

Let's Do Science

Grade Three

Animal Life Cycles

3

Animal Life Cycles



Science Alberta Programs for Your Classroom



Science-In-A-Crate

From digging for dinosaur bones to balancing a budget or learning about light, each trunk-sized "crate" contains everything you need to bring science and math to life in any learning environment. Science-In-A-Crate uses seven highly visual, hands-on and minds-on activities to illustrate how science is used in everyday situations, all directly linked to Alberta curriculum.

Crates are self-contained—they include everything you need to conduct science learning activities—including an activity guide with detailed, step-by-step instructions for each activity.

Visit www.sciencealberta.org for a complete listing of the crates available or call 403-220-0077 for a program guide.

Wonderville.ca

Step inside the whimsical world of Wonderville.ca, where colourful characters and enchanting environments stimulate learning through exciting online activities.

Wonderville.ca is an award-winning web site that makes science relevant, fun, and accessible to children, youth and families. Wonderville.ca is chockfull of world-class science content in a format that children and youth want to use—exciting digital activities, printable experiments, career videos and hidden science facts. The intriguing and engaging activities directly meet Alberta science curriculum knowledge outcomes from Grades 3 to 7.

Surf to Wonderville.ca to engage in the experience.



Animal Life Cycles Before You Begin

Animal Life Cycles is a motivating unit, as most children are naturally interested in, and curious about, animals. Within the expectations of this unit, children should develop an appreciation and wonder for the life cycles of a variety of animals. Children should be guided to learn about the changing needs of young animals as they grow and develop, and how changes in the environment can impact upon animal life cycles. This unit can perpetuate the idea that people can do things to help conserve animal life and that children themselves can develop, as well as carry out, a plan of action to assist with this.

This unit builds upon three previous units: grade 1, Needs of Animals and Plants and Seasonal Changes; and grade 2, Small Crawling and Flying Animals.

Animal Life Cycles develops some of the experiences and background necessary to guide the students into grade 4, Plant Growth and Changes and Waste and Our World; grade 5, Wetland Ecosystems; and grade 6, Trees and Forests.

Note: No activities have been included in this unit for the life cycle of frogs, as frogs are very difficult to obtain. There is also international concern regarding the decreased number of frogs in the world. No one knows the cause of their decline, but pollution of various sorts is suspected. Making students aware of this is important, and using animals in the classroom that are not endangered is an important consideration. The life cycles of frogs may still be taught with the use of pictures, books, charts and movies. Activities and information about frogs may be found in: *The Life Cycle of a Frog* (Williams), p. 4-32; *Innovations in Science, Level 5, Ponds and Polliwogs*, p. 19; *Tadpole Diary* (Drew), p. 1-17.

Topic E: Animal Life Cycles

(Suggested time: 6-8 weeks)

This unit lends itself to being taught in the spring or early summer, as life cycles of various animals are best observed at this time of year. The weather, too, can be more conducive for being outside.

You will need to plan ahead for raising an animal that will undergo a complete life cycle in the classroom, for example, butterfly larvae, mealworms, praying mantises, earthworms. Book field trips and films, and arrange for guest speakers and experts to visit your classroom.

Background Information

Since the ancient Greeks first began the sorting of plants and animals into groups with shared characteristics (*taxonomy*), we have developed a wealth of criteria upon which to base classification schemes. As applied to animals, these criteria reflect, among other things:

- eating habits—is the animal a *herbivore* (plant-eater), a *carnivore* (meat-eater), an *omnivore* (plant- and meat-eater) or a *saprovore* (eater of decaying organic matter)?
- gross physical characteristics—is the animal a *vertebrate*, with a backbone, or an *invertebrate*, without a backbone? Does it have two feet (*biped*), four feet (*quadruped*), or more? Is its body covered in hair, scales, smooth skin, feathers or a crusty hard substance? Does it breathe by means of lungs, gills or spiracles (holes along the sides of the body)?
- body temperature—is it a *warm-blooded* (endothermic) animal whose internal body temperature remains constant or is it a *cold-blooded* (ectothermic) animal whose temperature fluctuates with the external environment?
- living environment—fresh-water, salt-water, desert, forest, prairie, above ground, underground...?

It should be noted that taxonomy is based solely upon physical characteristics. While eating habits and living environments are important animal characteristics, they are not good indicators of whether species are related. For example, horses, iguana lizards and canaries all qualify as herbivores, yet they belong to completely separate animal categories (mammals, reptiles and birds, respectively).

If you attempt to apply the above criteria, you quickly see that some animals cannot be tagged as fitting a certain criterion throughout their lives. For example, most amphibians begin life in the water, breathing by means of gills, but by adulthood they spend significant time on land, breathing by means of lungs. (The very word *amphibian* originates from the Greek word *amphibios*, meaning “double life,” which refers to this water-to-land lifestyle transition.) Likewise, a single insect can be encountered as a green caterpillar at one stage of its life, as an immobile chrysalis at another and as a multi-coloured butterfly, which may lay eggs in the adult stage.

Obviously, the life cycles of animals constitute an essential component of any coherent classification scheme. Let's look at some major animal categories and describe the developmental stages common to their member species.

Insects

These cold-blooded invertebrates undergo significant changes in form, or *metamorphosis*, during the course of their lifetime. Metamorphosis can be complete, passing through four stages (*egg*, *larva*, *pupa* and *adult*), or incomplete, going from *egg* to *nymph* to *adult*. For example, darkling beetles (mealworms in the larval stage), house flies, butterflies and moths all go through complete metamorphosis, whereas grasshoppers undergo incomplete metamorphosis, hatching from the egg looking much like miniature versions of the adult. Both the larval stage of complete metamorphosis and the nymph stage of incomplete metamorphosis can involve several skin moults as the insect feeds and grows in size. The intervals between moultings are called *instars*. Adult insects lay their eggs on sources of food for the larvae—such as plants, dung and decaying organic matter—but this is as far as their sense of parental responsibility goes. Once the eggs are deposited, there is no parental care.

Fish

These cold-blooded water dwellers were likely the first vertebrates to develop on Earth. They bear their young either as deposits of soft-shelled eggs or live. Some species, such as the salmon, must return to their own place of birth in order to produce offspring. The newborn fish are partially undeveloped. They go through a larval stage that usually lasts up to a few weeks but, in exceptional cases like the lamprey, it can go on for up to five years. It's a fish-eat-fish world out there. The larvae are susceptible to attack from larger animals, even their own parents in species such as guppies, so it is not uncommon to find them living in a more protected habitat, eating a different diet than the adult fish of their species.

Amphibians

Most amphibians start life in the water, usually as tadpoles hatched from great masses of soft eggs. At first, tadpoles breathe by means of feathery exterior gills that soon give way to internal gills. They eat tiny water plants and protozoans in the water. As the tadpoles develop further, they grow hind legs, then front legs, and their tails gradually shrink and disappear. These cold-blooded vertebrates also develop lungs and a means of breathing through their skins. The need to be where there is air draws them out of the water and onto land, where they spend all or part of their adult lives. As adults, their diet also changes—small animals such as insects and crustaceans augment their staple of protozoans.

Reptiles

Snakes, lizards, alligators, crocodiles and turtles all belong to this group of scale-covered, cold-blooded vertebrates. Most reptiles lay eggs with leathery shells, but a few snakes, including the garter snake, retain their eggs inside their bodies until they hatch, so the young are live at birth. The parents, usually the mother, build a rudimentary nest or find a sheltered hollow in which to lay their eggs. During the incubation period (usually 60 to 105 days for most North American reptiles) one or more of the parents may tend the nest, turning the eggs and chasing off predators. Once hatched, reptiles go through a rapid growth spurt and have the potential for continued growth throughout life. Reptiles eat a wide variety of foods, depending on the species: alligators and crocodiles feast on fish, some turtles and lizards are strict vegetarians, and snakes are carnivores. Unlike amphibians, reptiles breathe through lungs from birth until death.

Birds

These feathered, warm-blooded vertebrates all hatch from hard-shelled eggs. The parents prepare nests, then sit on the eggs to protect them and keep them warm during the incubation period. Some newly hatched birds, such as robins, owls and eagles, are featherless, and require anywhere from several weeks to several months to grow flight feathers and acquire the foraging skills necessary for independence (they are said to be *precocial*). Others, like geese, hatch with a full coat of down and the ability to forage for themselves immediately (they are *altricial*). Regardless of whether they eat insects, fish, rodents, berries or seeds, birds have no teeth, so their food is ground up in an organ called the *gizzard*. An important aspect of many birds' life cycles is an annual migration from their summer breeding ground to a warmer winter feeding ground and back again. They also undergo at least one moult of feathers every year, usually just after breeding season.

Mammals

The very fact that one of the primary distinguishing features of mammals is the presence of mammary glands to suckle their young gives some indication of the parental instinct displayed by animals in this category, or at least the females. These hair-growing, warm-blooded vertebrates, ranging from shrews to whales, inhabit both the watery and dry habitats of Earth. With the exception of the egg-laying monotremes (the platypus and the echidna), mammals bear live young. The newborns of some mammal species, such as horses, are able to move about at once, whereas the newborns of other species, such as humans, are quite helpless. The mothers protect their young and nurse them until they are capable of digesting foods other than milk. In some instances this can take a prolonged period, during which the young have the opportunity to learn social behaviours from their elders.

The primary characteristics listed above are common to the majority of species belonging to each group. It would be impossible to cover the amazing diversity of secondary physical features and behaviours evolved by individual species in response to the environmental challenges of different habitats. As adaptive as life is to environmental change, evolution takes time. If an alteration in habitat comes about too fast, entire species can die out (become *extinct*) before adaptive features evolve. Currently, humans can help preserve endangered species in a number of ways. We can gather together and protect breeding populations and we can avoid bringing about a destruction or substantial change of critical habitat area.

Note: See “Care of Living Things in Live Animal Studies” in the Introduction for grade 3 on page 21.

Elementary Science Program of Studies

General and Specific Learner Expectations

The following general and specific learner expectations have been taken directly from the 1996 Elementary Science Program of Studies. The specific learner expectations (SLEs) are referred to by number in the second column of the activities table.

General Learner Expectations

Students will be able to:

- Describe the appearance and life cycles of some common animals and identify adaptations to different environments.
- Identify requirements for animal care.

Specific Learner Expectations

Students will be able to:

1. Classify a variety of animals based on observable characteristics; for example, limbs, teeth, body covering, overall shape, backbone.
2. Observe and describe the growth and development of at least one living animal as the animal develops from early to more advanced stages. The animal(s) should be from one or more of the following groups: mammals, birds, fish, reptiles, amphibians, insects. (Suggested examples: gerbils, guppies, mealworms, tadpoles, worms, butterflies or moths. Additional examples from other animal groups may also be included: brine shrimp, isopods, spiders.)
3. Predict the next stages in the growth and development of at least one animal from each of the following groups: mammals, birds, fish, reptiles, amphibians and insects, and identify similarities and differences in their developmental sequences.
4. Identify the food needs of at least one animal from each of the following groups: mammals, birds, fish, reptiles, amphibians and insects, and describe changes in how each animal obtains food through different stages of its life.
5. Demonstrate awareness that parental care is characteristic of some animals and not of others, and identify examples of different forms of parental care.
6. Demonstrate awareness that animals require different habitats in order to meet their basic needs of food, water, shelter and space.
7. Recognize adaptations of a young animal to its environment and identify changes in its relationship to its environment as it goes through life; for example, tadpoles are adapted for life in an aquatic environment; adult frogs show adaptations to both terrestrial and aquatic environments.

Cross-Curricular Connections

8. Identify examples of environmental conditions that may threaten animal survival, and identify examples of extinct animals.
9. Recognize that habitat preservation can help maintain animal populations and identify ways that students' actions can assist habitat preservation.
10. Demonstrate knowledge of the needs of animals studied, and skills for their care.

Mathematics

- Graphing.
- Estimating.
- Calculate percentages.
- Solve word problems.
- Conduct surveys.

Reading/Language Arts

- Interview.
- Research.
- Debate.
- Compose stories/poetry.
- Write plays.
- Develop communication skills.
- Choral reading.

Art

- Create imaginary animals (for example, sculpt and then paint) knowing the requirements for life of that animal (mammals, reptiles, birds, etc.); make a mural, diorama, etc. of that animal's habitat and life cycle.

Health

- Study the life cycles of humans or other mammals and the environmental conditions necessary to meet their basic needs.

Drama

- Participate in readers' theatre.
- Role-playing.
- Perform plays.

Technology

- Research an animal life cycle.
- Graphs, diagrams.
- Draw animals and the life cycle of animals using drawing tools.

Children's Alternative Frameworks

Concept of an Animal

Humans are not usually considered to be animals. Very young students seem to only connect animals with something four-legged and furry. By 7 to 10 years of age, students tend to include more organisms as animals than just mammals. As students grow into adolescence, however, this understanding of animals as being a large group, including all living organisms, decreases. This is believed to decrease because as students become more familiar with terms such as reptile, bird, amphibian, etc., they tend to group animals only as mammals and group the other organisms in the classifications such as reptiles, birds, amphibians, insects, etc.

Animal Classification

At the ages of 7 to 10, students are usually able to classify with more than two groups, whereas younger students tend to manage with only two groups at a time.

Concept of Animals and Their Food

Some students at this age may still think that people provide animals with their food, but most students will see animals as being capable of seeking food for themselves. Most students at this age feel that animals have a wide range of food, and that the animals can change and adjust their diet when necessary.

(See: Leach, John, Rosalind Drive, Philip Scott and Colin Wood-Robinson. *Progression in Understanding the Ecological Concepts by Pupils Aged 5 to 16*. Leeds: Children's Learning in Science Research Group, Centre for Studies in Science and Mathematics Education. The University of Leeds, 1992. ISBN 0-904-421-481.)

Activities

Classroom teachers have identified the following activities that address the Specific Learner Expectations (SLEs) in the Program of Studies. The list is not prescriptive and teachers may select activities that are most appropriate for their students.

Activities have been listed under two headings. Key Activities and Extension Activities. Key activities are supported by authorized resources and identify “powerful and practical” means for achieving learner expectations. Extension activities represent alternative ways of achieving or supporting learner expectations.

Key Activities

Key Activity	SLE	Print Resources	Essential Materials	Comments
Investigating the characteristics of some common animals	1, 4, 6, 7	<i>Explorations in Science, Level 3, Discovering Adaptation (Our Pets Are Unique)</i> , p. 12	pets with proper housing and feeding facilities	By doing this activity the teacher can determine the students’ initial ideas about animals.
		<i>Explorations in Science, Level 3, Discovering Adaptation (Taking Inventory)</i> , p. 14	magnifying lenses, line master 1	
		<i>Innovations in Science, Level 3, Who’s Who at the Zoo? (Who’s Who at the Zoo?)</i> , p. 9	pins or masking tape, pictures of animals, lined paper, mural paper, drawing paper, crayons or pastels, paint	
		<i>Innovations in Science, Level 2, Looking for a Home (A Closer Look)</i> , p. 17	hula hoops or stakes and string, magnifying glasses, clipboards, large sheets of paper, mural paper	
Collecting and classifying a variety of arthropods	1, 4, 6, 7	<i>Explorations in Science, Level 3, Six Legs or Eight? (What is an Insect?)</i> , p. 10	camera, art materials, Plasticine, paper tubes, pipe cleaners, hula hoop	To extend this, have each student collect an insect with its food source and bring it back to the classroom to observe.
		<i>Innovations in Science, Level 5, Animals in Armour (Wanted—Alive!)</i> , p. 8	black line master 2, 3 and 4, containers with nylon stocking covers, labels, rulers	
		<i>Critters (AIMS) (Allen et al.) (Wings ‘n Webs)</i> , p. 19	insects and spiders (or pictures of these), hand lenses, scissors, clay, pipe cleaners, toothpicks, construction paper, activity sheets	
		<i>Critters (AIMS) (Allen et al.) (Popping Through the Garden)</i> , p. 25	scissors, glue, paper, activity sheets	

Key Activity	SLE	Print Resources	Essential Materials	Comments
Investigating the feeding behaviour of arthropods	1, 4, 6, 7	<i>Innovations in Science, Level 5, Animals in Armour (Mouth Parts)</i> , p. 15	magnifying glass, binocular microscope, arthropods (beetle, grasshopper, aphid), containers, food and water	
		<i>Explorations in Science, Level 3, Six Legs or Eight? (Many Mouths)</i> , p. 15	pliers, syringes (without needles), small sponges, samples of food, photos of insects showing mouth parts, line master 2	
		<i>Critters (AIMS) (Allen et al.) (Table Manners)</i> , p. 111	flex straws, regular straws, clothespins, sponges, narrow-necked bottles, plastic wrap, tuna can or small bowl	
		<i>Explorations in Science, Level 2, Creatures and Crawlers (One Very Hungry Caterpillar!)</i> , p. 18	<i>The Very Hungry Caterpillar</i> (Carle), containers with lids	
Creating habitats for observing metamorphosis of butterflies or moths and observing them through a life cycle	1, 2, 3, 4, 5, 6, 7, 10	<i>The Life Cycle of Butterflies, Teacher's Guide</i> , Carolina Biological Supply Co.		This book includes many lessons on observing, feeding and caring for butterflies or moths during all life stages. These, and the following three groups of activities, identify an area of extensive study. At least one of these activities should be selected and used as a focal point for student learning about life cycles.
		<i>Innovations in Science, Level 5, Animals in Armour, (Mysterious Transformation)</i> , p. 25	clean 1-L jars, smaller jars, moist sifted soil, twigs, rocks 6 cm round, nylon stockings, rubber bands, student diaries, butterfly (or other) larva	
Observing and caring for spiders	1, 2, 3, 4, 5, 6, 7, 10	<i>Explorations in Science, Level 3, Six Legs or Eight (Spiders Up Close)</i> , p. 13	jars, diagrams, examples of insects and spiders, line master 1	
		<i>Innovations in Science, Level 5, Animals in Armour (Spy on Spiders!)</i> , p. 31	black line masters 6 and 7, research sheets, plant misters	
		<i>Explorations in Science, Level 2, Creatures and Crawlers (Eating Others)</i> , p. 19	containers, spiders, insects	

Key Activity	SLE	Print Resources	Essential Materials	Comments
Observing and caring for darkling beetles (mealworms)	1, 2, 3, 4, 5, 6, 7, 10	<p><i>Explorations in Science, Level 2, Creatures and Crawlers (What a Life!)</i>, p. 24</p> <p><i>Explorations in Science, Level 3, Six Legs or Eight? (Mealworm Mania)</i>, p. 29</p> <p><i>Critters (AIMS) (Allen et al.) (My Mealworm)</i>, p. 31</p> <p><i>Critters (AIMS) (Allen et al.) (Mealworms on Stage)</i>, p. 35</p>	<p>mealworms, containers, rubber bands, apple or potato, rolled oats</p> <p>large glass or plastic container with lid, bran, slices of potato or apple</p> <p>mealworms, containers for mealworm homes, cereal or grain, activity sheets</p> <p>mealworms (classroom culture), activity sheets</p>	
Observing and caring for other small animals	1, 2, 3, 4, 5, 6, 7, 10	<p><i>Explorations in Science, Level 5, It's A Small World (Raising Brine Shrimp)</i>, p. 32</p> <p><i>Explorations in Science, Level 3, Six Legs or Eight? (The Ants Go Marching)</i>, p. 27</p> <p><i>Innovations in Science, Level 5, Animals in Armour (Creatures from the Woodpile)</i>, p. 19</p> <p><i>Critters (AIMS) (Allen et al.) (Warming Up to Worms)</i>, p. 39</p> <p><i>Critters (AIMS) (Allen et al.) (Snail Observations)</i>, p. 59</p>	<p>jars, lenses, microscope, brine shrimp eggs, aquarium salt, dry yeast, food colouring</p> <p>large jars or old aquarium, ants, soil, other materials suggested by students</p> <p>containers, branches, leaves, stones, moist soil, paper towel, pieces of carrot or potato</p> <p>earthworms, paper towels, hand lenses, rulers</p> <p>snail, magnifiers, activity sheets</p>	<p>The animal described in this resource is the brine shrimp, which can be raised at any time of year. Eggs can be obtained from pet stores and stored for extended periods of time without special care.</p> <p>Ants are easy to collect except the queen, which is essential to the survival of a colony.</p> <p>The animal introduced here is the isopod or wood louse, a common animal in forest litter.</p> <p>Earthworms can be found in garden soil and are easiest to collect following wet weather when they come to the surface.</p> <p>In addition to snail observation activities, this resource suggests a number of studies of snail anatomy and movement.</p>
Comparing animal life cycles	2, 3, 4, 5, 6, 7	<p><i>The Life Cycle of Butterflies, Teacher's Guide (National Science Resource Center), Lesson 15, (Other Life Cycles)</i>, p. 91</p>	<p>materials would vary for this depending on what other animal groups you choose to compare</p>	<p>There are some excellent post-unit assessments on pages 97-99.</p>

Key Activity	SLE	Print Resources	Essential Materials	Comments
Learning about extinction	8, 9	<i>Explorations in Science, Level 6, The Endangered (Going...Gone?)</i> , p. 18	coloured pencils, markers, resource books, posters	
	4, 6, 8, 9	<i>Explorations in Science, Level 6, The Endangered (Why Preserve Wild Species?)</i> , p. 20	fliers, newspaper advertisements, cookbooks	<i>The Great Kapok Tree (Cherry)</i> would help emphasize this.
Developing habitats in environmentally responsible ways	9	<i>Explorations in Science, Level 6, The Endangered (A Changing Habitat)</i> , p. 30	sheets of paper, scissors, markers, tape	
		<i>Explorations in Science, Level 6, The Endangered (Habitat Enhancement)</i> , p. 34	materials vary with the project chosen	

Extension Activities

Extension Activity	SLE	Print Resources	Essential Materials	Comments
Studying animal populations and their environments	8, 9	<i>Critters (AIMS) (Allen et al.) (Census Takers)</i> , p. 139	activity sheets, scissors	
		<i>Critters (AIMS) (Allen et al.) (Who's Home in the Biome?)</i> , p. 142	activity sheets (used in making data cards, record cards and playing cards), crayons, coloured markers	
Determining if a community is environmentally friendly toward animal life	8, 9	<i>Explorations in Science, Level 6, The Endangered (Environmentally Friendly)</i> , p. 32	materials will vary	This activity gives students a sense of power, control and ownership over a situation.
Creating animals adapted to particular environments		<i>Explorations in Science, Level 3, Discovering Adaptation (Designer Birds)</i> , p. 21	line master 3	Students should describe their "birds," explaining why they designed them the way they did.
		<i>Explorations in Science, Level 3, Discovering Adaptation (A Cast of Creatures)</i> , p. 28	cardboard, newsprint, coloured paper and other building materials	With time and imagination this could be extended to cover all the SLEs.
Exploring bird beak adaptations	4, 7	<i>Explorations in Science, Level 3, Discovering Adaptation (Birds Carry Their Own Tool Kits!)</i> , p. 19	pictures of birds, common household utensils and tools	

Extension Activity	SLE	Print Resources	Essential Materials	Comments
Creating a sculpture of an endangered animal species	8	<i>Explorations in Science, Level 6, The Endangered (A Sculptured Tale)</i> , p. 33	cardboard boxes or ice-cream containers, art materials, other materials as suggested by the students	
Investigating insects		<i>Explorations in Science, Level 3, Six Legs or Eight? (Entomologists' Convention)</i> , p. 31	resource materials on insects	
Learning about habitats and how they affect plant and animal populations	6, 7, 8, 9	<i>Explorations in Science, Level 3, Discovering Adaptation (Taking Inventory)</i> , p. 14 <i>Explorations in Science, Level 6, The Endangered (Who Needs a Home?)</i> , p. 14 <i>Explorations in Science, Level 6, The Endangered (Environmentally Friendly)</i> , p. 32	magnifying lenses, line master paper, pencil, crayons, markers	Students should be directed to think about the animals they find and what features of their habitat help them survive.
Observing birds in a variety of habitats	1, 4, 5, 6, 7, 10	<i>Explorations in Science, Level 3, Discovering Adaptation (Chow Time!)</i> , p. 18	binoculars	Discuss what humans can do to preserve habitats for birds.
Investigating pond animals to see how they are adapted for pond life	1, 4, 6, 7	<i>Innovations in Science, Level 5, Ponds and Polliwogs (Pond Personalities)</i> , p. 33	class pond or pond mural, cardboard, scissors, small sticks, tape	
Exploring factors that influence decisions to alter a natural area	8, 9	<i>Innovations in Science, Level 5, Ponds and Polliwogs (Pondering a Pond)</i> , p. 41	various materials to make a poster or banner	

Assessment

For a broader discussion of science classroom assessment techniques see *Assessing Student Learning* in the introduction of this publication on p. 15. Good places to begin looking for the unit-related ideas are *Explorations in Science* assessment handbooks, *Innovations in Science* teaching notes, Unit tests and Portfolio ideas, Alberta Education sample tests at www.education.gov.ab.ca and Alberta Assessment Consortium at www.aac.ab.ca

Bibliography

- Alberta Environmental Protection. *Woodsman Doug's Activity Book—Beginner Bird Watching*.
- Alberta Forestry, Lands and Wildlife (Fish and Wildlife Division). *Alberta's Threatened Wildlife: Bull Trout*. Edmonton, 1994.
- Alberta Forestry, Lands and Wildlife (Fish and Wildlife Division). *Alberta's Threatened Wildlife: Burrowing Owl*. Edmonton, 1990.
- Alberta Forestry, Lands and Wildlife (Fish and Wildlife Division). *Alberta's Threatened Wildlife: Ferruginous Hawk*. Edmonton, 1990.
- Alberta Forestry, Lands and Wildlife (Fish and Wildlife Division). *Alberta's Threatened Wildlife: Northern Leopard Frog*. Edmonton, 1991.
- Alberta Forestry, Lands and Wildlife (Fish and Wildlife Division). *Alberta's Threatened Wildlife: Peregrine Falcon*. Edmonton, 1990.
- Alberta Forestry, Lands and Wildlife (Fish and Wildlife Division). *Alberta's Threatened Wildlife: Piping Plover*. Edmonton, 1990.
- Alberta Forestry, Lands and Wildlife (Fish and Wildlife Division). *Alberta's Threatened Wildlife: Trumpeter Swan*. Edmonton, 1992.
- Alberta Forestry, Lands and Wildlife (Fish and Wildlife Division). *Alberta's Threatened Wildlife: Whopping Crane*. Edmonton, 1991.
- Alberta Tourism, Parks and Recreation, Kananaskis Country. *Pond Pals*. Alberta Tourism, Parks and Recreation, Kananaskis Country, 1991.
- Allen, Maureen Murphy et al. *Critters*. AIMS Education Foundation, 1992. ISBN 1-88143129-0.
- Bailey, Jill. *The Life Cycle of a Bee*. East Sussex, England: Wayland, 1989. ISBN 1-85210621-2.
- Bailey, Jill. *The Life Cycle of a Duck*. East Sussex, England: Wayland, 1988. ISBN 1-85210120-2.
- Bailey, Jill. *The Life Cycle of a Grasshopper*. East Sussex, England: Wayland, 1989. ISBN 1-85210772-3.

- Bailey, Jill. *The Life Cycle of a Spider*. East Sussex, England: Wayland, 1989. ISBN 1-85210124-5.
- Bailey, Jill. *The Life Cycle of an Owl*. East Sussex, England: Wayland, 1989. ISBN 1-53118315-7.
- Barrett, Katharine et al. *Animals in Action, Teacher's Guide (Grades 1-4)*. Berkeley, California: Regents, 1986. ISBN 0-91251110-9.
- Brinckloe, Julie. *Fireflies*. New York: Macmillan, 1985. ISBN 0-02713310-9.
- Brutschy, Jennifer. *Winter Fox*. New York: Knopf, 1993. ISBN 0-67981524-4.
- Campbell, Steve et al. *Explorations in Science, Level 2, Creatures and Crawlers*. Don Mills, Ontario: Addison-Wesley, 1992. ISBN 0-201-88133-0.
- Campbell, Steve et al. *Explorations in Science, Level 3, Six Legs or Eight?* Don Mills, Ontario: Addison-Wesley, 1993. ISBN 0-201-88165-9.
- Campbell, Steve et al. *Explorations in Science, Level 3, Discovering Adaptation*. Don Mills, Ontario: Addison-Wesley, 1992. ISBN 0-201-88156-X.
- Campbell, Steve et al. *Explorations in Science, Level 5, It's a Small World*. Don Mills, Ontario: Addison-Wesley, 1993. ISBN 0-201-88173-X.
- Campbell, Steve et al. *Explorations in Science, Level 6, The Endangered*. Don Mills, Ontario: Addison-Wesley, 1993. ISBN 0-201-88161-6.
- Canadian Wildlife Federation. *Project WILD*. Ottawa: 1989. ISBN 1-55029020-7.
- Carle, Eric. *The Very Hungry Caterpillar*. Philomel Books, 1969. ISBN 0-39920853-4.
- Cherry, Lynne. *The Great Kapok Tree*. San Diego: Harcourt Brace Jovanovich, 1990. ISBN 0-15200520-X.
- Clarke, Jacqueline. *Creepy, Crawlies*. Scholastic Canada, 2001. ISBN 0-439-16235-1.
- Crewe, S. *The Bee*. Harcourt Canada, 1997. ISBN 0-81726225-3.
- Crewe, S. *The Butterfly*. Harcourt Canada, 1997. ISBN 0-81726227-X.
- Crewe, S. *The Kangaroo*. Harcourt Canada, 1997. ISBN 0-81726233-4.
- Cross, G. et al. *Animals Grow: Growth and Changes in Animals: Teacher's Guide*. Scholastic Canada Ltd, (Ontario Edition). ISBN 1-55268898-4.
- Drew, David. *Tadpole Diary*. Australia: Black Cockatoo Publishing Design (U.S. distributor: Rigby Education), 1993. ISBN 0-73270900-8.
- Eyewitness Series: Insect*, 1994. Video: 35 minutes. ISBN 0-7894-0036-7.
- Gates, Julie M. *Consider the Earth*. Colorado: Teacher Ideas Press, 1989. ISBN 0-87287734-5.

- Griffin, M. and D. Seed. *The Amazing Egg Book*. Toronto: Kids Can Press, 1989. ISBN 0-92110384-0.
- Hickman, Pamela. *Birdwise*. Toronto: Kids Can Press, 1988. ISBN 0-92110358-1.
- Hickman, Pamela. *The Kid's Canadian Bug Book*, 1996. ISBN 1-55074-329-5.
- Hickman, Pamela. *The Life Cycle of a Butterfly*. East Sussex, England: Wayland, 1988. ISBN 1-85210118-0.
- Hickman, Pamela. *The Life Cycle of a Duck*. East Sussex, England: Wayland, 1988. ISBN 1-85210120-2.
- Hickman, Pamela. *The Life Cycle of a Grasshopper*. East Sussex, England: Wayland, 1989. ISBN 1-85210772-3.
- Hickman, Pamela. *The Life Cycle of a Rabbit*. East Sussex, England: Wayland, 1988. ISBN 1-85210306-X.
- Hickman, Pamela. *The Life Cycle of a Spider*. East Sussex, England: Wayland, 1989. ISBN 1-85210124-5.
- Hickman, Pamela. *The Life Cycle of an Owl*. East Sussex, England: Wayland, 1989. ISBN 1-85210622-0.
- Jones, A. and R. Purnell. *SPECIALS! Science: The Living World*. England: Folens, 1992. ISBN 1-85276291-8. (This book is intended for use by students with special learning needs.)
- Kramer, D. *Animals in the Classroom: Selection, Care and Observations*. Pearson Education, 1989. ISBN 0-20120679-X.
- Lawson, J. *Hands-on Science*. Canada: Peguis.
- Leach, John, Rosalind Drive, Philip Scott and Colin Wood-Robinson. *Progression in Understanding the Ecological Concepts by Pupils Aged 5 to 16*. Leeds: Children's Learning in Science Research Group, Centre for Studies in Science and Mathematics Education. The University of Leeds, 1992. ISBN 0-904-421-481.
- National Science Resources Center. *The Life Cycle of Butterflies, Teacher's Guide*. Burlington, North Carolina: Carolina Biological Supply Co., 1992.
- Parker, Steve. *Eyewitness Explorers: Insects*, 1997. ISBN 0-7894-2215-8.
- Peacock, G. and T. Hudson. *Exploring Habitats*. England: Wayland, 1992. ISBN 0-75020215-7.
- Peturson, Rod and Neil McAllister. *Innovations in Science, Process and Inquiry, Level 2*. Toronto: Harcourt Brace & Company, Canada, 1996. ISBN 0-7747-0189-7.

Peturson, Rod and Neil McAllister. *Innovations in Science, Process and Inquiry, Level 3*. Toronto: Harcourt Brace & Company, Canada, 1996. ISBN 0-7747-0184-6.

Peturson, Rod and Neil McAllister. *Innovations in Science, Process and Inquiry, Level 5*. Toronto: Harcourt Brace & Company, Canada, 1996. ISBN 0-7747-0179-X.

Pfeffer, Wendy. *From Tadpole to Frog, Let's Read and Find-Out-Science*, 1994. ISBN 0-06-445123-2.

Pringle, Lawrence. *Living Treasure. Saving Earth's Biodiversity*. Morrow Junior Books, 1991. ISBN 0-68807709-9.

Richards, Roy. *An Early Start to Nature*. England: Simon and Schuster, 1989. ISBN 0-75010044-3.

Schlichting, Diane. *Growth and Change in Animals: Learning Material*. Life Science Series, 2000. ISBN 1-55035-670-4.

Schoenherr, John. *Bear*. Philomel Books, 1991. ISBN 0-39922177-8.

Seuss, Dr. *The Lorax*. New York: Random House, 1971. ISBN 0-39482337-0.

Souza, D.M. *Insects Around the House*. Minneapolis, Minnesota: Carolrhoda Books, 1991. ISBN 0-87614438-5.

Souza, D.M. *Insects in the Garden*. Minneapolis, Minnesota: Carolrhoda Books, 1991. ISBN 0-87614439-3.

Souza, D.M. *What Bit Me?*. Minneapolis, Minnesota: Carolrhoda Books, 1991. ISBN 0-87614440-7.

Taylor, Barbara. *Look Closer, POND LIFE*. Canada: Stoddart, 1992. ISBN 0-77372562-8.

Terry, Trevor and Margaret Linton. *The Life Cycle of an Ant*. England: Wayland, 1987. ISBN 1-85210117-2.

Terry, Trevor and Margaret Linton. *The Life Cycle of a Butterfly*. New York: Bookwright Press, 1988. ISBN 0-53118188-X.

White, E.B. *Charlotte's Web*. Harper Collins, 1952. ISBN 0-06026385-7.

Williams, John. *The Life Cycle of a Rabbit*. New York: Bookwright Press, 1988. ISBN 0-53118189-8.

Williams, John. *The Life Cycle of a Frog*. England: Wayland, 1987. ISBN 0-85210116-4.

Williams, P., J. Greenler, R. Greenler, L. Graham, M. Ingram, L. Kehle and D. Eagan. *Bottle Biology*. USA: Kendall/Hunt, 1993. ISBN 0-84038601-X.

Yolen, Jane. *Ring of Earth*. San Diego: Harcourt Brace Jovanovich, 1986. ISBN 0-15267140-4.

