

Pre-trip Information for Teachers

Program Description

Hidden beneath the surface of VanDusen's ponds and streams is a diverse world of beautiful and strange life. Students learn about and explore the aquatic environment, use nets to dip below the surface and identify the creatures they find. Students will also seek out the plants and animals that make their homes along the pond's edge.

Learning Objectives:

Students will:

1. Investigate various water bodies looking for plants and wildlife
2. Understand the pond as a layered ecosystem (edges, bottom, water column, surface)
3. Collect, observe, and identify aquatic invertebrates
4. Learn that life cycles and survival are features of animal life

Curriculum Connections

Grade 1

BIG IDEAS

- Living things have features and behaviors that help them survive in their environment

CURRICULAR COMPETENCIES

- Demonstrate curiosity and a sense of wonder about the world
- Experience and interpret the local environment
- Make and record observations
- Compare observations with predictions through discussion
- Transfer and apply learning to new situations

CONTENT

- Classification of living and non-living things
- Names of local plants and animals
- Structural features of living things in the local environment
- Behavioral adaptations of animals in the local environment

Grade 2

BIG IDEAS

- Living things have life cycles adapted to their environment

CURRICULAR COMPETENCIES

- Demonstrate curiosity and a sense of wonder about the world
- Make simple predictions about familiar objects and events
- Make and record observations
- Experience and interpret the local environment
- Compare observations with predictions through discussion
- Transfer and apply learning to new situations

CONTENT

- Metamorphic and non-metamorphic life cycles of different organisms
 - Similarities and differences between offspring and parent
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Grade 3

BIG IDEAS

- Living things are diverse, can be grouped, and interact in their ecosystems

CURRICULAR COMPETENCIES

- Demonstrate curiosity about the natural world
- Make predictions based on prior knowledge
- Make observations about living and non-living things in the local environment
- Experience and interpret the local environment

CONTENT

- Biodiversity in the local environment
 - Energy is needed for life
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Grade 4

BIG IDEAS

- All living things sense and respond to their environment

CURRICULAR COMPETENCIES

- Demonstrate curiosity about the natural world
- Make predictions based on prior knowledge
- Make observations about living and non-living things in the local environment
- Experience and interpret the local environment
- Transfer and apply learning to new situations

CONTENT

- Animals and plants have different ways of sensing and responding to their environment

Preparing students for their visit to a botanical garden

Visiting a botanical garden

A botanical garden is a place of beauty, where students will get to see and learn about a variety of plants. Have a discussion about what the students think a botanical garden is and what they might be able to see at a botanical garden. Refer to our General Pre-visit package for more information.

Garden Code of Conduct

Refer to our Code of Conduct sheet in our General Pre-visit Information package, and discuss with your students why it is important not to pick any living plants in the Garden:

- If you pick a living plant, it can no longer grow or be enjoyed by other visitors to the Garden
- Plants and their parts, such as seeds, cones and leaves are all food sources for wildlife or a home for insects.

Preparing students for the program

These interdisciplinary activities are designed to integrate science, visual art and language arts in preparation or as a follow up to your visit to VanDusen. Feel free to adapt the activities to be relevant to the age group and experience of your students.

Learning about the Pond Habitat

Activity: A Web of Pond Life

PART 1: Introductory Discussion- Ponds

- Brainstorm these ideas with your students: What is a pond? What makes a pond different to other water bodies? Which plants and animals can be found living in and around a pond?
- Generate a list of general differences between ponds and other water bodies (sea, ocean, streams, lake, river etc...)
- Generate a list of the plants and animals found in and around a pond. Stick with what the student's ideas are at this stage because we will introduce them to less-known animals on their guided tour.
- Have an art session where your students chose one plant or one animal from the pond habitat to make a picture of. These pictures will be used in a later activity so you will need pictures of a variety of organisms.

Tell your students that the pond and its surroundings are home to many living things, both animals and plants and that we call their home a habitat. Tell them that a habitat must have everything that the organism needs to survive. Discuss these needs. Relate this to their everyday needs and whether these are met in their homes (food, water, shelter etc...).

PART 2: Food Chain/Web Game

Objective: Introduce the idea that organisms interact and depend on each other for survival

The students' pictures will now be used to teach them about food chains/webs. You will need to do a bit of preparation for this activity. You will need to make pictures of the sun, water and air to add to the game.

- Punch two holes in the top of the pictures and thread string through to make into a 'necklace' that can be hung around the student's shoulders. Alternatively, they can hold their pictures.
- Cut lengths of string (2m/200cm), enough for each students (and some spares)
- Gather your class into a circle in a large space
- Hand out their pictures and give everyone a piece of string. Have the students wear or hold out their picture so everyone can see it.
- Tell them that they are the plant or animal that they are holding
- Tell them that they are all part of the Pond Habitat and you are going to play a game to show them how they link together
- Select a student, representing one of the animals in the pond habitat to begin with. Ask them if they can see what they eat around the circle. Tell them to hold one end of their string. Take the other end and give it to the food source. Tell the group that these two are joined in the habitat as one is food for the other.
- Introduce the vocabulary, herbivore/carnivore/predator/prey
- Continue this process, working through the group until all the students are linked and interlinked together (one is eaten by... but eats...) by their string. This is a fun game where it will be tricky for you to keep joining your students by the string. As the game progresses they will see a big web of string joining them all together!

As you play them game use habitat vocabulary relevant to your age group:

- Consumer, producer, web, chain, herbivore, carnivore, predator, prey, energy

Round up this activity by explaining that they will soon be visiting VanDusen to discover what is living in and around the ponds at the garden and learning more about the pond habitat.

Place the pictures on a wall of the habitat they generated. Connect them with string, labelling organisms with the habitat words. After your visit to the garden you may want to add new animals and plants seen to expand your food web.

Websites and Links to Support Learning

Water Striders and Water Tension Video Clip: for Grades 3 and 4

This short video demonstrates the way in which water striders move atop of water by placing them on food coloured water. You will also scientist David Hu's water strider robots. Watch and discuss surface tension. How do these delicate insects stay afloat?

<http://www.sciencefriday.com/videos/watch/10404>

Take a Virtual Pond Dip at Microscopy-UK's interactive weblink: for Grades 3 and 4

Take a virtual pond dip to discover the algae, anthropods, aquatic insects and microscopic pond life that coexist to create a balanced and healthy pond ecosystem.
<http://www.microscopy-uk.org.uk/ponddip/>

Smart Board Pond Life Activity: <http://exchange.smarttech.com/details.html?id=fbe5f54e-959a-42d8-a299-c2b1b60e89ea>

Literature Activities – all titles available through VSB and VPL

Early Primary

- **Lily Pad Pond – by Bianca Lavies**

This short story of a lily pond habitat and the creatures that live there is an excellent introduction to a pond community, the significance of lily pads and simple pond food webs.

Questions for discussion: How does the lily pad benefit the tadpole (shelter from predators), dragon fly nymph (a ladder to the surface) and the fisher spider (a cool shelter)?

Food web activity: Match the stories characters to display who eats and is eaten by whom.

- **Strange Beginnings – by Karen Needham and Launi Lucas**

This is a short but useful introduction to the common aquatic insects students will be looking for during the guided program. An excellent resource to look at before visiting and after pond dipping.

- **Pond Seasons – Sue Ann Alderson**

This story details how the creatures of a pond habitat adapt to the changing seasons through charming poetic text. An excellent introduction to a pond community big and small and great inspiration for student-written poems.

Suggested Activity: Visualization Activity. Give each student a quartered landscape piece of paper. Read the story Pond Seasons aloud without showing pictures. Students can sit with clipboard and pencil and label and sketch each season at the pond based on the author's words. Give extra time to add detail at seats. Finally, regroup and reread showing pictures and spotlight student work in a circle.

Upper Primary / Early Intermediate

- **Water Insects – by Sylvia A. Johnson**

This book is an excellent read-aloud for grades 2-4. Text and beautiful detailed pictures explore topics from classifying the difference between bugs and beetles; aquatic insect adaptations and life cycle.

- **A Freshwater Pond – by Adam Hibbert**

An excellent introduction to pond plant life (p.8-11) such as algae, duckweed, hornwort, bladderwort, pond lilies, reeds and rushes as well as aquatic insects and mammals. Accessible text for independent student research.

- **Minibeasts In a Pond – by Sarah Ridley**

Excellent clear, large pictures of the common aquatic insects and information on the lifecycle of mosquitoes and dragonflies. Accessible text for independent student research.

- **Song of the Water Boatman and Other Pond Poems – by Joyce Sidman**

This anthology of pond poems is elegant and accessible.

Suggested activity: Read a few poems from the book to your class, then have students write their own concrete poem for the aquatic insect of their choice. The poem should take on the shape and character of the insect's movement pattern: whirling, striding, diving or paddling...

Art Activity

Lily Pad Life Cycle Wheel: Grades K-1



What You Need:

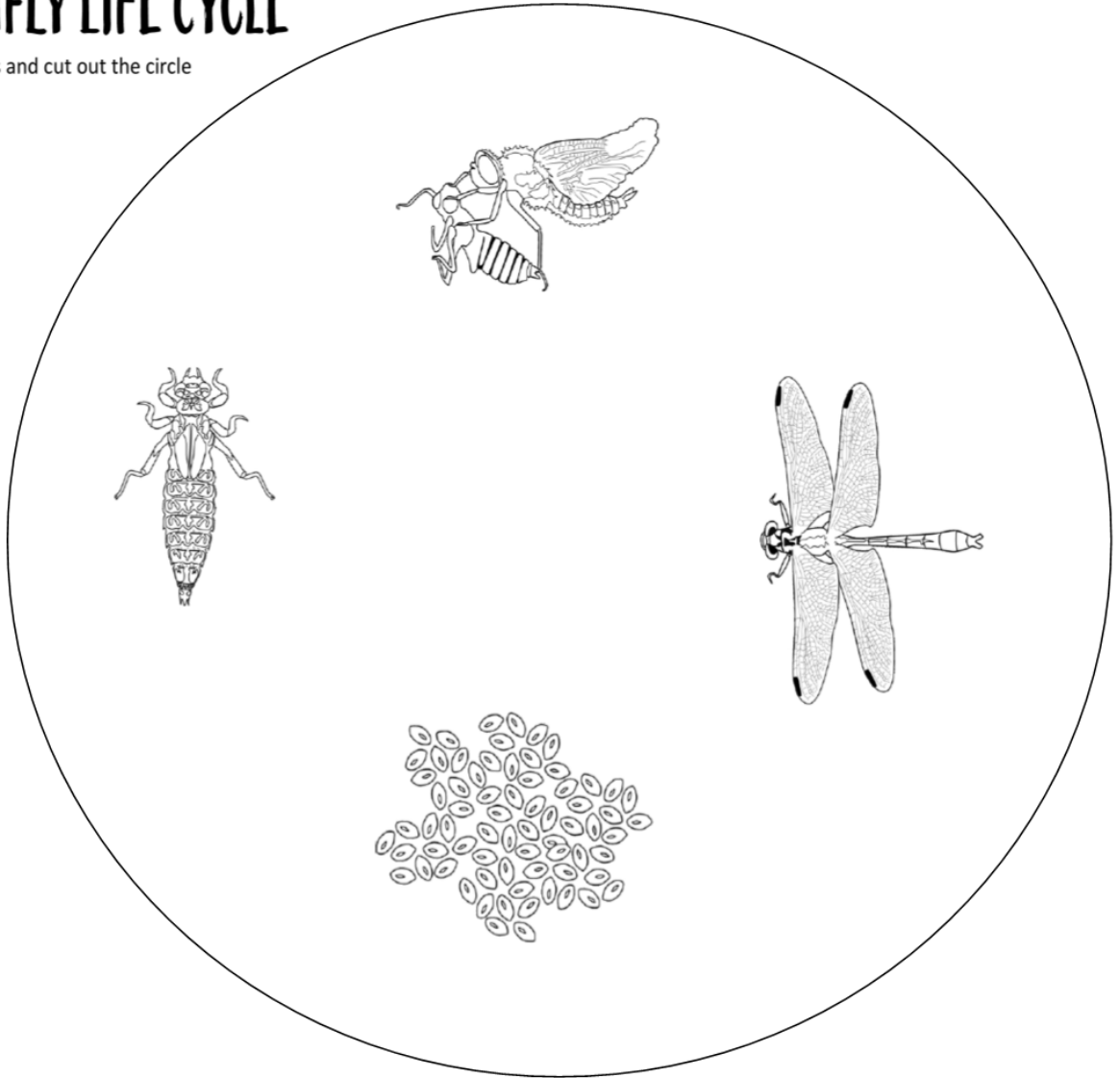
- Scissors
- Glue sticks
- Green construction paper for lily pad
- 1 copy per student of life cycle of dragonfly
- 1 round head fastener per student
- 1 white cupcake sleeve per student
- 1 small piece of yellow tissue per student

What You Do:

1. Cut out green lily pad template.
2. Open cupcake cream or yellow cupcake cup and cut small slits to make petals.
3. Crinkle yellow tissue in center of lily and glue in place.
4. Cut out circle template and glue the 3 or 4 life stages of chosen aquatic insect in the correct order
5. Fasten lily pad to info. Sheet with a round head fastener and turn tail ends up to secure.

DRAGONFLY LIFE CYCLE

Colour the pictures and cut out the circle



Background information for teachers

Questions about Ponds

What is a Pond?

A pond is a quiet body of water that is shallow enough for rooted plants like water lilies to grow across it. The bottom of a pond is muddy. There are usually plants like cattails and irises growing along the shore too. Ponds can vary in size, but they are usually no deeper than around 6 metres (15 feet), about the height of 4 or 5 primary students standing on top of each other.

How are ponds formed?

There are lots of ways for ponds to form. For example, some are potholes left by glaciers that fill with water, some are cutoffs from old streams, and some, like the ponds of VanDusen, are made by people.

How does life get to the pond in the first place?

There are a few different ways that organisms get to ponds. Many plant seeds arrive on the wind. Seeds are also carried by animals on their feet, in the bellies, or on their fur or feathers. Adult insects can fly to a new pond and lay their eggs in it. Frogs, turtles, and ducks can travel overland to a pond. Fish can swim through streams that enter the pond.

What lives in ponds?

Ponds provide habitat, or homes for many different animals and plants. Many types of birds, fish, turtles and insects live in and around ponds. Frogs and tadpoles are almost always found in ponds too. At VanDusen though, frogs are very shy and not seen very often. Some animals who live in the pond are very small, such as daphnia, cyclops, and mites.

Plants that like a lot of water do very well around ponds. There are even plants that grow in the pond, some with their roots stretching down to the bottom and leaves floating on top like water lilies, some that grow entirely underwater, and some that float in the water, like duckweed. Algae is also very common in ponds, and provides food and energy for many animals.

How do animals and plants survive the winter in a pond?

Many animals move down to the bottom of the pond and rest in the mud where it does not freeze. Their bodies slow down so that they use less energy (sometimes called hibernation). Turtles, fish, worms, and dragonfly larvae all spend the winter this way. Some insects overwinter as eggs. They do not hatch until the spring when it is warmer and there is more to eat. Some animals stay active, such as ducks and herons.

Some plants stay green all year, but many plants stop growing and lose their leaves. Examples are waterlilies, cattails, and willows. They do not make very much food (photosynthesize) over the winter. Plants that die down eventually become mud at the bottom of the pond. Some plants make a lot of seeds in the fall. The seeds wait through the winter until spring to start growing.

What happens if the pond dries up?

As time passes, ponds gradually fill up with mud and dirt from soils and decaying plants nearby. The deepest part of the pond gets shallower and eventually plants with roots and floating leaves can grow. As many years go by, only emergent plants like cattails that have their roots in the muddy water but grow up out of the water are left. Eventually the whole pond dries up as trees and grasses move in, and the area may become a grassy prairie or a forest.

Pond Peering Vocabulary

AQUATIC:	An organism that must live in water
CARNIVORE:	An organism that eats other organisms (a meat eater)
COMMUNITY:	Groups of living things that are found in the same area
CONSUMER:	An organism that cannot produce its own food and eats other things for its energy source
DETRIVORE:	An organism which feeds upon dead or decaying plants or animals. Detrivores tend to feed on small bits of materials, while scavengers tend to feed on larger pieces or whole organisms
ECOLOGY:	The study of how living things interact with each other and the world of non-living and living things around them
ECOSYSTEM:	A community of living things and their surroundings. An ecosystem can be anything from a small piece of rotting wood to a vast lake
ENVIRONMENT:	The surroundings and all external conditions which affect the life and development of an organism
FOOD CHAIN:	A food pathway that connects one species with another where energy and nutrients are passed from one organism to another. A simple food chain often begins with a plant, which makes its own food, and continues with an organism that feeds on the plant, followed by an organism that feeds on the plant-eating organism
FOOD WEB:	The interconnection of different but related food chains within an ecosystem
HABITAT:	The area in which an organism naturally lives
HERBIVORE:	An organism that eats plants
LARVA(E):	A young insect that develops by complete metamorphosis. Larvae hatch out of eggs, looking quite different from its parent (for example a caterpillar is the larva of a butterfly). Larvae turn into pupa, a resting stage (the chrysalis of a butterfly). Pupa emerge as adults. Examples of animals who go through a larval stage include ladybugs, flies, bees, and butterflies
LIFE CYCLE:	The unending series of changes that occurs as an organism develops from an egg to an adult, which then reproduces and so continues the cycle
METAMORPHOSIS:	The set of changes some organisms go through as they develop from egg to adult

NYMPH:	A young insect that develops by incomplete metamorphosis; for example, crickets and dragonflies. Nymphs resemble the adults they'll become, but they are smaller, have no wings, and cannot reproduce
OMNIVORE:	An organism that eats both plants and animals
ORGANISM:	A living thing
PLANKTON:	Microscopic plants and animals that live in the water
POND:	A quiet body of water with a muddy bottom that is shallow enough for rooted plants like water lilies to grow across it
PREDATOR:	An organism, which hunts, seeks out or waits to capture animals for food
PREY:	An organism that is killed and eaten by a predator
PRODUCER:	An organism which can produce its own food via photosynthesis - ie. is able to convert CO ₂ and water to simple sugars ("food") using the energy from sunlight
PUPA:	A pupa is the resting stage in an insect which goes through complete metamorphosis, for example, the chrysalis of a butterfly. Pupa emerge as adults.

Fabulous Facts on Freshwater Turtles

- Cold-blooded and therefore depend on external sources of heat: This is why you see turtles basking on rocks on sunny days. On colder days they will bury themselves in the mud at the bottom of the pond to keep warm
- Turtles are active during the day and at night they will rest on the bottom of the pond
- Good eyesight, colour vision and hearing (they do not have ears but can feel vibrations) and an excellent sense of smell
- They communicate through touch
- During the winter months turtles return to the bottom of the pond to hibernate. This is called a state of torpor.
- They are very good swimmers
- Turtles are ancient life forms and have been around for 200 million years (Triassic)
- Turtles can live for up to 100 years but the average life span is 40 years



Red-eared slider. The non-native turtle species found in VanDusen ponds.

Body Parts:

- They have beak-like mouths and no teeth
- The outer shell, called the Carapace, is for protection
- The shell has up to 60 bones covered by plates
- The bottom shell (underneath) is called the Plastron
- They have webbed feet for swimming and claws for digging



Western painted turtle native to B.C. Not found in VanDusen ponds. Note coloured underbelly.

Reproduction:

- Breeding takes place early spring – late summer after hibernation and before feeding
- Female turtles lay their eggs on land. The female digs a long, thin nest, lays her eggs and then covers them with earth. Female turtles do not incubate their eggs. The eggs are left to hatch on their own and young turtles (hatchlings) are independent immediately, digging themselves out of the nest
- The female will lay 5-10 eggs which hatch within 10 weeks
- The temperature of the nest determines the sex of the hatchlings. A warm environment produces females whilst a colder environment produces males
- Young turtles are known as hatchlings

Food Chain:

- Omnivorous: they feed mainly on plants and small animals (fish and aquatic invertebrates)
- Raccoons and coyotes are the main predators to turtle eggs

Information on Pond Invertebrates

Dragonflies and Damselflies Nymphs



Dragonfly nymph

- Dragonflies and damselflies have not changed for millions of years- they were around at the time of the dinosaurs
- The development from egg to adult is an example of incomplete metamorphosis (no larval or pupal stage, from egg to small insect which then grows)
- Dragonflies and damselflies can take 2 to 3 years to develop from egg to adult

- The young nymphs crawl around in the sediment
- Nymphs only come to the surface when they are ready to emerge as adults (they crawl up the plants to find dry land – you will see them drying in the sun and will notice their). They are very pale when they first emerge, and it takes a few days before their bright colours develop fully
- Nymphs move around by jet propulsion, pumping water in and out of the tip of their abdomens



Damselfly nymph

- The nymphs and adults are carnivorous
- Have a hooked "mask" which can be shot forward to catch their prey
- Nymphs eat: (lesser) water boatmen, pond snail eggs, water fleas, bloodworms and even newt larvae and small fish.
- Nymphs are eaten by large insect larvae, leeches and fish. However, they are camouflaged well (usually brown) so they are well hidden. This helps them to creep up on prey and to hide from predators
- Nymphs breathe through complicated gills inside the end of their bodies. Water is pumped in and out of the gills, to bring in oxygen and get rid of carbon dioxide (this also helps to propel the animal forward)

Adult dragonflies and damselflies



Eight-spotted skimmer

- The adult males and females often fly about together while mating. The female sometimes lays her eggs while she is still joined to the male. Some species carefully make a slit in plant stems, and lay their eggs there. Others simply dip their tail into the water and let their eggs go
- Adults are eaten by birds
- Adults have large compound eyes - which are perfect for hunting because they are good at detecting movement. Dragonflies can also twist their head around, which helps them to spot flies

while flying through the air. They scoop flies out of the air with their legs, and grab them with their jaws. The adults have jaws specially adapted for catching flying insects

- Dragonfly wings do not fold (unlike more complex insects). Dragonflies rest with their wings spread open, while damselflies have them closed along their back
- Adults are amazingly talented flyers. They can hover and even fly backwards. Dragonflies are much more energetic flyers than the more delicate damselflies
- Dragonflies and damselflies can take 2 to 3 years to develop from egg to adult
- Breathe through holes in their bodies, called spiracles
- The largest ever known dragonfly lived a long time ago – its fossilized wings span was 60 cm



Pacific forktail

Greater Water Boatman



Greater Water Boatman

- These are insects. Water Boatmen are 'bugs'. Bugs are a type of insect with a piercing and sucking mouth tube
- Water Boatmen live in freshwater ponds and lakes
- Greater Water Boatmen swim upside-down. They use their long, hair-fringed hind legs as paddles, they can also move between water bodies by using their wings to fly. When in the water, their wings are hidden - tucked away

- Mostly carnivorous. They often feed on prey larger than themselves such as frog and newt tadpoles and small fish. They also eat water fleas and mites. They suck out the body fluids of their prey
- They also suck up particles of debris (including plants and algae) using their proboscis (tube-like mouth part) like a vacuum cleaner
- They are eaten by other aquatic invertebrates, fish and ducks
- The development from egg to adult is through a process called incomplete metamorphosis (no larval or pupal stage, from egg to small insect which then grows)
- The eggs are laid singly attached to the stems of plants or fixed to the threads of floating alga
- The larvae of the Greater Water Boatmen are white and green. They do not have wings
- When they are larvae, they breathe through their outer coating
- The adult water boatman can make a shrill noise by rubbing two of their legs together

Lesser Water Boatman

- These are insects. Water Boatmen are 'bugs'. Bugs are a type of insect. Bugs have a piercing and sucking mouth tube
- These creatures are powerful swimmers, and use their powerful back legs, like paddles, to power themselves along through the water
- **Unlike the Greater Water Boatman, they do not swim upside-down**
- They eat algae and dead plant material (detritus) from the bottom of ponds and lakes. They suck up food using their proboscis (tube-like mouth part) like a vacuum cleaner
- They are eaten by aquatic invertebrates, fish and ducks
- The eggs are laid singly attached to the stems of plants or fixed to the threads of floating algae
- The larvae gradually grow, shedding their outer coating, during incomplete metamorphosis
- When they are larvae, they breathe through their outer coating
- Both Greater and Lesser Water Boatmen can grow up to 16 mm in length
- Lesser Water Boatmen are different to Greater Water Boatmen in 2 main ways: they are herbivores and they don't swim upside-down



Lesser Water Boatman

Freshwater Shrimp (Scud)

- These are crustaceans
- These little creatures have a curved body. They are a brown- yellow colour
- Freshwater shrimps prefer flowing water, such as streams, but they are also found in lakes and ponds - usually at the water's edge
- They hide under stones and between the bases of plant stems
- They swim on their side by wagging their legs
- Shrimps are filter feeders and filter the water for small particles of food
- They are eaten by aquatic invertebrates and fish
- In the springtime, the females and males are often seen swimming around together - the smaller female being held by the male



- The female carries her eggs held within her body, inside what is known as a brood pouch. Young shrimp later hatch from the eggs - so the female releases live young
- These shrimps need a lot of oxygen in the water
- The front 3 pairs of legs move constantly, and produce a current of oxygen-rich water over gills

Phantom Midge Larvae

- Larval stage of the lake fly
- Go through complete metamorphosis -spends the majority of its life in larval stage
- Dark “dots” on either end of body are hydrostatic air sacs which help the larvae move vertically in the water column
- Voracious predators- eat mosquito larvae, water fleas, daphnia and many other organisms
- Preyed upon by small fish and other invertebrates



Phantom midge larval stage



Phantom midge (lake fly) adult

Mosquito



- **Larvae:** eat microscopic plants and animals or organic debris filtered through brushes that surround their mouth. Larvae breathe through gills at the end of the abdomen
- **Pupae:** head and thorax are fused into one unit (unlike larvae) and breathe through tubes in their thorax. In contrast to pupae of most other insects, they are active and can swim by using leaf-like tail appendages
- Only female mosquitoes drink blood and often need a blood meal before laying eggs. Females also drink nectar prior to mating.
- Male mosquitoes feed on nectar and ripe fruit. Mosquitoes are known pollinators of goldenrod and bog orchids
- Mosquitoes survive winter and periods of drought in the egg stage, hatching as soon as conditions are favorable
- About 120 species of mosquitoes occur in North America

Feeding Habits of Other Pond Animals

Mallard ducks

Mostly herbivorous, but actually omnivorous

Dabbling Ducks – feeding just below the surface (they do not dive)

They eat small plants, grasses, seeds, invertebrates, small fish and tadpoles

Turtles

Omnivorous: invertebrates, small fish, small aquatic plants. They also feed from dead animals

such as large fish and birds (scavengers)

Heron

Carnivorous: Wading bird that 'fishes' for its prey

Canada Goose

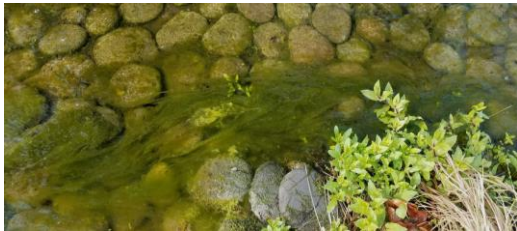
Herbivores: grass on land and aquatic plants

Carp

Omnivorous but feeding on the bottom of a pond, so also a detritivore: small plants and animals and plant and animal remains

Notes on Plant Life

Algae



- form pond scums and hairy growths on underwater surfaces such as rocks
- plants range in size from single cells to dense growths and sometimes join together in chains
- some single-celled algae swim like one-celled animals
- They release oxygen into the water, however if

there is a lot of algae in the water, sometimes their decay reduces oxygen and can kill other aquatic plants and animals

- the algae we see most at VanDusen is called green algae

Duckweed

- Tiny floating plants, a favourite food of waterfowl
- Has tiny flowers that rarely reproduce. Most reproduction is by division of plant body
- There are about 25 species. Some common examples:
 - GREAT DUCKWEED: several rootlets beneath plant body, undersurface is often purplish. Grows in quiet waters and sluggish streams, sometimes forming dense mats on the surface
 - SMALL DUCKWEED: has a single rootlet hanging below plant body. Common in ponds and slow streams and forms floating mats that cover pond's surface
 - IVY DUCKWEED: plants often interlock, leaf-like bodies joined to form lattice-like sheets on the surface or just beneath. Plants may lack roots.

