plants (page 189) (TR page 218)	Per group: • metre stick or measuring tape • calculators	Per group: • 4 wooden pegs or nails • 2 to 3 m of string or twine • plastic bag	**Recommended** BLM 9–3 Counting Populations of Plants Assessment Master 1 Co-operative Group Work Checklist Assessment Master 2 Co-operative Group Work Rubric Assessment Master 6 Scientific Communication Rubric
What's Going On? Turkeys and Wolves (page 194) (TR page 222)	• 2 different coloured pencils		**Optional** Master 3 Centimetre Grid Paper BLM 3–7 Making a Line Graph BLM 3–8 Making a Line Graph in Microsoft® Excel
Find Out: Survivor (page 197) (TR page 226)	Per group: • pencil (optional) • marker (optional) • die • 2 to 4 playing pieces • calculators (optional)	Per group: • cardstock paper (optional) • paper clip (optional)	**Recommended** BLM 9–5 Survivor Game Board OHT C–4 Survivor Game Board Assessment Master 2 Co-operative Group Work Rubric
Test It! What Are the Limits for Brine Shrimp Eggs? (page 200) (TR page 228)	• chemical splash-proof goggles • marker • 3 test tubes • test-tube rack	• brine • vinegar (in dropper bottle) • 0.2 Mol/L sodium hydroxide solution (in dropper bottle) • brine shrimp eggs	**Recommended** BLM 9–6 Acid Rain Assessment Master 7 Safety Checklist Assessment Master 8 Safety Rubric Assessment Master 16 Visual Presentation Rubric
What's Going On? How Fast Does Yeast Grow? (page 204) (TR page 233)	• 250 mL beaker • spoon • medicine dropper • measurement slide • microscope	• 125 mL water • 75 mL molasses • 5 mL active dry yeast	**Recommended** BLM 9–8 Show You Know! Microscope Certification BLM 9–9 How Fast Does Yeast Grow? OHT C–6 Microscope Checklist Assessment Master 10 Using Tools and Equipment Rubric **Optional** Master 3 Centimetre Grid Paper
Test It! How Does Overcrowding Affect Plants? (page 208) (TR page 234)		• 3 – 10 cm plastic pots or 4 – 1L milk cartons with the tops cut off • potting mixture • water • beans (mung, pinto, or lima) • large, clear plastic bag • masking or duct tape	**Recommended** Assessment Master 6 Scientific Communication Rubric Master 3 Centimetre Grid Paper **Optional** BLM 3–8 Making a Line Graph in Microsoft® Excel

CHAPTER 9 Populations (page 185)

SUGGESTED TIMING

15–20 min

MATERIALS

- same-size objects such as marbles
- 2 same-size, transparent containers

Overall Expectations

BLTV.02 – investigate, using appropriate laboratory and research skills, the implications of organisms existing in communities

Key Terms Teaching Strategies

Have students complete some or all of the following activities to help them learn and remember what it means to estimate:

- Show students a container filled with marbles. Tell them how many marbles there are in the jar. Then, show them another container that has fewer marbles. Have students estimate the number of marbles in the container. Help students recognize that it is easier to estimate when there is a point of reference.
- Write a definition for the term in their Science Log. You may wish to have students keep a glossary at the back of their Science Log.

Help students remember the key term by posting it on a science word wall.

Reading Icon Answer (page 184)

1. Answers will vary. Accept any reasonable use, such as estimating the time it takes to walk from place to place.

Activity Planning Notes

After reading the introductory paragraphs as a class, find out what students already know about estimation. Have students compare estimating a number of moving organisms with a number of still objects. Have students brainstorm strategies to estimate a large group of moving organisms, such as fish. Encourage students to realize that size of organism is another factor that affects ease of estimation. Use an example such as trees in a city park and the number of birds in each tree. Ask which organism is easier to estimate. Ask what strategies they could use to estimate the total number of birds in the trees.

Have students complete and then discuss the questions. Alternatively, you might address the questions as a class activity. Explain that scientists solve the problem of fish moving by using electrofishing. They put an electric current through the water. That shocks the fish, which float to the surface and are counted before they revive and go back to the bottom.

Accommodations

- Have students who have difficulty writing discuss the answers orally.

Check Your Understanding Answers (page 184)

2. a) Answers will vary. Accept any three reasonable challenges. For example:

- The fish are constantly moving.
- It is hard to count smaller fish because they are hard to see.
- Fish often hide in the shade or near logs, so they're hard to see.

b) Answers will vary. Accept any reasonable solution for one problem. For example:

- Dam an area and move all small fish into the area for the count.

9.1 Individuals and Populations (page xx)

SUGGESTED TIMING

25–30 min
30–40 min for Try This!
30 min for Find Out: Counting Peas
60–75 min for Find Out: Counting Populations of Plants

MATERIALS

- jar of beans (e.g., kidney beans, lima beans)
- 4 cups
- chart paper and markers

BLACKLINE MASTERS

Master 1 Narrative Lab Report
BLM 9–1 The Name Game
BLM 9–2 Using Mass to Estimate a Population
BLM 9–3 Counting Populations of Plants
OHT C–2 Estimating Beans
Assessment Master 1 Co-operative Group Work Checklist
Assessment Master 2 Co-operative Group Work Rubric
Assessment Master 6 Scientific Communication Rubric
Assessment Master 17 Narrative Lab Report Checklist

Specific Expectations

BLT1.02 – identify challenges that arise from organisms living together in communities, including human populations
BLT1.04 – use appropriate scientific terminology related to concepts of organisms living together
BLT2.06 – explain and interpret observations by summarizing patterns obtained from graphing data, organizing information, and communicating orally and in writing

Key Terms Teaching Strategies

Have students complete some or all of the following activities to help them learn and remember the key terms:

- Write definitions for these terms in their Science Log. You may wish to have students keep a glossary at the back of their Science Log.
- Use words and pictures to show the meanings of population, individual, and species.

Help students remember the key terms by posting them on a science word wall.

Reading Icon Answer (page 185)

3. Individual elk: individual

Population of elk: population

Reading Icon Answers (page 186)

1. a) 3 species

b) 3

c) 2

d) 5

3. Answers will vary. Look for a reasonable estimate and an effective strategy for estimating the number of beans. For example:

- 80 beans: Estimate the number of beans in the bottom layer. Next, estimate the number of layers. Then, multiply the estimate of beans in one layer by the estimated number of layers.

Activity Planning Notes

After reading the introductory paragraph, use the example of a class to reinforce the key terms. The population of the class includes individuals such as students and a teacher. They all belong to the human species and live in the same area.

Ask students for other examples of species. If available, use pictures to help illustrate the outcome when different species mate with each other. For example: horses and donkeys produce mules, lions and tigers produce ligers, camels and llamas produce camas, whales and dolphins produce wholphins. Each of these pairings produces sterile offspring. Students might be interested in speculating about other possible pairings.

Have students complete and then discuss the questions on page 185. Make sure they understand the concept of a species before moving on to counting and estimating populations.

As a class, read the information on pages 186 and 187. As a class, consider walking through the two ways to estimate the number of beans by using a jar of beans, four cups, and a four-square grid drawn on chart paper.

Have students complete and then discuss question 4 on page 187.

Use the Try This! activity as a follow-up to the class discussion about estimation, and as a lead into the two Find Out activities. Make sure students understand the sampling technique that they practise in Find Out: Counting Peas, as they will build on what they learned to count a population of plants in the Find Out activity that immediately follows.

Consider using the following blackline master and overhead transparency:
- **BLM 9–1 The Name Game**
- **OHT C–2 Estimating Beans**

Accommodations

- Pair students who have difficulty writing with those who can help record their answers.

Check Your Understanding Answers (page 185)

4. a) 4

b) Cat, horse, snake, dandelion

c) Answers will vary. Look for the idea that although there are two different groups of cats, they belong to the same species.

Making Connections Answer (page 186)

2. Answers will vary. Accept any reasonable idea. For example:

- Spill out the coins from the jar. Sort the coins by denomination. Count each group. Find the sum of each group of coins.

Check Your Understanding Answer (page 187)

4. Answers will vary. Look for a reasonable estimate and an effective strategy for estimating the number of beans. For example:

- 40 beans: Count the beans in two squares. Find the average number of beans and then multiply by 4.

Try This! Activity (page 187)

Purpose

- Students use mass to estimate the number of beans in a jar.

Science Background

Scientists count samples to estimate the size of a population when the individuals in the population vary in mass. They can use mass to estimate population size when the individuals in a population have similar mass. For example, if you weigh one penny, you can assume that most pennies weigh the same. In order to estimate the number of pennies in a jar, weigh the jar of pennies, and then divide by the mass of one penny.

Advance Preparation

WHEN TO BEGIN	WHAT TO DO
1 day before	• Prepare a container of beans. • Photocopy **BLM 9–2 Using Mass to Estimate a Population**, **Master 1 Narrative Lab Report**, and **Assessment Master 17 Narrative Lab Report Checklis**t.
Day of	• Set out materials.

APPARATUS	MATERIALS
• jar of pennies (optional) • digital scale (1 per group) • calculators	• jar of dry beans such as lima, kidney, or fava (1 per group)

Suggested Timing

30–40 min

Safety Precautions

- Caution students to be careful if using glass jars. Point out the container for broken glass, and remind them to inform you about any glass breakage.
- Have students clean up the work area and wash their hands thoroughly with soap and water at the end of the activity.

Activity Planning Notes

You might model the concept of using mass to estimate a population using a jar of pennies and a scale.

Distribute and read as a class **BLM 9–2 Using Mass to Estimate a Population**. Choose beans such as lima, kidney, or fava, which are large and have uniform mass. Since beans have a small mass, students find the mass of ten beans and calculate the average mass of one bean.

As you circulate, troubleshoot for students who struggle with the calculations. Before students write the lab report, consider having students solve problems that involve estimating population. For example:

- A swarm of bees has a mass of 2000 g. If one bee weighs 1g, how many bees are there?
- A school of trout has a mass of 500 kg. If one fish weighs 2 kg, how many fish are there?

Accommodations

- Some students may have difficulty processing the steps and need some coaching. Pair such a student with someone who has stronger skills. The weaker students could do the weighing while partners record.

Activity Wrap-up

- Have students complete and then discuss the narrative lab report using M**aster 1 Narrative Lab Report**. Have students complete **Assessment Master 17 Narrative Lab Report Checklist** to help assess their work. Have students make any improvements to their report.
- Consider providing some examples (e.g., herd of buffalo occupying 1 km^2, large container of grasshoppers, 1 L container of trout eggs) and asking students how they would estimate each population. For each one, ask how they would sample the population (i.e., mass or count) and a reason for their choice.

Find Out Activity (page 188)

Counting Peas

Purpose

- Students use a grid to estimate the number of peas in a container.

Science Background

Students learn how to sample using a grid and extend the results to a larger population. Help students gain the understanding that scientists use sampling extensively to get useful information about animal and plant species, such as the growth and decline of populations.

Advance Preparation

WHEN TO BEGIN	WHAT TO DO
2 to 3 days before	• Obtain split peas and cardboard box lids. Although photocopy paper box lids are ideal, any lid with sides cut to 5 to 8 cm will work. • Prepare box lids. • If using, photocopy **Assessment Master 2 Co-operative Group Work Rubric**.
Day of	• Set out materials.

APPARATUS	MATERIALS
• 2 dice (per group) • calculators	• split peas in small plastic bag (about 250 peas) (1 bag per group) • prepared cardboard box lid (1 per group)

Suggested Timing

30 min

Safety Precaution

- Have students clean up the work area and wash their hands thoroughly with soap and water at the end of the activity.

Activity Planning Notes

In advance, prepare box lids by drawing a 6 by 6 grid (for a total of 36 squares) that takes up the entire space of the inside bottom of each box lid.

Read through the directions together and make sure students understand what they are to do. Students can work in pairs for this activity. They sample four squares, calculate the average number of peas per square, and then estimate the total number of peas by multiplying the average number of peas by the number of squares on the grid.

You might do a class demonstration by showing students how to spread peas evenly on a grid, sample using dice and an overhead of a grid, record the results, and complete sample calculations.

As you circulate, coach students who experience difficulties.

Accommodations

- Students with dexterity problems could be teamed with those without such difficulties.
- Some students may need additional reinforcement to process the information and the instructions. Alternatively, such students could be paired with students who have stronger skills.

Activity Wrap-up

- Have students complete and then discuss question 7 on page 189.
- As a class, discuss how sampling might be used for estimating larger populations. For example, you might show pictures of a large herd of livestock, a corn or wheat field, or people at an outdoor rally or concert.

Find Out Activity Answers (page 189)

5. a) Answers will vary depending on the number of peas. For example, assuming that there are approximately 250 peas, students might calculate 7 peas per square.

b) $7 \times 36 = 252$

6. Look for an accurate calculation based on the input values. For example, using the above information, the answer is 252.

7. Twice as many peas. Explanations may vary. For example:

- Estimated total = Average number per square $\times$ number of squares $\times$ 2
- Estimated total of peas in bag = 1×2

Find Out Activity (page 189)

Counting Populations of Plants

Purpose

- Students identify plants to study and then use sampling to estimate how many of each plant species grow in an outdoor area.

Science Background

Scientists sample small study areas and then make estimates about larger areas. Often, they take many samples to improve the reliability and validity of the results.

Advance Preparation

WHEN TO BEGIN	WHAT TO DO
Several weeks before	• Select a study area. • Identify three to five study plant species.
1 or 2 days before	• Gather pegs or nails, metre sticks or measuring tape, and string or twine. • Photocopy **BLM 9–3 Counting Populations of Plants** and any assessment masters you decide to use.
1 day before	• Set out materials.

APPARATUS	MATERIALS
Per group: • metre stick or measuring tape • calculators	Per group: • 4 wooden pegs or nails • 2 to 3 m of string or twine • plastic bag

Suggested Timing

60–75 min

Safety Precautions

- Check that the study area has not been chemically treated in the past week. Avoid areas that present risks, such as broken glass and poison ivy.
- Have students wash their hands thoroughly with soap and water at the end of the activity.

Activity Planning Notes

In advance, select a study area that is safe and contained. If possible, select an area in which there are a limited number of plant species.

As a class, identify the plants that students will study. Consider recommending a range of three to five easily identifiable species of plants. Common plants in a schoolyard may include dandelions, clover, bindweed, plantain, creeping charlie, crabgrass, chickweed, and fescue. You might provide an overhead of each plant as a reference for students' drawings.

Read through the directions with students and make sure they understand what to do.

Reinforce the importance of using equipment correctly.

Have students get the materials needed and go outdoors. Students will need the student resource to record data outdoors. Alternatively, provide a photocopy of the table on page 191 for recording data. Consider assigning study areas to each group to make sure that they don't overlap. Before students begin, demonstrate how to make a quadrat. Tell students not to count other plant species. They could collect a sample of other plant species in a plastic bag to identify them later.

As you circulate, ensure that students are using equipment properly and staying on task, and troubleshoot for students who have difficulty identifying the study plants.

Have students use **BLM 9–3 Counting Populations of Plants** to estimate the total number of each plant species in the whole study area. Either provide the total study area to students or, as a class, measure the length and width of the total area and multiply the length by the width.

Example
Length = 50 m
Width = 30 m
Area = 50 m × 30 m = 1500 m^2

You might check that students' observations outdoors are reasonable, before they continue. Consider modelling a calculation for one plant species. Troubleshoot for students who find the calculations difficult.

Accommodations

- Have students work in pairs or small groups.
- Consider the ability of students to sketch study plants. Students with limited drawing abilities might use a digital camera to take pictures of plants.
- Students with physical disabilities could be teamed with those without disabilities, and they could use their partner's results to answer the questions.
- Students with attention difficulties may go off task. You might supervise such students more closely and/or chunk the activity.
- Students with weak math skills could be paired with students who have stronger skills.

Find Out Activity Answers (page 191)

9. Answers will vary depending on the kind of plant species studied and the count of each species. Students should calculate the sum of each plant species.

10. Answers will vary depending on the plant species studied, but should indicate the species with the highest population.

11. Answers will vary. Accept any reasonable change in methodology. For example:

- Take a sample over a larger area, since tree species take up more space than smaller plants.

12. The population of the remaining plant species will increase. Accept any reasonable explanation. For example:

- There will be less competition for space and nutrients.

Activity Wrap-up

- Review using a sample to estimate the population in a whole area. For example, if there are six dandelions in 1 m^2, how many do you estimate there are in 10 m^2?
- Have students complete and then discuss questions 10 to 12 on page 191.
- Have students compare their observations with those of their peers. In a class discussion, summarize the class results.
- Have students complete **Assessment Master 1 Co-operative Group Work Checklist** to assess how well they worked in a group. Have students discuss how to improve group work.

Ongoing Assessment

- Use **Assessment Master 6 Scientific Communication Rubric** to assess the quality of student work in Find Out: Counting Populations of Plants.
- Use **Assessment Master 2 Co-operative Group Work Rubric** to assess how well students worked together during the Find Out activities.

Alternative Activities

- Have students make a quadrat to study populations of organisms that live in soil (e.g., centipedes, millipedes, arachnids, insects, worms). Students may more likely find organisms if you choose rough terrain rather than a lawn. Have students shake vegetation over a sheet, or check leaves, logs, rocks, and soil. They will need four wooden pegs or nails, two to three metres of string, a trowel, a white sheet, as well as field guides and magnifying glasses for identification. Tell students to respect all life, which means making sure that no organisms are harmed. Have students keep a count of several or all species found, and then estimate the total number of each species in the whole study area.
- Have students use the Internet to research names of groups of the same species (e.g., school of fish, lion pride, raft of ducks, whale pod, and wolf pack). Allow students who have difficulty navigating on web sites to work with a partner who can help. Provide students with **BLM 9–1 The Name Game** to record their research. Consider having students quiz each other about other names of groups that they find.

9.2 Population Growth and Decline

(page 192)

SUGGESTED TIMING

45–60 min (including the Science and Literacy Link)
30 min for What's Going On?

BLACKLINE MASTERS

Master 3 Centimetre Grid Paper
BLM 3–7 Making a Line Graph
BLM 3–8 Making a Line Graph in Microsoft® Excel
BLM 9–4 Making an Action Plan
OHT C–3 Factors that Affect the Size of a Population

Specific Expectations

BLT1.02 – identify challenges that arise from organisms living together in communities, including human populations
BLT1.04 – use appropriate scientific terminology related to concepts of organisms living together
BLT2.06 – explain and interpret observations by summarizing patterns obtained from graphing data, organizing information, and communicating orally and in writing
BLT3.01 – develop a simple action plan, using a consistent written format, to address an environmental concern

Key Terms Teaching Strategies

Have students complete some or all of the following activities to help them learn and remember the key terms:

- Point out how to differentiate between immigration and emigration. Emigration means to exit. Both emigration and exit start with "e."
- Use the analogy of a neighbourhood to practise the key terms (i.e., people move in, move out, are born, and die).
- Write definitions for these terms in their Science Log. You may wish to have students keep a glossary at the back of their Science Log.

Help students remember the key terms by posting them on a science word wall.

Reading Icon Answer (page 192)

1. Students should highlight: Birth rate, Death rate, Emigration rate, and Immigration rate.

Activity Planning Notes

As a class, read and discuss page 192. Help students understand that population size is always changing and that the changes are not constant. Ask students to share examples when populations changed dramatically. Examples include: after a natural disaster such as a tsunami, the death rate increases sharply; after World War Two, the birth rate increased dramatically; in the absence of natural predators, the rabbit population in Australia exploded.

After reading and discussing questions 2 and 3 on page 193, help students understand that organisms like fish are very sensitive to environmental changes such as water pollution. Discuss other factors that affect a fish population, such as over fishing, predators, and climate change.

Accommodations

- ESL and LD Learners could be paired with students who have stronger language skills.
- Some students may require assistance with research and planning techniques. Pair students with complementary skills.
- Allow students some choice in volunteer opportunities that are related to environmental concerns.
- Pair students who have difficulties using computers with those who are particularly knowledgeable.

As a class, read the information about FrogWatch on page 193. In advance, book the computer lab. Allow time for students to do research before writing an action plan. Provide students with **BLM 9–4 Making an Action Plan** and review the criteria for the action plan. The blackline master helps students organize a plan for observing frog and toad calls.

Consider using the following blackline master and overhead transparency:
- **BLM 9–4 Making an Action Plan**
- **OHT C–3 Factors that Affect the Size of a Population**

Check Your Understanding Answers (page 193)

2. a) death rate; decrease

b) emigration rate; decrease

c) birth rate; increase

d) immigration rate; increase

Making Connections Answer (page 193)

3. Accept any two reasonable answers. For example:

- Ducks and other birds eat eggs.
- Pollution from chemical wastes kills eggs.
- Eggs may not be fertilized.
- Water temperature may be too warm.

What's Going On? Activity (page 194)

Turkeys and Wolves

Purpose

- Students make and interpret a graph of a predator-prey relationship.

Science Background

Graphs help scientists predict population growth and decline. In some cases, graphs show a regular pattern. Scientists can make fairly accurate predictions about populations if all of the factors affecting growth stay constant.

In other cases, graphs show a dramatic change in a population as a result of factors such as an increase in predation or a natural disaster.

Advance Preparation

WHEN TO BEGIN	WHAT TO DO
1 day before	• Photocopy **Master 3 Centimetre Grid Paper** (optional).

APPARATUS	MATERIALS
• 2 different coloured pencils	

Suggested Timing

30 min

Activity Planning Notes

As a class, read the information. Discuss how the relationship between predator and prey affects the number of wolves and turkeys in an area. For example, a decline in the wolf population will result in an increase in the turkey population until more wolves immigrate into the area.

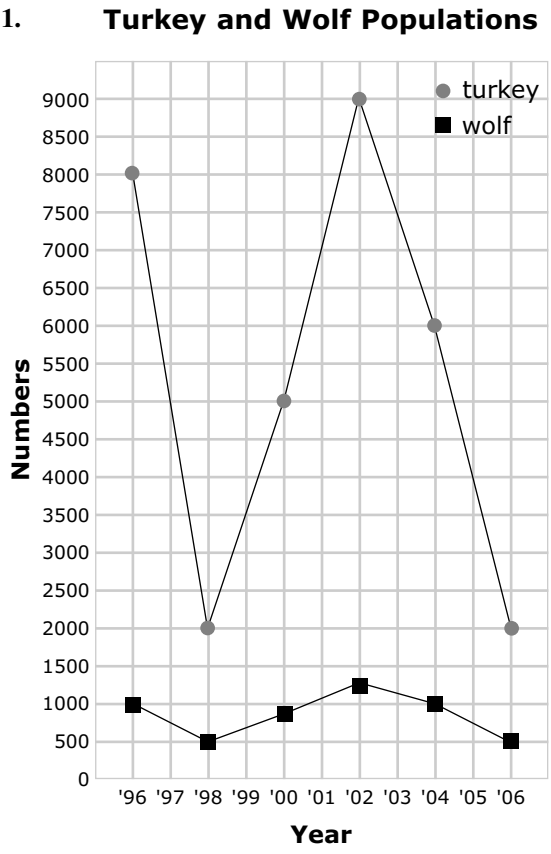
Review graphing skills to prepare students for question 1 on page 194. You may wish to have students use **BLM 3–7 Making a Line Graph**. Remind them to use a ruler and connect the points for each animal on the graph.

Accommodations

- Provide students who need more space to record their graph with **Master 3 Centimetre Grid Paper**.

What's Going On? Answers (pages 194–195)

1.



2. a) 750

b) 5000

c) 2002

d) The wolf population increased. Explanations will vary. Look for the idea that when the turkey population increases, there is more food available for wolves. As a result, the birth rate for wolves increases.

3. a) and **b)** Answers will vary. Accept any reasonable explanation. For example:

- When there are fewer turkeys, there is less food for wolves. This causes a decrease in the wolf population.
- When there are many wolves, more prey is eaten. This causes a decrease in the turkey population.

4. 2500 wolves. Students will use different methods to determine the answer. For example, they may

- extend the line for turkeys on the graph and then estimate the wolf population
- use ratios to determine that if 2000 turkeys supported 250 wolves, 20 000 turkeys may support 2500 wolves

- Weaker students may have trouble answering question 4. On the graph, show students how to extend the line for turkeys and then estimate the wolf population.
- Let students with motor difficulties use **BLM 3–8 Making a Line Graph in Microsoft® Excel**.

Activity Wrap-up

- As a class, check that students can interpret information from the graph by discussing the patterns between the turkey and wolf populations.
- Have students complete and then discuss questions 2 to 4 on page 195.

Alternative Activity

- Use some or all of the activities in the following Life Science *ActiveFolders*: Ecology.

Ongoing Assessment

- Use Check Your Understanding question 2 on page 193 to assess students' understanding of factors that affect population size.
- Use student work in the What's Going On? activity to assess students' abilities to interpret and summarize patterns from graphing data.

9.3 Limiting Factors (page 196)

SUGGESTED TIMING

50–65 min (including the Science and Media Link)
25–45 min for Find Out
60–70 min for Test It!
60–75 min for the Science and Literacy Link (includes research time)

BLACKLINE MASTERS

Master 2 Writing an Opinion Paragraph
BLM 9–5 Survivor Game Board
BLM 9–6 Acid Rain
BLM 9–7 Test It! What Are the Limits for Seeds?
OHT C–4 Survivor Game Board
OHT C–5 Draining a Wetland to Build a Mall
Assessment Master 2 Co-operative Group Work Rubric
Assessment Master 7 Safety Checklist
Assessment Master 8 Safety Rubric
Assessment Master 16 Visual Presentation Rubric

Specific Expectations

BLT1.02 – identify challenges that arise from organisms living together in communities, including human populations
BLT1.04 – use appropriate scientific terminology related to concepts of organisms living together
BLT2.06 – explain and interpret observations by summarizing patterns obtained from graphing data, organizing information, and communicating orally and in writing
SIM2.04 – organize and communicate information collected from lab investigations and information research using graphic organizers
SIM3.04 – communicate science-related information to a workplace audience

Key Terms Teaching Strategies

Have students complete some or all of the following activities to help them learn and remember the key terms:

- Write definitions for these terms in their Science Log. You may wish to have students keep a glossary at the back of their Science Log.
- Share examples of predators, prey, and parasites that students are familiar with.
- Provide a list of limiting factors and have students identify each one as biotic or abiotic.

Help students remember the key terms by posting them on a science word wall.

Reading Icon Answers (page 196)

1. Answers will vary. For example, students might say the farthest point you can go or an agreed upon maximum.

2. a) Students should highlight tornado and water is contaminated.

b) Students should circle predator and parasite.

Activity Planning Notes

After reading the introductory paragraph and table on page 196 as a class, reinforce the terms by relating them to the turkey and wolf populations on page 194. Consider having students identify abiotic and biotic factors that limit the growth of a plant population. For example:

- Abiotic factors—A drought results in lack of water. A poor supply of nutrients in the soil results in poor growth. A late frost kills plants.
- Biotic factors—Dandelions successfully compete for space and crowd out the other plants. Trees successfully compete for water.

Have students complete and then discuss question 3 on page 197.

Use the Find Out on page 197 and the Test It! on page 200 as follow-up activities to reinforce students' learning about abiotic and biotic factors. Immediately following the Find Out, read the instructions on page 199 as a class, before assigning students to complete and then discuss the table.

Read the Science and Media Link on page 202 together, after students have completed the Test It! investigation. Explain how human activity, such as draining wetlands, is an example of a biotic factor limiting the survival of populations living in the wetlands. When humans use wetlands to meet their own needs, they displace the other animal and plant populations. This results in an increase in the emigration and death rates.

Have students identify the two points of view and complete and then discuss questions 1 and 2 on page 203. Explain that for question 3, they will need to form and support an opinion about draining the wetlands. Review the criteria for writing a supported opinion paragraph. For question 3 c), consider having students use **Master 2 Writing an Opinion Paragraph** to write the paragraph.

Consider using the following blackline master and overhead transparency:

- **Master 2 Writing an Opinion Paragraph**
- **OHT C–5 Draining a Wetland to Build a Mall**

Accommodations

- ESL and LD learners could be paired with students who have stronger language skills. Remind students to refer to their Science Log when they are confused about the key terms.
- Allow students some choice in presenting their opinion for the Science and Media Link (e.g., prepare an oral report).

Making Connections Answer (page 197)

3. Answers will vary. Accept any two reasonable examples of abiotic and biotic factors. For example:

- Abiotic—It is raining. The pond provides water to wildlife.
- Biotic—Insects or slugs eat plant leaves. Bees pollinate flowers so they can reproduce.

Game of Life Answers (page 199)

1. d) Both male and female fish are involved in egg laying.

2. e) Fertilizers and other chemical wastes changes water quality.

3. a) Eggs need to be laid in clean gravel beds in streams.

4. c) Salmon need cold water to hatch.

5. b) Ducks and other birds eat salmon eggs.

Draining a Wetland to Build a Mall Answers (page 203)

1. d) All of the above.

2. d) b) and **c)**

3. a) Answers will vary. Students need to take an opinion and provide at least three supporting points. For example:

- We should build the mall. We need the services a mall offers. A mall will attract more people and improve the economy. There are enough wetlands elsewhere in Ontario.

b) Answers will vary. Students need to identify another opinion and provide at least two supporting points. For example:

- We should not build the mall. Draining wetlands destroys habitat of many species. We have a responsibility to protect wetlands.

c) Answers will vary. Look for a paragraph based on the information in a) and b). If students use **Master 2 Writing an Opinion Paragraph**, expect students to complete the sentence stems that are provided.

Find Out Activity (page 197)

Survivor

Purpose

- Students play a game about abiotic and biotic factors that affect a population of fish eggs.

Science Background

The game presents abiotic and biotic factors that affect the survival of salmon eggs in a stream. The factors are presented on the game board as either positive or negative events.

The events are based on the following facts: unfertilized eggs do not hatch; eggs die as a result of exposure to pollution from fertilizers and other chemicals; eggs suffocate if the gravel they are laid in is plugged with sediment (which prevents oxygen-rich water from flowing past the eggs) or if they are overcrowded; eggs starve if they do not contain enough nutrients; salmon eggs need cold water to hatch; eggs are eaten by predators such as birds.

Technology Links

- For information about threats to salmon, go to **www.mcgrawhill.ca/books/Se10** and follow the links to Salmon.

Advance Preparation

WHEN TO BEGIN	WHAT TO DO
2 to 3 days before	• Collect dice or make a spinner for each group.
1 day before	• Familiarize yourself with the game by playing a few rounds. • Photocopy **BLM 9–5 Survivor Game Board** and **Assessment Master 2 Co-operative Group Work Rubric**.
Day of	• Set out materials.

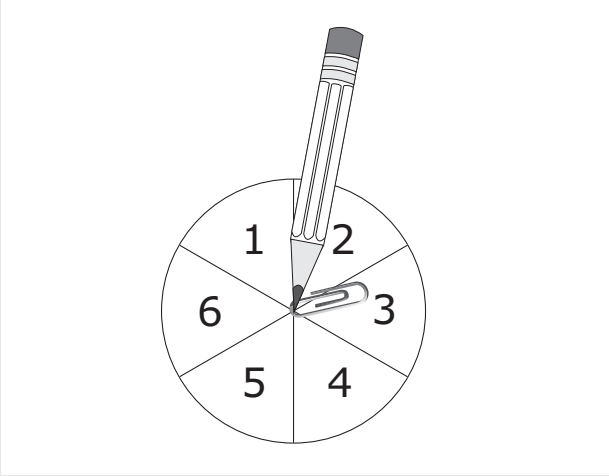
APPARATUS	MATERIALS
Per group: • pencil (optional) • marker (optional) • die • 2 to 4 playing pieces • calculators (optional)	Per group: • cardstock paper (optional) • paper clip (optional)

Suggested Timing

25–45 min, depending upon the number of times that students play the game

Activity Planning Notes

In advance, make spinners if you are using them.



Attach a paperclip to the end of a pencil to make the spinner work.

Tell students they will play a game featuring abiotic and biotic factors that affect survival of salmon eggs in a stream. Have students review the meaning of abiotic and biotic factors. Draw student attention to the game board on page 198. Consider using **OHT C–4 Survivor Game Board** to help explain how the abiotic factors on the game board are either positive or negative events for eggs. Give a brief explanation of each factor.

Read the instructions for playing the game together. Consider playing a few rounds as a class. Encourage discussion until everyone understands how to play. Distribute **BLM 9–5 Survivor Game Board** to each group.

Suggest that students keep track of their own egg numbers on a separate piece of paper. Students should play at least three games to experience the results of random chance on survival.

Accommodations

- Students with weak math skills can be paired with students who have stronger skills.
- Allow students to use calculators.
- If students have trouble halving or doubling odd numbers, suggest rounding up to the next even number.

Find Out Activity Answers (page 199)

4. a) Look for three of the following abiotic factors:

- Water is too warm
- Not enough food
- Eggs suffocate and die
- Pollution kills eggs
- Eggs too crowded

b) Look for one biotic factor. For example:

- Ducks eat eggs
- Eggs do not hatch

5. No. Look for the idea that rolling a die generates random numbers. There is an element of chance.

Activity Wrap-up

- Before students complete and then discuss questions 4 and 5, have them classify each factor on the game board as helpful or harmful. If a factor is confusing, tell students to check whether it is associated with a gain or a loss of eggs.
- Discuss how generating random numbers in a game is similar to what happens to individual fish eggs in a stream. Both are subject to the element of chance.

Test It! Activity (page 200)

What Are the Limits for Brine Shrimp Eggs?

Purpose

- Students study the effects of an acid or a base on the hatching of brine shrimp eggs.

Science Background

An investigation that tests the effects of acids or bases must be carried out on lower organisms, which have simple nervous systems. The use of brine shrimp is humane, and they have the advantage of growing quickly. They are very sensitive to the environment they are placed in, so pH can have significant and easily observable effects on their rate of hatching.

Brine shrimp are sensitive to low pH. Acid rain causes the covering of shrimp eggs to toughen, which prevents the shrimp from breaking free. Many eggs die before hatching. In this investigation, many of the shrimp exposed to an acid may not hatch, and the ones that do may die relatively quickly. Brine shrimp are also sensitive to high pH. Half of the eggs exposed to a base may hatch, but since the base is diluted, the brine shrimp should survive.

Advance Preparation

WHEN TO BEGIN	WHAT TO DO
2 to 3 weeks before	• Order brine shrimp eggs. Avoid purchasing eggs that are sterilized or stored for too long in a pet store.
1 to 2 days before	• Obtain 1 L of distilled water and let it sit at room temperature for a day or two.
1 day before	• Prepare the brine solution. • Prepare the dropper bottles of vinegar and sodium hydroxide solution.
	• Photocopy **BLM 9–6 Acid Rain** and any assessment masters you decide to use.
Day of	• Set out materials.

APPARATUS	MATERIALS
• chemical splash-proof goggles • marker • 3 test tubes • test-tube rack	• brine • vinegar (in dropper bottle) • 0.2 Mol/L sodium hydroxide solution (in dropper bottle) • brine shrimp eggs

Suggested Timing

60–70 min (time to set up, observe 2 to 3 days later, and do the wrap-up)
60–75 min for the related Science and Literacy Link (includes research time)

Safety Precautions

- Caution students to be careful with glass. Point out the container for broken glass, and remind them to inform you about any glass breakage.
- Remind students that they are working with acids and bases. Anytime they work with potentially corrosive chemicals, they must wear the proper safety equipment.
  Remind them that sodium hydroxide may cause blindness if it gets in the eye.
- Point out the container for brine shrimp, and dispose of the shrimp properly at the end of the investigation.
- Have students clean up the work area and wash their hands thoroughly with soap and water at the end of the investigation.

Activity Planning Notes

In advance, prepare the brine solution by adding 10 g non-iodized salt to 1 L of distilled water. A pinch of baking soda can be added to buffer the solution.

Prepare the sodium hydroxide solution by using 2 g of sodium hydroxide per 250 mL water.
Note: Keep brine shrimp at room temperature and out of direct light. They hatch best in minimum light conditions.

Introduce the lab by briefly explaining that an environmental condition such as pH (acidity of water) is an abiotic factor that can affect the development and growth of organisms.

Read the directions together as a class, and make sure everyone understands what to do. Have students make predictions before they begin.

Review the safety precautions. Consider having students complete **Assessment Master 7 Safety Checklist** to help emphasize the importance of following safety practices in the lab.

Provide time at the beginning or end of class several days later for students to make observations. Students should be able to count the brine shrimp without using a magnifying glass. If the shrimp are too small to count, let them grow for a day or two. They grow very quickly if fed with a drop of solution prepared from a small quantity of baker's yeast added to distilled water.

Accommodations

- Consider doing a demonstration of what to do.
- Students with visual impairments could be paired with other students to carry out the procedure and make observations.
- ESL and LD Learners could be paired with students who have stronger language skills.

Test It! Answers (pages 200–201)

1. Questions may vary. Look for a question such as,

- What effect does an acid or a base have on the hatching of shrimp eggs?

2. Answers will vary. Accept any reasonable answer. For example:

- Both the acid and the base will affect the number of shrimp that hatch.
- The acid will affect the shrimp more than the base.

5. Look for a labelled sketch of each test tube and a count. Counts may vary but you could expect the following results:

- Test tube A—All 10 eggs should hatch.
- Tests tube B—Perhaps 2 or 3 eggs will hatch.
- Test tube C—Perhaps 5 or 6 eggs will hatch.

6. a) An acid severely reduces the hatching of shrimp eggs. Many of the eggs that do hatch do not survive.

b) A base reduces the hatching of shrimp eggs. Most of the eggs that do hatch survive.

7. Look for the idea that acid rain reduces the hatching of shrimp eggs.

8. Explanations will vary for a) and b). Look for one reasonable explanation for each.

a) Birth rate will decrease. For example, fewer eggs will hatch.

b) Death rate will increase. For example, the organisms that do hatch may be sensitive to acid, and weaken and die. Or, the organisms may not be able to find enough smaller organisms to eat, and die.

9. See **BLM 9–6 Acid Rain** for answer.

Activity Wrap-up

- Have students compare their observations with those of their peers.
- Have students complete and then discuss questions 6 to 8 on page 201. Help students make connections between pollution such as acid rain and its effects on eggs that hatch in water. Even a small change in pH can affect the life cycle of small organisms.
- Distribute copies of **BLM 9–6 Acid Rain** to help students answer question 9 on page 201. Students are to read the article, do research, and then design a poster. Discuss how students should research energy-saving practices that reduce acid rain (e.g., books, Internet, interviews). In advance, gather text references and book the computer lab. Allow time for students to do research before writing a summary of the main points and then designing a poster. Allow students some flexibility in choosing a format to present their findings (e.g., writing an article). Display the completed posters in the classroom.

Ongoing Assessment

- Use question 3 on page 197 and question 8 on page 201 to assess student understanding of abiotic and biotic factors and how they affect populations.
- Use **Assessment Master 2 Co-operative Group Work Rubric** to assess how well students worked together during Find Out: Survivor.
- Use **Assessment Master 8 Safety Rubric** to assess students' safety practices during the Test It! investigation.
- Use **Assessment Master 16 Visual Presentation Rubric** to assess students' posters.

Technology Links

- For information on a project for students to develop an investigation about how different factors affect the hatching and development of shrimp eggs, go to **www.mcgrawhill.ca/books/Se10** and follow the links to Brine Shrimp Project.

Alternative Activity

- Have students test the effects of an acid or a base on seed germination. In advance, prepare the sodium hydroxide solution by using 2 g of sodium hydroxide per 250 mL water. Provide students with **BLM 9–7 Test It! What Are the Limits for Seeds?**
  Have students compare their observations with those of their peers and predict which conditions are best for seedlings. As an extension, students could use water-soluble fertilizer to investigate the effect of fertilizer on seed germination.

9.4 Working With Limiting Factors

(page 204)

SUGGESTED TIMING	MATERIALS	BLACKLINE MASTERS
30–35 min 60 min to set up and observe;15–20 min per observation for 2 days for What's Going On? 30–45 min to set up; 30–45 min for the Test It! investigation	• 2 – 1 L containers with fish (optional)	Master 3 Centimetre Grid Paper BLM 3–8 Making a Line Graph in Microsoft® Excel BLM 9–8 Show You Know! Microscope Certification BLM 9–9 How Fast Does Yeast Grow? BLM 9–10 Calculating Population Density OHT C–6 Microscope Checklist Assessment Master 6 Scientific Communication Rubric Assessment Master 10 Using Tools and Equipment Rubric

Specific Expectations

BLT1.02 – identify challenges that arise from organisms living together in communities, including human populations
BLT1.04 – use appropriate scientific terminology related to concepts of organisms living together
BLT2.01 – plan and conduct an experiment to investigate the results of overcrowding in microscopic populations, including estimation and measurement of population size
BLT2.02 – plan and conduct an experiment to investigate the results of overcrowding in macroscopic populations, including measuring rate of growth of population size
BLT2.03 – make accurate observations of the organisms that exist in a community, using a microscope
BLT2.06 – explain and interpret observations by summarizing patterns obtained from graphing data, organizing information, and communicating orally and in writing

Science Background

Scientists use an s-shaped curve to show the explosive growth and rapid decline of a fruit fly population. Fruit flies reproduce rapidly in a relatively short period of time. However, limiting factors prevent a fruit fly explosion from ever happening. As a fruit fly population exceeds its carrying capacity, the population of flies decreases due to lack of nutrients. The population will crash and die.

Generally, organisms with a high production of offspring have a low survival rate among their offspring. In worms, insects, and fish, which lay thousands of eggs, only a few of their eggs will ever reach maturity.

Key Terms Teaching Strategies

Have students complete some or all of the following activities to help them learn and remember the key terms:

- Write definitions for these terms in their Science Log. You may wish to have students keep a glossary at the back of their Science Log.
- Write a sentence that contains the two key terms.

Help students remember the key terms by posting them on a science word wall.

Reading Icon Answers (page 206)

1. a) Look for a spot marked at the top of the s-shaped growth curve.

b) Wording may vary. The fruit fly population crashes and dies at a high rate.

Activity Planning Notes

As a lead into the What's Going On? activity, explain the concept of a population explosion using spider eggs as an example. Explain how organisms such as spiders lay thousands of eggs, but that only a few eggs ever survive.

Read the information about overcrowding and population density on page 206 as a class. Explain the s-shaped curve of a population explosion. Have students identify the factors that limit the growth of a fruit fly population in a closed container.

Students may have difficulty understanding population density. Consider showing them two examples of a population with different densities. For example, use two 1-litre containers of fish. Have the second container hold three times as many fish as the first one. Calculate the density of each population as a class (e.g., 3 fish per litre; 9 fish per litre). Ask which container is more crowded and which has higher density. Go on to calculate the density of students per m^2 in the classroom.

Accommodations

- Students with weak math skills could be paired with students who have stronger skills.
- Allow students who have difficulty solving density problems to use manipulatives such as containers of marbles. Consider providing extra problems for reinforcement.

Read the Science and Math Link on page 207 as a class. Have students practise solving density problems using **BLM 9–10 Calculating Population Density** before they complete and then discuss questions 3 and 4 on page 207. For question 3, tell students to think about problems related to the services that a city provides for people.

Consider using the following blackline master:

- **BLM 9–10 Calculating Population Density**

Solve This One Answer (page 207)

2. 5000 people/km^2

Making Connections Answers (page 207)

3. Answers will vary. Accept any two reasonable problems. For example:

- Lack of transportation infrastructure leads to traffic congestion.
- Lack of sanitation increases risk of disease.
- More garbage leads to an increased demand for disposal sites.

4. Answers will vary. Accept any two reasonable factors. For example:

- shortage of work
- lack of transportation to move people and goods
- inadequate food or water supply

What's Going On? Activity (page 204)

How Fast Does Yeast Grow?

Purpose

- Students study a yeast population explosion.

Science Background

Yeast cells are easy to grow and multiply very quickly in the presence of sugar, water, oxygen, and warmth. Although yeast cells are relatively small, they can readily be viewed under low power on a microscope.

Students will observe rapid growth, leveling off, and decline of a yeast cell population.

Technology Links

- For more information on factors that affect the population of Drosophila (fruit flies), go to **www.mcgrawhill.ca/books/Se10** and follow the links to Population Dynamics.

Advance Preparation

WHEN TO BEGIN	WHAT TO DO
1 to 2 days before	• Buy fresh active dry yeast and light molasses at a grocery store. • Photocopy **BLM 9–8 Show You Know! Microscope Certification**, **BLM 9–9 How Fast Does Yeast Grow?**, **Assessment Master 10 Using Tools and Equipment Rubric**, and **Master 3 Centimetre Grid Paper** (optional).
Day of	• Set out apparatus and materials.

APPARATUS	MATERIALS
• 250 mL beaker • spoon • medicine dropper • measurement slide • microscope	• 125 mL water • 75 mL molasses • 5 mL active dry yeast

Suggested Timing

60 min to set up and observe; 15–20 min per observation for 2 days

Safety Precautions

- Caution students to handle slides carefully.
- Remind students not to eat anything in the science lab.
- Remind students to unplug microscopes properly.
- Have students clean up the work area and wash their hands thoroughly with soap and water at the end of the activity.

Activity Planning Notes

If using tap water, let it stand for a few hours to rid itself of excess chlorine.

Before students begin, reinforce the importance of properly handling and using a microscope. You might do a class demonstration and review the information on **OHT C–6 Microscope Checklist**. Have students complete **BLM 9–8 Show You Know! Microscope Certification** and make sure they get your approval before using a microscope.

Read the directions together as a class, and make sure everyone understands what to do.

Remind students to follow the directions carefully for preparing the yeast solution. Keep the yeast solution in a warm place at about 25°C.

While students wait to make their observations, do a class demonstration of how to take a sample, making sure to stir the yeast solution first, and how to prepare a slide.

Explain how to use the microscope and a measurement cell to estimate the number of yeast cells in a growing population. Consider using an overhead to show how the cells on a measurement slide are similar to the cells on a graph, and then count a sample of yeast cells using hypothetical data.

Accommodations

- It is not necessary for each student to make a yeast solution, as four or five containers will be sufficient. Consider having students work in pairs.
- If students have difficulty counting yeast cells, they can estimate the count.
- Provide visually-impaired students with a microscope that can project images onto a TV screen, if available.
- Provide students who need more space to record their graph with **Master 3 Centimetre Grid Paper**.
- Let students with motor difficulties use **BLM 3–8 Making a Line Graph in Microsoft® Excel**.

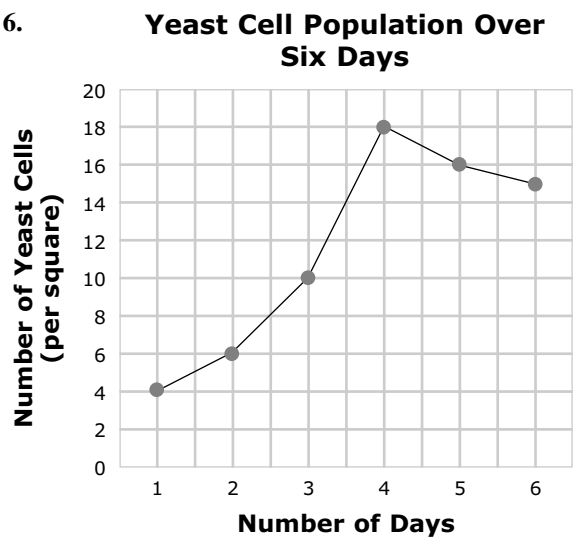
Activity Wrap-up

- Have students compare their observations with those of their peers and discuss how fast yeast grows.
- Have students complete and then discuss questions 5 and 6 on page 205. Provide them with **BLM 9–9 How Fast Does Yeast Grow?** to complete their graphs. Have them answer and then discuss questions 7 and 8 on the blackline master.
- You might discuss the effects of a population explosion using other examples (e.g., human population in crowded cities; rabbit population in suburbs).

What's Going On? Answers (page 205)

5. Sample answer: Yeast cells increase rapidly.

6.



Test It! Activity (page 208)

How Does Overcrowding Affect Plants?

Purpose

- Students study the effects of overcrowding on planted seeds.

Science Background

Seeds do not need light before germinating. However, as soon as seeds sprout, remove the containers from the bags and put the seedlings in a sunny or bright area.

Advance Preparation

WHEN TO BEGIN	WHAT TO DO
1 month before	• Order seeds from a supplier.
1 day before	• Gather materials. • Photocopy **Assessment Master 6 Scientific Communication Rubric** and **Master 3 Centimetre Grid Paper**.
Day of	• Set out materials.

APPARATUS	MATERIALS
	• 3 – 10 cm plastic pots or 4 – 1 L milk cartons with the tops cut off • potting mixture • water • beans (mung, pinto, or lima) • large, clear plastic bag • masking or duct tape

Suggested Timing

30–45 min to set up; 30–45 min for completing the investigation

Safety Precautions

- Have students clean up the work area and wash their hands thoroughly with soap and water at the end of the investigation.

Activity Planning Notes

Purchase rapid-growing bean or radish seeds. Since plants need time to develop, organize the activity so that students plant the seeds about two weeks before they make observations. When the seeds germinate, have students remove the containers from the bag and keep the containers in a sunny or bright area. They will need to be watered occasionally.

Before they begin, have students make predictions about what will happen.

Provide time for students to make and record observations.

Accommodations

- Students with physical disabilities could be teamed with those without disabilities, and use their partner's results to answer the questions.
- ESL and LD Learners could be paired with students who have stronger language skills.

Test It! Answers (pages 208–210)

1. Answers will vary. Accept any reasonable answer. For example:

- Seeds that are planted too close together will not grow.

10. Answers will vary depending on what students predicted and what actually happened. For example:

- The container with the fewest seeds had the highest number of seedlings, which is what I expected.

11. a) No. Sample answer: The plants in Container B are spread out enough so that the roots can get nutrients.

b) Sample answer: Plants will start to struggle for space and will eventually need more space.

c) Yes. Plants in Container C are growing too close together and have to compete for nutrients and light.

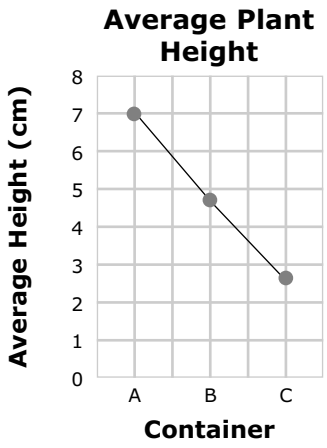
d) Sample answer: Plants in Container C will eventually die, except perhaps for a few of the strongest plants that compete successfully for nutrients, light, and space.

12. a) Container C. It has the highest number of seedlings growing in a container that is the same size as the other containers.

b) Wording will vary. Look for the idea that as population density increases, the growth rate decreases.

13. a) 1. 7.0 cm; 2. 4.8 cm; 3. 2.5 cm

b)



c) plants in Container A

d) Look for the idea that the plants in Container A will produce the strongest plants because they have enough space to grow.

14. Answers may vary. Look for the idea that each plant species has different needs for space to grow to maturity. For example:

- Gardeners use the directions to plan the space that each plant will need to grow successfully.

Activity Wrap-up

- Have students compare their results with those of their peers and predict which of the containers will produce strong and healthy plants.
- Have students complete and then discuss questions 10 to 14 on pages 210 and 211. Provide **Master 3 Centimetre Grid Paper** to help students make their graph for question 13.
- Consider allowing students to use computer software to make the graph. If so, students may find **BLM 3–8 Making a Line Graph in Microsoft® Excel** helpful.
- Discuss how overcrowding is a significant limiting factor to the growth of trees. Ask students how close trees in a forest grow to each other. Explain that trees need a lot of space for roots and access to sunlight to make food. Each tree produces many seeds each year but very few grow. Seedlings on the forest floor have very little chance to get enough sunlight unless some large trees that are close to them die.

Ongoing Assessment

- Use the Science and Math Link and question 3 on page 207 as a formative assessment of how well students understand population density and overcrowding.
- Use the graphs that students make in What's Going On? and Test It! to assess their ability to graph and interpret data. Consider assessing the accuracy of graphs and asking students to explain the results orally.
- Use **Assessment Master 10 Using Tools and Equipment Rubric** to assess students' use of the microscope during What's Going On?
- Use **Assessment Master 6 Scientific Communication Rubric** to assess the quality of student work during the Test It!

Chapter 9 Review (page 212)

SUGGESTED TIMING

60–75 min to complete and take up the review, and assign the Practice Test

BLACKLINE MASTERS

Master 5 Certificate
Master 6 List of Skills
BLM 9–11 Chapter 9 Practice Test
BLM 9–12 Chapter 9 Test
BLM 9–13 BLM Answers

Using the Chapter Review

Depending on your class, students should be able to work through the review at their own pace. In order to have success with the Chapter Review, some students may need to do it in chunks, by completing several questions and then taking them up before continuing. This process will prevent students from completing many questions incorrectly.

Once the review is completed and taken up, assign **BLM 9–11 Chapter 9 Practice Test** for students to answer individually. They may wish to use their completed review to help them.

Review Guide

Question	Section(s)	Refer to
1	9.3	Limiting Factors (page 196)
2	9.4	Population Density (page 206)
3	9.3	Limiting Factors (page 196)
4	9.1	Individuals and Populations (page 185)
5	9.1	Individuals and Populations (page 185)
6	9.1	Estimating Populations (page 186)
7	9.1	Individuals and Populations (page 185)
8	Chapter Opener	Populations (page 184)
9	9.3	Limiting Factors (page 196)
10	9.2	Population Growth and Decline (page 192)
11	9.3	Limiting Factors (page 196)
12	9.3	Limiting Factors (page 196)
13	9.3	Limiting Factors (page 196)
14	9.3	Limiting Factors (page 196)

Accommodations

- In advance, prepare an index card that lists the key terms for Unit C. Provide the card to students who struggle with vocabulary and spelling during review activities.
- Allow students to make a chapter summary page of the key ideas/skills from the chapter. The back of the student resource provides space to do this. Alternatively, you might develop a chapter summary as an entire class.
- If students have difficulty with a particular review question, use the Review Guide to identify the section they need to review.
- **BLM 9–11 Chapter 9 Practice Test** can be customized to produce extra reinforcement questions.

Summative Assessment

- Have students complete **BLM 9–12 Chapter 9 Test** to assess individual skills.
- You may wish to develop **Master 5 Certificate** to show students what they have learned during this chapter. Cut and paste the related skills from **Master 6 List of Skills**.

Chapter 9 Review Answers (pages 212–213)

1. c) limiting factor

2. a) population density

3. g) predator

4. f) species

5. h) individual

6. e) sample

7. b) population

8. d) estimate

9. k) prey

10. c) death rate and emigration rate

11. c) tornado

12. b) bear

13. Answers will vary. Look for four reasonable limiting factors and descriptions. For example:

a) water pollution from chemical waste; fish die

b) predators; bears eat fish

c) not enough food; fish leave the area or die

d) parasites; lampreys feed off fish blood

14. a) not enough food

b) Accept any two reasonable abiotic factors. For example:

- not enough water
- natural disaster such as forest fire, flood, and extreme weather

c) Population A will decrease. Look for a reasonable explanation. Sample answers:

- When the rabbit population gets overcrowded, there won't be enough food to eat.
- The predator's population will increase because there is a rich food supply. This will reduce the rabbit population.
- When rabbits are overcrowded, disease can spread quickly and wipe out the population.