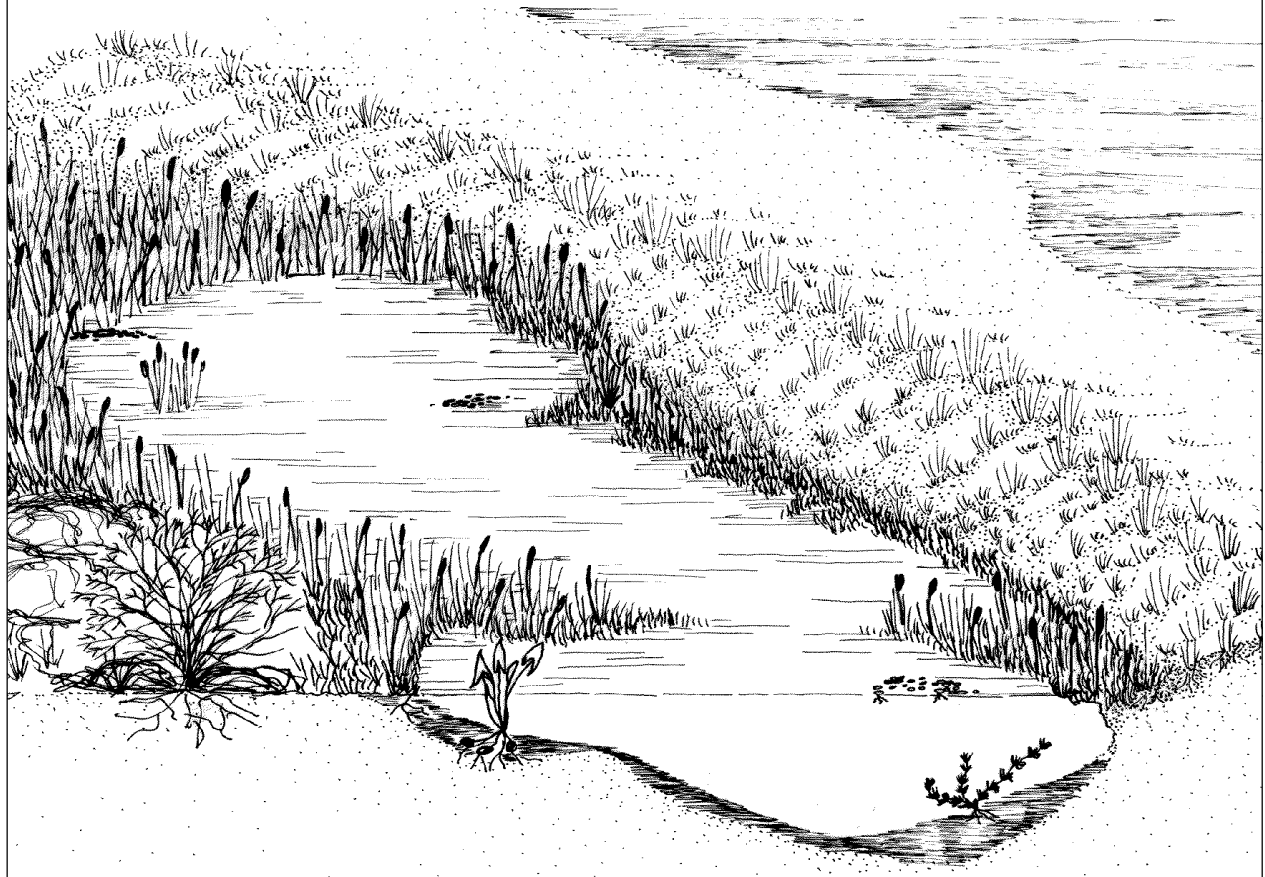


BY THE SEA

**A GUIDE TO THE COASTAL
ZONE OF ATLANTIC
CANADA**

**MODULE 11:
FRESHWATER BARRIER PONDS**



Canada

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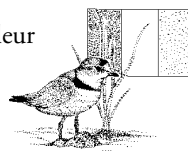
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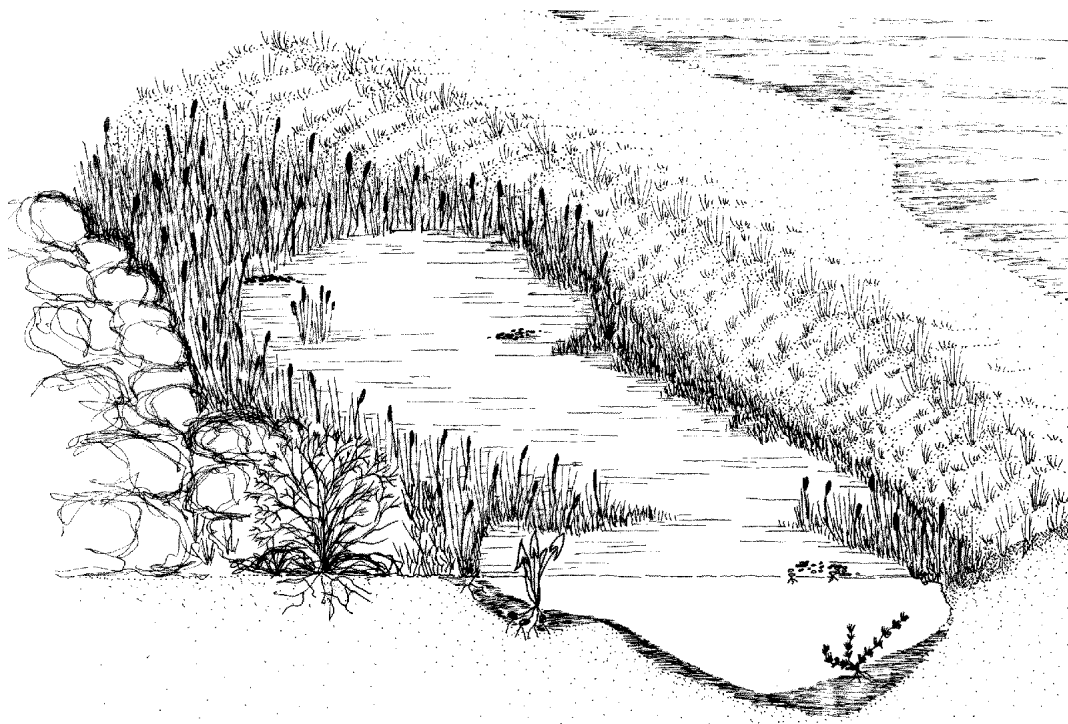
FRESHWATER BARRIER PONDS

What is a Freshwater Barrier Pond?

Freshwater barrier ponds are unique areas in the predominately salty environment of Atlantic Canada's coastal zone. They are sporadically located on the lee side of towering dunes, at the edge of salt marshes, and behind rocky shores. They vary in size from small depressions to large ponds but are typically smaller and shallower than inland lakes. The barrier that protects them from the sea usually consists of sand, rock, or cobble. Sometimes the barrier is so effective at preventing saltwater from entering the pond that a permanent freshwater ecosystem evolves.

The barrier is often formed by wave action over time as it pushes the sediment onto the shore enclosing a saltwater bay. Over time the saltwater is replaced by freshwater from precipitation and inflowing streams.

Freshwater barrier ponds can be divided into two categories - ponds that are completely composed of freshwater and ponds that receive some salt from sea spray during storms and high tides when sea-water flows into the pond through a creek.



These coastal freshwater ponds provide a haven for many plants and animals, including some endangered species. Different types of aquatic plants grow along the shoreline and in the pond waters. Insects hide in the shadows of the vegetation. Waterfowl nest along the shores and muskrats build lodges out of reeds and cat-tails.

The Freshwater Barrier Pond within the Coastal Zone

Freshwater barrier ponds play a unique role in the coastal zone, primarily because they provide an important link between salt and freshwater ecosystems and are often the only source of nearby freshwater along the coast. Transitional visitors such as migratory birds use freshwater barrier ponds to replenish themselves after their long transatlantic flights. They also provide an extremely important freshwater breeding habitat for waterfowl such as Black Duck and Green-winged Teal.



Some linguistics and history

Freshwater barrier ponds are sometimes called barasway or barachois ponds. The word barachois, to describe freshwater barrier ponds, is unique to Atlantic Canada. It is Acadian in origin and depending on where you live there are 12 different spellings and pronunciations (barachois, barrachois, barrisois, barasway, barrasway, barrisway, barrysway, barasois, barsshay, barashway, baraswa, barashwa). There are also many place names related to the word barachois, such as Barachois in New Brunswick and Quebec, Barachois Harbour in Nova Scotia, and Barasway Bay in Newfoundland.

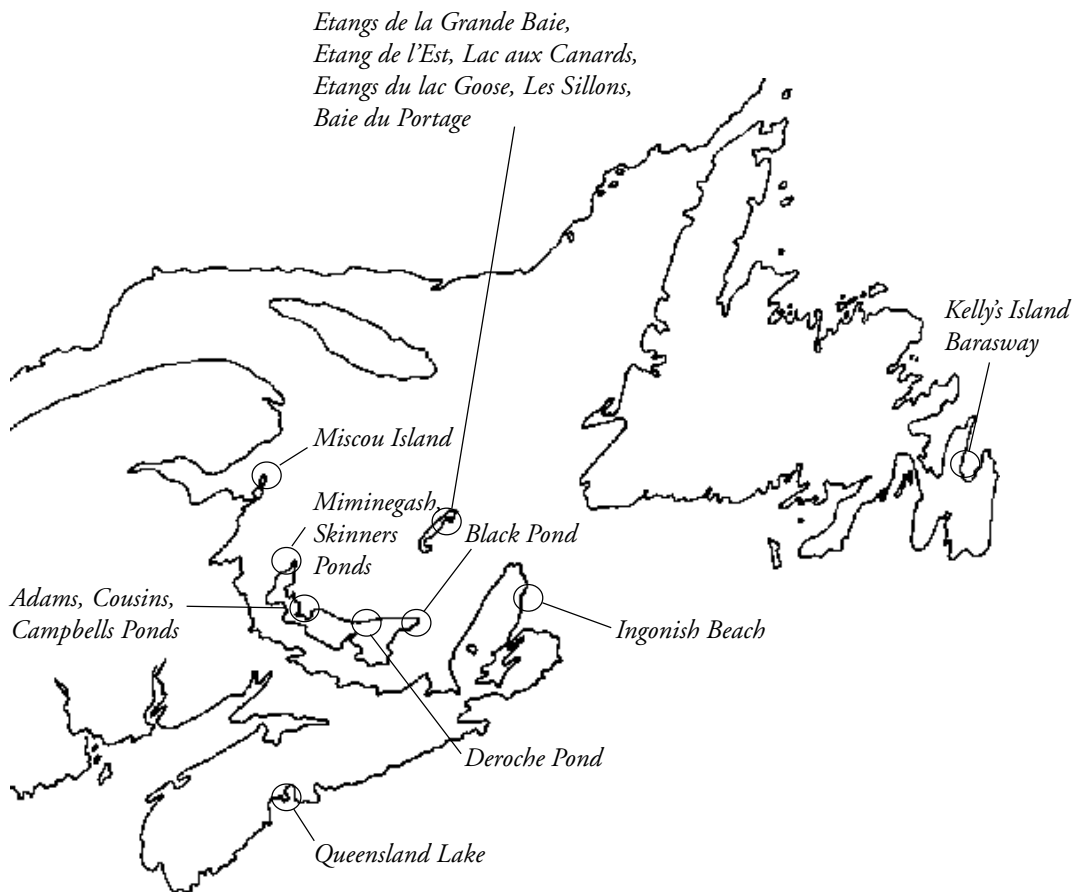
The word barachois is an early term used to describe a small pond near the sea, separated by a causeway of sand or rock.

Depending on where you live barachois may mean something different, anything from a pond, marsh, or bog, a body of water completely enclosed, to a body of water with an opening to the sea. For some interesting historical quotations and interpretations of the word barachois refer to the *Dictionary of Newfoundland English*, and the *Dictionary of Prince Edward Island English*.

Location

Freshwater barrier ponds are located throughout the coastal zone of Atlantic Canada. Every province in Atlantic Canada has several significant freshwater barrier ponds.

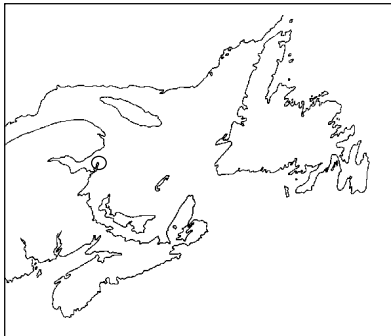
Location of some major freshwater barrier ponds in Atlantic Canada





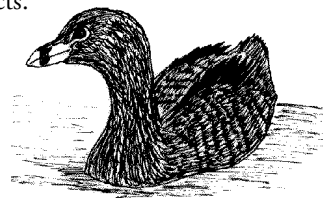
A freshwater barrier pond in New Brunswick

On Miscou Island, in New Brunswick, there is an excellent example of a freshwater barrier pond. A tall sand dune protects the pond from an influx of saltwater, creating a productive freshwater ecosystem close to the salty shore of Chaleur Bay. If you visit the pond you will observe a wide variety of freshwater plants and animals. Listen for the 'okalee' call of the Red-winged Blackbirds as they perch on the cat-tails. Watch dragonflies skim over the water and



catch insects in mid flight with their long hairy legs. Discover colourful clusters of small bell-shaped flowers blooming on the Bog-rosemary. Watch for ducks and muskrats eating the starchy tubers of the arrowhead. The Miscou Island barrier pond provides a small but rich freshwater habitat along the coastal shore. In fact it is one of the few areas on the Acadian Peninsula where birds such as the Pied-billed Grebe nest, confirming the vital importance of freshwater barrier ponds along the coastal zone of Atlantic Canada.

Pied-billed Grebes are solitary birds, known for their thick, short, chicken-like bills. They are duck-like divers and eat crustaceans, small fish, tadpoles, and insects. Breeding pairs are very secretive and often only one pair will nest at a pond. Listen for their 'kuk-kuk-cow-cow-cow-cow-cowp' call.



THE PHYSICAL ENVIRONMENT

Freshwater barrier ponds in Atlantic Canada are all different. Their formation, size, and location with respect to the salty shore play a vital role in their composition. In order to understand a freshwater barrier pond we must explore the pond's history, how it was formed, where the fresh water comes from - precipitation in the form of rain and snow, or a nearby river or spring - and how much, if any, saltwater it receives from salt spray and high tides during storms. All these factors affect the pond environment and its development as a freshwater ecosystem.

Formation

In order to understand freshwater barrier ponds it is important to understand their geological origins. Ponds are formed in different ways.

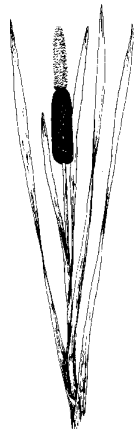
Some ponds are small depressions in the rock or soil, created by the scouring action of glacial ice. These depressions eventually fill in with fresh water from rain, snow, or a local stream.

The formation of freshwater barrier ponds is very dependent on the surrounding coastal ecosystems. As the sea changes the coast, freshwater barrier ponds are being formed and altered on a continuous basis.

When the incoming tidal waters are stopped by sand or rock, the depression of salty water eventually gives way to fresh water, creating a freshwater barrier pond. Over a long period of time salt water collects at the bottom of the pond.

Many small freshwater barrier ponds are transitory. If a storm destroys a pond's protective cover or a high tide rushes in and inundates the fresh water with salt water, the pond changes. Some of the plants and animals may disappear. But with the next rainshower, spring melt, or inflow of fresh water, the pond recolonizes with plants and animals and begins life anew.

Ponds along the edge of sandy beaches and dunes are extremely vulnerable to change. If the sandy barrier is altered during a storm, salt water will enter the pond. On the other hand, shifting dunes can actually help create freshwater barrier ponds. As dunes travel and grow they become a complete barrier for the pond from salt water and prevent even an occasional inflow of salt. As a result, there are freshwater barrier ponds in Atlantic Canada that have not had an influx of salt water in over a decade, creating a stable and relatively permanent freshwater ecosystem.



Many of the freshwater barrier ponds in New Brunswick and Prince Edward Island are found behind large barrier dune systems. In PEI for example the formation of freshwater barrier ponds is closely related to the ocean currents. All of the freshwater barrier ponds are found on the north shore of the island where there is a strong west-east current, which in turn affects the movement and the buildup of the dunes. The freshwater barrier ponds that are completely freshwater are behind large, mature dunes.

There are several barrier ponds around the coast of Newfoundland. These ponds are called barasway and are all unique. Many of them have more of a marine influence than a freshwater influence. Fresh water in these ponds comes from precipitation, small inflowing streams, or run-off from nearby bogs. The barriers around the barasways are constructed of shingle-boulder bars by the action of storms and sea-ice. These rocky walls isolate the barasway from adjacent marine communities, creating a very distinct coastal ecosystem.

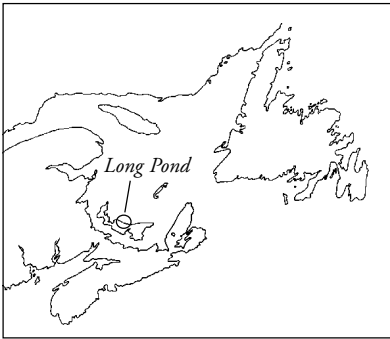
For more information on sandy beaches and dunes see Module 6: Sandy Beaches and Dunes.

Pond Succession

Succession is a term used to describe the developmental changes of a pond.

Over time as vegetation in and around the pond dies and decomposes, the pond fills in with organic debris and eventually becomes shallower. In some ponds, inflowing waters carry silt, which also helps to fill in the basin. As more emergent vegetation grows along the edge, the pond shrinks in size. When plants grow across the middle of the pond, the pond becomes a freshwater marsh. Succession from open water, to freshwater pond, to cat-tail-filled marsh can take many years.

The history of Long Pond in Prince Edward Island



Long Pond, located in the Dalvay area of Prince Edward Island's north shore, provides an interesting history of the effects of the marine environment. In the early 18th century Long Pond was a long, jutting bay open to the sea and the home of an Acadian fishing settlement. Over time, the wind and longshore currents deposited sand at the mouth of the bay. As the sand accumulated the outlet to the sea eventually became so narrow that the small fishing boats could no longer make their way out to sea. The shifting sands eventually closed off the harbour completely from the open ocean

and caused the collapse of the Long Pond fishing community. With an effective barrier to the sea in place, the bay no longer experienced the daily tidal fluctuations or wave action. Fresh water from snow melt, spring streams, summer rains and other freshwater sources altered the salt concentration of the water and created a freshwater ecosystem.

Freshwater marshes in the coastal zone

At the upper end of salt marsh ecosystems you will sometimes find coastal freshwater marshes, which are similar in appearance to freshwater barrier ponds. They are usually found in areas where the salinity of the water drops, farther inland at the farthest reaches of the salt marsh. Saltwater-tolerant plants such as Salt-water Cord-grass and Eelgrass give way to freshwater plants such as bulrushes, cat-tails, and sedges. In the water live water boatmen, fly and mosquito larvae, and succineid snails. These areas are important migratory waterfowl feeding areas in the spring and fall.



As a pond evolves and the number of plants increases there is a natural buildup of rich organic material. Freshwater ponds can be very eutrophic, meaning they are rich in nutrients.

Salt is a limiting factor for freshwater barrier ponds. Ponds that get a considerable inflow of salt, particularly on the side of the pond closest to the ocean, are usually not eutrophic. The invading salt actually keeps the pond at an early stage of succession. They may however be eutrophic farther inland at the source of fresh water.

Freshwater barrier ponds, unlike their inland freshwater pond cousins, experience another form of succession that is dependent on the sea and surrounding coastal ecosystems. They can mature from a brackish pond to a truly freshwater pond if the barrier between the ocean and the pond is wide enough and tall enough to prevent salt water from entering the pond. The reverse can also happen, if a strong storm alters the surrounding ecosystem and allows salt water to enter the freshwater environment. The pond will become young again and fall back into an early stage of succession.

When studying succession of a freshwater barrier pond it is important to look at not only the developmental changes in the pond itself, but also the influences from the local ecosystems. How does a dune, rocky shore, salt marsh, or estuary close by influence succession in the pond? It is also interesting to investigate the development of succession from the ocean, inland to the farthest reaches of the pond.

Physical Characteristics

Life in and around a pond changes dramatically throughout the year depending on the climate. Seasonal changes create great variations in the pond ecosystem. The temperature of the water and the amount of ice restrict the oxygen and nutrient levels in the pond environment. These components in turn affect the diversity of plants and animals that inhabit the pond.

Ice

In the winter the amount of ice and snow on the pond greatly affects the oxygen level. Ice prevents the water from circulating and blocks out light, which may prevent photosynthesis. When ice builds up and photosynthesis diminishes the oxygen level drops. As a result the plants and animals may die, creating a 'winterkill.'

Salt

The amount of salt in freshwater barrier ponds varies. Some ponds have been salt-free for many years, while others receive salt on a regular basis from sea spray, high tides, and storms. The amount of salt in the pond affects the variety of plants and animals that live there. Stratification or layering can also occur in a pond. The heavier salt water sinks to the bottom while a layer of fresh water on top can provide temporary habitat for freshwater species.

When saltwater mixes with freshwater it is termed brackish. The amount of salt in brackish water varies. Some ponds, depending on the freshwater and saltwater inflow, can be brackish closest to the shore and freshwater farther inland. (For more information on the salinity levels of brackish water refer to Module 1: Introductory Module, and Module 3: Estuaries.)

Sediment

Sediments that flow into a pond from a local freshwater source such as a stream are often rich in mineral and organic material. If a pond is close to a beach or a dune there may be an influx of sand which can change the shape, depth, or configuration of the pond.

Storms or heavy run-off can bring large amounts of sediment into ponds in a relatively short period of time.

Temperature

The water temperature in ponds changes little from day to day, but there can be wide seasonal variations. In the spring the surface water of the pond absorbs the sun's heat and warms up faster than the water below. Water is densest (heaviest) a few degrees above its freezing point, about 4 degrees C. As the surface ice melts and warms up it sinks to the bottom and pushes the colder water to the surface. The same thing happens in the fall. The surface water cools faster, becomes more dense and sinks to the bottom, pushing the warmer water to the surface. This movement of water in the spring and the fall is called spring and fall turnover.

Oxygen

Oxygen is soluble in water, but the amount dissolved in fresh water is lower than in the atmosphere. The cooler the water the more dissolved oxygen it will hold. Oxygen levels in a pond can vary greatly in a 24-hour period. During the day when the sun shines on the water, the plants give off oxygen through the process of photosynthesis. Eventually a reserve of oxygen builds up. At night, when photosynthesis stops, animals and plants use this oxygen.

Nutrients

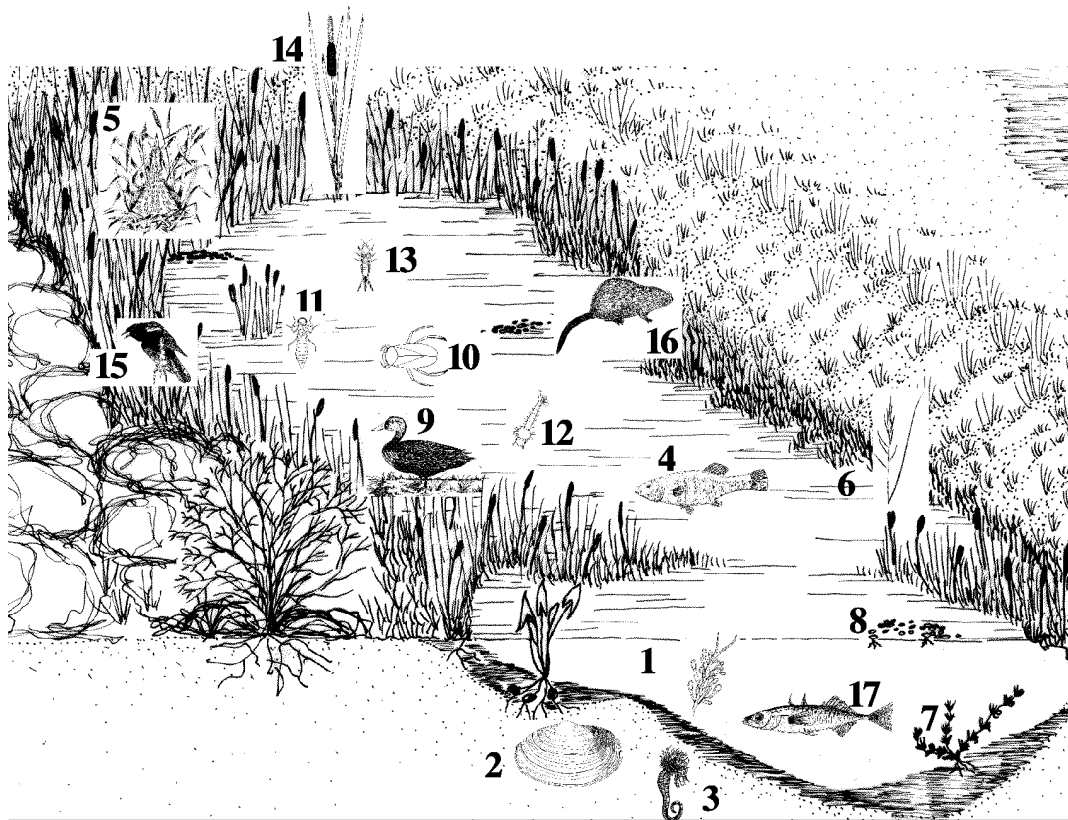
When plants die and decompose in the pond waters the pond becomes eutrophic, full of rich organic nutrients that sustain life in the pond. Spring and fall turnover provide the mechanism for mixing nutrients and dispersing oxygen throughout the pond water.

BIOLOGICAL FEATURES

The life found in a freshwater barrier pond will vary depending on the salinity level. The amount of oxygen and nutrients also affects the diversity of plants and animals that inhabit the pond.

Who Lives Where?

- | | | | |
|----|-------------------------------|----|------------------------------|
| 1 | <i>rockweed</i> | 2 | <i>Soft-shelled Clam</i> |
| 3 | <i>terebellid worm</i> | 4 | <i>Mummichog</i> |
| 5 | <i>American Bittern</i> | 6 | <i>Freshwater Cord-grass</i> |
| 7 | <i>pondweed</i> | 8 | <i>Lesser Duckweed</i> |
| 9 | <i>Black Duck</i> | 10 | <i>water boatman</i> |
| 11 | <i>dragonfly nymph</i> | 12 | <i>mosquito larva</i> |
| 13 | <i>mayfly nymph</i> | 14 | <i>cat-tail</i> |
| 15 | <i>Red-winged Blackbird</i> | 16 | <i>Muskrat</i> |
| 17 | <i>Threespine Stickleback</i> | | |



The Four Sub-Habitats of a Pond

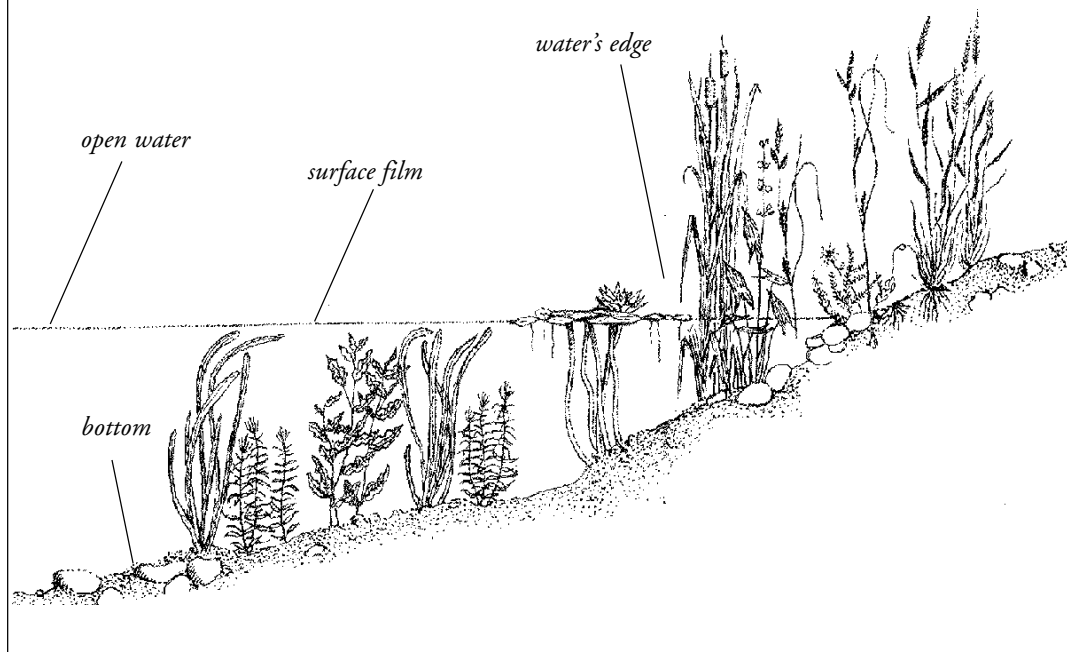
Freshwater barrier ponds that have evolved into permanent freshwater ecosystems can be divided into 4 distinct sub-habitats: open water, water's edge, the surface film, and the bottom. Each of these areas provides a habitat for creatures to find food, shelter, water, and space.

The open water is located in the centre of the pond. Here free-swimming animals and small microscopic plants live. Rooted plants do not usually grow in the pond's centre.

The water's edge is the area where the land meets the water. The first zone in the water's edge is the area where plants, such as pondweed, live right under the water. The zone closest to the shore is the area where large aquatic plants grow with their leaves and flowers above the water. These plants provide micro-habitats for many aquatic animals.

The surface film is the top layer of water. Here creatures such as mosquito larvae get their oxygen directly from the air. The larvae hang on the underside of the water's surface. The pond bottom is the area of decomposition. When things sink to the bottom, bacteria help to recycle the dead material and turn it into organic matter. Many creatures, such as worms, clams, and dragonfly nymphs, burrow in the mud.

The water's edge is the easiest area to explore in a freshwater barrier pond. Here too exists the greatest number of plants and animals to discover.



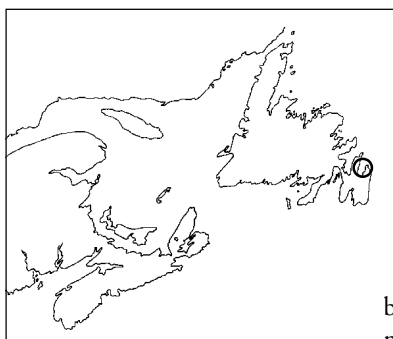


Freshwater barrier ponds in Newfoundland

Unlike estuaries, some barasways in Newfoundland do not have the tidal circulation and flushing, or the continuous freshwater input of inflowing rivers. Fresh water is limited, creating very saline environments. As a result, the plants that live in barasways are similar to the estuary ecosystem. Hollow green weed, marine algae, and *Rivularia atra* are common species, but they do not form the productive, tide- and river-flushed algal beds of estuaries. (For more information on the productivity of estuaries see Module 3: Estuaries.)

Seaweed such as rockweed, Knotted Wrack, Irish Moss, and Smooth Chord Weed are more abundant in barasways than in estuaries due to the sheltered conditions. The animals of barasways consist of large populations of a relatively few species. Whoever colonizes the barasway first appears to be the most successful. In many barasways, periwinkles and scuds are the only apparent macro-herbivores. Periwinkles are snails that eat the seaweed off the rocks. Scuds are bug-like creatures that live in the decaying seaweed and eat the algae and tiny microscopic animals. Limpets are an additional herbivore found at a few sites. Sticklebacks are usually the only type of fish found in the barasway community. The Soft-shelled Clam is so abundant in barasways that it not only burrows into the sediments, it also nestles between the branches of the algae.

Kelly's Island Barasway, Conception Bay



The Kelly's Island barasway is a triangular pond bordered by Kelly's Island on the landward side, and on the seaward side two boulder and shingle bars. The rocks on the bars match Kelly's Island bedrock. They apparently eroded over time and were carried to their present site by the action of ice and storms. Sea-water from Conception Bay enters the barasway by percolation through the bars. Inside the barasway it is completely sheltered, but temperature and salinity appear to fluctuate more than outside the barasway. Colonies of Kittiwakes, gulls and terns nest around the barasway.

Their droppings contribute nutrients to the barasway ecosystem.

The diversity of plants and animals in and around the barasway is very low, due to the relatively high salinity levels of the water. Other, less saline barasways along the coast have more of a variety of plants and animals. In Kelly's Island barasway only 16% of the flora found in Newfoundland are present, and animal diversity is even lower. However, what makes this barasway unique, even though the diversity is low, is the total abundance of seaweed.

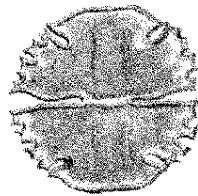
Different types of lichen and brown, red, and green seaweed live in the various littoral zones. The animals that live in the barasway include periwinkles, scuds, Soft-shelled Clams, creeping bryozoan and terebellid worms.

Plankton

Plankton are tiny microscopic plants and animals that drift freely through the pond waters. Carried by the water's currents, they provide the basis for all food chains within freshwater barrier ponds.

Tiny plants are called phytoplankton, which consists mostly of different types of algae. Zooplankton include small suspended animals such as tiny crustaceans and some insect larvae. They graze on the phytoplankton and are in turn eaten by creatures such as small aquatic insects and fish.

For more information on Plankton see Module 1: Introductory Module, and Module 2: To the Horizon - The Nearshore.



Desmids

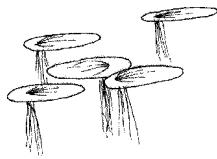
Desmids are bright green cells (unicellular green algae) found especially in freshwater ponds and lakes.

Plants

Plants are the primary producers in a freshwater barrier pond. Through photosynthesis they create the oxygen needed for plants and animals to survive. The types of plants growing in and around the pond can be very different from one end of the pond to another, depending on the level of salinity and the type of sediments. Brackish freshwater barrier ponds that have a consistent salty influence tend to have reeds, sedges, and grasses as their predominant vegetation. Ponds with more of a freshwater influence encourage the growth of Narrow-leaved Cat-tails and bulrushes. In ponds that are only freshwater, Broad-leaved Cat-tails are one of the most predominant plants.

Freshwater barrier ponds are unique in that they portray a merging of salt and freshwater ecosystems. It is not unusual to see saltwater plants at the side of the pond closest to the ocean, salt-tolerant plants somewhere in between, and freshwater plants at the incoming source of fresh water.

Two types of plants grow in the pond waters. Submergent plants, whose leaves and flowers grow below the surface of the water, and emergent plants, whose stem, leaves and flowers rise out of the water. There can also be a variety of interesting trees, shrubs, and flowers growing around the freshwater barrier pond.

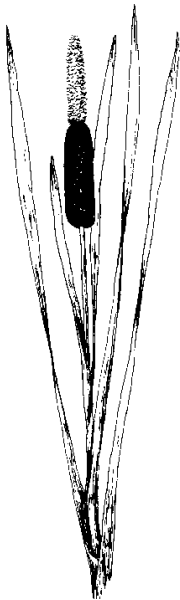


Lesser Duckweed

Duckweed are tiny floating plants that inhabit freshwater ponds. They form floating mats that can cover a pond's surface.

Sweet Gale

Sweet Gale grows along the shores of some freshwater barrier ponds. When the twigs or leaves of the plant are bruised they give off a spicy odour.



Broad-leaved Cat-tail

The Broad-leaved Cat-tail is also called the common cat-tail. It can be identified by flat leaves that are up to 2.5 cm broad. It grows in freshwater ponds and marshes, wet areas in fields, ditches, along the edges of rivers and streams, and in estuaries away from or above the salt water. It cannot tolerate more than 1 per cent sodium chloride (salt) in the water.

Narrow-leaved Cat-tail

The Narrow-leaved Cat-tail has leaves that are slightly rounded on the back and less than 1 cm broad. Unlike the Broad-leaved Cat-tail it can tolerate some salt, is more common along the coast, and is often found in brackish water at the upper ends of salt marshes, estuaries, and freshwater barrier ponds that maintain a certain percentage of salt.

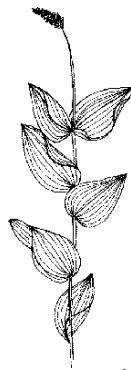
Bur-reed

Bur-reeds often grow with cat-tails along the marshy borders of freshwater ponds. They have long slender leaves and their seeds appear in dense bur-like clusters on a separate stalk. The seeds are eaten by ducks and muskrats.



Freshwater Cord-grass/Slough-Grass

Freshwater Cord-grass, unlike other cord-grasses, occurs in areas where fresh water is predominant. The spikes usually have a yellowish tinge.

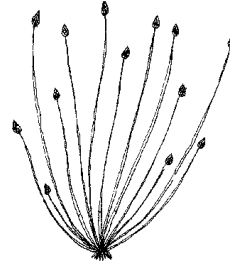


Pondweed

Pondweeds are submergent plants of freshwater and brackish ponds. Their dense underwater growth provides shelter for fish and other animals. They are also a very important food source for several kinds of ducks.

Spike Rush

Spike rush grows in clumps and the soft, thin green stems look like grass. Look for the flowers of the plant, which are crowded onto an oval spikelet at the tip of the stem.



Baltic Rush

Baltic Rush is common in brackish ponds and in the shoreward reaches of salt marshes. Its flowers are a deep brown to purple-brown colour.

Quillwort

Quillwort grows in mud a few inches deep or is submerged under the water. It is a small tufted plant with grass-like leaves. Like ferns, quillwort reproduces by spores. The spores are the size of a grain of salt and are located in a sac at the base of the leaf.

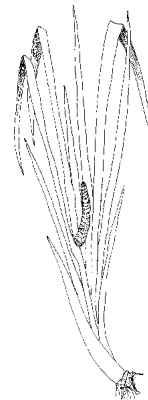


Duck Potato/Arrowhead

Arrowhead grows in freshwater ponds and gets its name from its thick tubers, which are a favourite food for ducks. The length and the shape of the leaf vary with the depth of the water.

Sweet Flag

The leaves of the Sweet Flag are iris-like. The flowers grow in small clusters on a spike-like stalk. The plant spreads under water by a creeping rootstock.





Is it a cat-tail or a bulrush?

Cat-tails are in a group of related species of plants (genus) called *Typha*. The Latin name for the cat-tail family is Typhaceae. Two of the most common species of cat-tails growing in the Atlantic provinces are Broad-leafed Cat-tail (*T. latifolia*) and Narrow-leafed Cat-tail (*T. angustifolia*). Cat-tails are sometimes mistakenly called bulrushes.

Bulrushes along with Narrow-leafed Cat-tails are common in transitional freshwater ponds that experience some salt.

Three-square (a bulrush)



Rare plants of freshwater barrier ponds

In Prince Edward Island National Park a rare plant species has been found in the freshwater barrier pond ecosystem. *Aster laurentianus*, a type of aster, is a plant that is classified as vulnerable to extinction at a national level. It is found in a limited number of places across Canada, including the freshwater barrier ponds of the Magdalen Islands. It grows in brackish water and must be submerged to disperse the seeds. In PEI National Park it is found at the border of a pond near a tidal outflow.

The freshwater barrier ponds of the Magdalen Islands not only provide habitat for the vulnerable *Aster laurentianus* but also three plants that are classified as being rare in Québec - Poverty-grass (*Corema conradii*), Arrow-grass (*Triglochin gaspense*), and Yellow-eyed Grass (*Xyris montana*).

Yellow-eyed Grass



Algae in freshwater barrier ponds

There are many different types of freshwater algae. They range in size from single cells, to cells that are joined to form long strings or filaments, to a large green algae called stonewort. Some freshwater algae actually have the ability to adapt to low levels of salinity and live and reproduce under such conditions. (*Microcystis aeruginosa*, *Pediastrum boryanum*)

All types of algae convert the sun's energy into food and oxygen. Sometimes minute algae multiply so quickly that they cloud the water, creating an algal bloom. As they decay and decompose they actually deplete the water of oxygen and can cause a 'summerkill' of plants and animals.

Algae in a marine environment are often called seaweed. For more information on seaweed refer to Module 1: Introductory Module, and Module 7: Rocky Shores.

Molluscs

Snails, clams, and mussels are abundant in freshwater. The appearance of freshwater snails in freshwater barrier ponds can be a clue to the water quality, because freshwater snails do not survive in brackish water.

Molluscs live in the sediments of the pond and on aquatic plants. Some molluscs filter the water for food, others graze on microscopic algae or prey on other tiny creatures. Molluscs are food for different kinds of fish, birds, and animals such as raccoons or mink.

For more general information on molluscs and filter feeders refer to Module 1: Introductory Module, and Module 13: Activities.

Eastern Elliptio Mussel



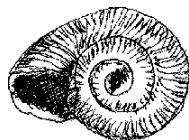
The Eastern Elliptio is abundant and lives in shallow water of permanent ponds. It can be found on gravel, clay, sand, or mud bottoms. The yellow perch is the host for the glochidium (larva).

Ubiquitous Pea Clam

The Pea Clam is the most widely distributed species of freshwater molluscs. It lives in ponds, lakes, rivers, small streams, ditches, swamps, and even temporary water habitats. 5 mm long.



Bell-mouthed Ramshorn Snail



This very common snail occurs in the slow moving waters of lakes and ponds of all sizes. It gets its name from its bell-shaped aperture. The living animal inside is reddish brown or blackish and slow moving. The shell has 7 whorls. Shell 15 mm wide, 6 mm high.

Flatly Coiled Gyraulus

This snail lives in ponds with thick vegetation and mud bottoms. The shell has 4 whorls. Shell 5 mm wide, 1.5 mm high.



Parasitic mollusc in Freshwater Lake, Cape Breton

At Freshwater Lake, a freshwater barrier pond in Cape Breton Islands National Park, there is a type of mussel called the Alewife Float (*Anoda implicata*) that hosts a specific larval parasite on Gaspereau fish. The larval stage of the mussel is called the glochidium. These tiny glochidia cling to the gills or fins of fish. In Freshwater Lake they are parasitic on Gaspereau. Eventually they drop off and settle in the bottom sediments of the pond to begin the next stage in their life cycle. (For a description of the life cycle of mussels refer to Module 3: Estuaries.)



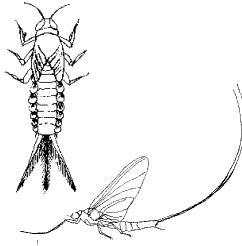
Alewife Float

glochidium



Insects and Spiders

The immature stages of many insects - larvae, pupae, and nymph - are abundant in freshwater ponds and play a vital role in the food chain. In barrier ponds the diversity of aquatic insects can be somewhat limited, depending on the level of salinity. Many insects do not survive in salty environments.

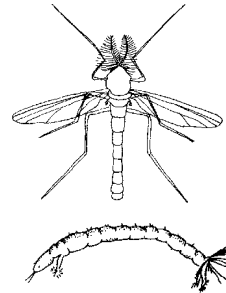


mayfly nymph and adult

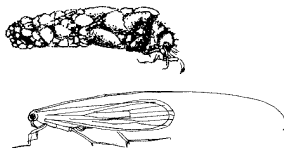
Mayflies spend most of their life as aquatic nymphs (naiads) in the pond waters. They eat microscopic green plants and organic debris. When they emerge as adults they live for only a couple of days. The nymphs are an important source of food for fish. 3-11 mm long, excluding the tail filaments.

midge, adult and larva

Midges are often mistaken for mosquitoes, but unlike mosquitoes they do not bite. When resting, they hold their wings out to the side, rather than folding them over their back like mosquitoes. Some midges are tolerant of saline water. The larvae live at the bottom of the pond where they eat decomposing plants. They are an important source of food for fish. Adult 1-10 mm long.



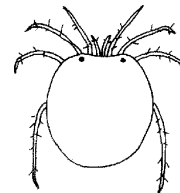
caddisfly, adult and larva



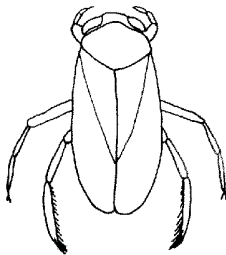
Most of a caddisfly's life is spent as a larva in the pond waters. The larvae are ingenious architects and build protective cases out of twigs, leaves, mud, or sand. From inside their cases they reach out and grab any food that happens to be within reach. Caddisfly larvae are a very important source of food for trout. Adult 14-25 mm, larva 20-27 mm long.

water mite

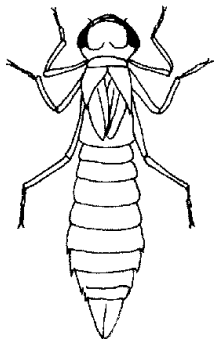
If you see a tiny flash of red swirling around in the pond waters then you have discovered a water mite. Water mites are actually not insects, but belong to the arachnids. They live in freshwater ponds amongst the floating plankton or along the shore. They eat tiny worms, crustaceans, and insects. 3 mm.



water boatman



Water boatmen are best known for their ability to manoeuvre like a boat. They have elongated, oval bodies and use their long middle and hind legs as oars to paddle themselves around the pond. Their short forelegs are used to collect food such as algae and other tiny submerged food particles. Adults can fly but are usually seen swimming on the surface of the pond. 5-13 mm long.

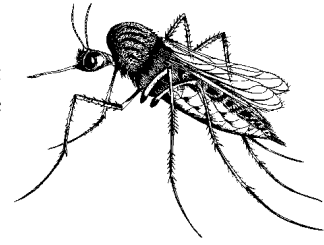


dragonfly nymph

The dragonfly's long slender abdomen has prompted insect watchers to give it other names. 'Horse Stinger,' 'Devil's Darning Needle,' and 'Mosquito Hawk' are commonly used to describe these powerful hunters of the pond. Adult dragonflies, when resting, hold their wings in a horizontal position. The nymphs are large, awkward looking creatures who feed on other aquatic insects, tadpoles, small crustaceans, and even fish. The adults (take heart) eat mosquitoes and deer flies. Wingspan up to 150 mm.

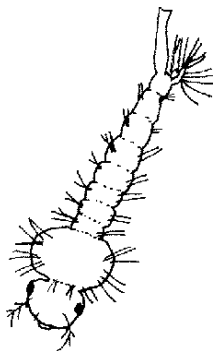
mosquito

The larvae and pupae of mosquitoes circulate throughout the pond. Some mosquitoes, even though they like to live in fresh water, are capable of surviving an inundation of salty water. The Salt Marsh Mosquito lives in brackish and salt water. 6 mm long.



Mosquito life cycle

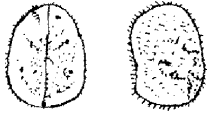
Those little creatures with the nasty bite and irritating buzzing sound have quite a fascinating life cycle. Before the female lays her eggs she must obtain that inevitable meal of blood with which we are all too familiar. She then lays her eggs on the water's surface or a nearby plant. The eggs turn into larvae, often called 'wigglers' due to their quick movements to escape danger. Larvae breathe through gills at the end of their abdomens. Eventually the larvae change into pupae. A pupa looks like a comma with a bulging head and thorax combined, and a slender abdomen. The pupae do not eat but continue to move about. They also have a nickname to describe their quick movements and are called 'tumblers.' When the pupae are mature the pupal case splits open and an adult emerges.



These irritating little insects are very important in the food chain in the pond community. They are food for fish, birds, and the larvae of other aquatic insects such as dragonflies. The next time you visit a freshwater barrier pond, take a look in the water for 'wigglers' and 'tumblers.' They don't bite!

Crustaceans

Crustaceans get their name from the hard shells that encompass the outside of their bodies. Most crustacean species live in salt water, but some inhabit brackish and freshwater ponds. With the aid of a magnifying glass many of these tiny crustaceans can be observed.

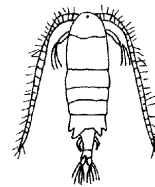


seed shrimp

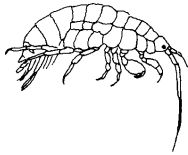
Seed shrimp are tiny clam-like crustaceans found in fresh water. They are scavengers and are eaten by small fish. Look for them around the pond vegetation and in the mud. Less than 1.5 mm.

copepod

Copepods are small crustaceans (1.5 mm long) found in brackish and freshwater ponds. They feed on algae, bacteria, and organic debris. The larvae or nauplius can be quite different in appearance from the adult. They pass through several nauplius stages before reaching maturity. During breeding season the female carries two egg sacs, one on each side of her body.



amphipod



Amphipods or scuds are active crustaceans. They live in brackish and freshwater ponds. Observing amphipods is a bit like watching acrobats at the circus. If you watch closely you will see them swimming on their sides, leaping out of the mud at the edge of the pond and scurrying underneath things when disturbed. Look for them around submerged objects and in the mud at the bottom of the pond. Here they scavenge on plant and animals debris and are food for fish. Up to 10 mm.

Worms

Many different types of worms can be found in freshwater ponds and brackish water. They are an important source of food for crustaceans, fish, and birds.

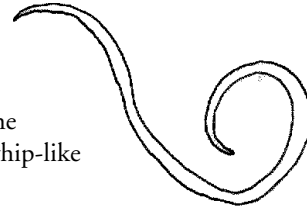


terebellid worm

The terebellid worm lives in a tube that it makes out of detritus and mud. It has many white tentacles which it uses to capture detritus at the surface or the bottom. To 25 cm.

nematode

Nematodes are round worms that live in the mud at the bottom of the pond. They can be identified by their whip-like thrashing motion. 1.5 mm long.



Some strange invertebrates of ponds

Rotifers



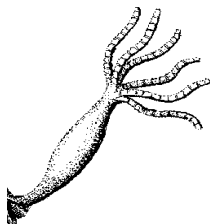
Rotifers are found in quiet waters. These tiny microscopic animals get their name from the rotating movement of the hair-like projections at the front of their bodies.

Protozoa

These one-celled microscopic animals can be found in great numbers in freshwater ponds. They reproduce by budding from the parent to create a new protozoa, or by a fusion of cells or cell parts. They are food for rotifers and small crustaceans.



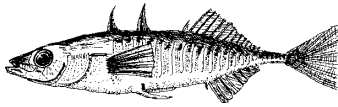
Hydra



These small animals can be identified by the way they move. They somersault through the pond water. At one end of their body they have tentacles. They use special cells in their tentacles to capture food. At the other end of their body they have a 'foot' which they use for inching along or doing somersaults.

Fish

The fish that are the most successful in brackish water can adapt to varying degrees of salinity, temperature, and oxygen. Sticklebacks and Mummichogs are excellent examples. Others such as the Gaspereau will actually enter a pond to spawn through a small outflowing creek. After spawning they will leave the pond to return to the sea.

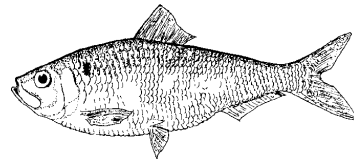


Threespine Stickleback

Sticklebacks are named for their sharp spines. They live in freshwater barrier ponds that have an influx of salt. They are well-adapted to changes in salinity. To 10 cm.

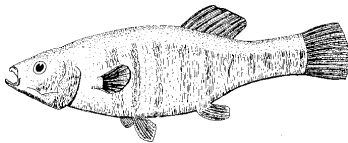
Gaspereau

The silvery body of the Gaspereau is compressed sideways. It can measure up to 30 cm.



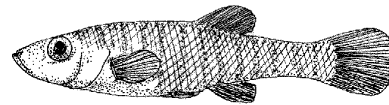
Mummichog

Mummichog can be found in freshwater barrier ponds, salt marshes, and estuaries. They have a rounded tail and dark vertical bands the length of their body. They feed on mosquito larvae, among many other things. 13 cm.



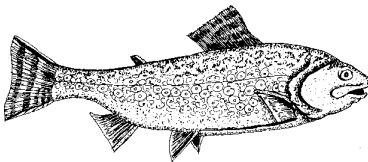
Killifish

Killifish are similar to Mummichog. Males have vertical black stripes, and females have horizontal stripes. Breeding males have bright orange bellies. 13 cm.



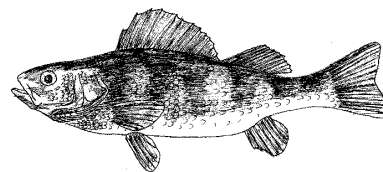
Brook Trout

Brook Trout live in some freshwater barrier ponds especially if there is an inflowing stream. They are native to the cold waters of Eastern North America. Up to 39 cm.



Yellow Perch

Yellow Perch are a freshwater species. They enter freshwater barrier ponds by travelling up streams that flow into the pond. Ducks and Great Blue Herons actually help perch to colonize by carrying their eggs to the pond on their muddy feet. Perch feed on smaller fish and crustaceans. Up to 40 cm.



Amphibians

Ponds that consist of only fresh water provide excellent habitat for a wide variety of amphibians (frogs, toads, salamanders) and reptiles (turtles). The frog chorus can be resonant in the early spring.

In barrier ponds salinity is a restricting factor. Amphibians in particular are sensitive to salt. The most resilient amphibian that can deal with the stress of salt is the American Toad. They are frequently observed in freshwater and brackish water ponds as well as at the upper ends of salt marshes. Snapping Turtles have also been observed in brackish water where the freshwater vegetation is appropriate. When a pond evolves from a brackish to a freshwater ecosystem the diversity of amphibians and reptiles increases.

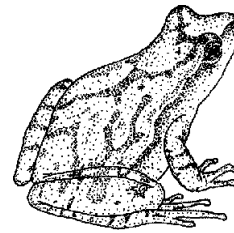


American Toad

American Toads inhabit brackish and fresh water. They mate in the pond in the spring and lay long strings of eggs. The eggs turn into tadpoles and can often be seen swimming in the pond waters. When the tadpoles become adults they leave the pond for a terrestrial life. 5-10 cm.

Spring Peeper

In the spring it is easy to identify the 'peep-peep-peep' call of the Spring Peeper. Surprisingly enough, these hardy frogs can inhabit ponds that have a certain percentage of salt. The spring peeper is actually a member of the tree frog family, which only comes to the pond to mate. It is seldom seen except during breeding season. 4 cm.



Amphibians in brackish ponds

A study done in the freshwater barrier ponds of Prince Edward Island National Park made a surprising discovery. Amphibians were found in the ponds that were behind a string of dunes. In the pond with the highest salinity, Covehead Pond, American Toads were found living right out in the brackish water. Spring Peepers were also found especially in areas of the pond where there was a freshwater source such as a spring. Green Frogs and Leopard Frogs appeared to tolerate the least amount of salinity, but were present when the conditions were right.

Spring Peepers have also been found in a brackish pond near Rivière de Portage, New Brunswick.

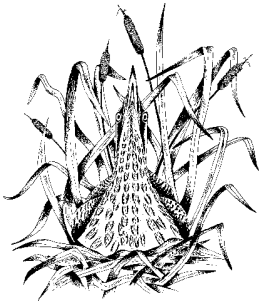


Birds

Freshwater barrier ponds provide a prime habitat for a variety of birds, particularly waterfowl. They come to the pond to rest, feed, and nest in the shelter of the tall emergent plants.

Bird watching near a freshwater barrier pond provides many interesting sightings. Swallows can be seen skimming the pond looking for insects. Great Blue Herons stand upright stalking for food. Kingfishers hover over the water and plunge in to dive for fish. Around the edges of the pond small perching birds such as Swamp Sparrows and Common Yellowthroat nest and search for food.

Freshwater barrier ponds also provide a haven for some rare and endangered species. In the Magdalen Islands, for example, the Horned Grebe, which is a vulnerable species in Quebec, breeds in the freshwater barrier ponds.

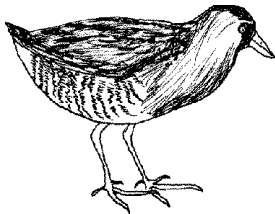


American Bittern

The American Bittern is a stocky brown heron with a long, pointed bill. It likes to nest at the base of cat-tails. When startled it stands rigid with its bill pointed upward. 58 cm.

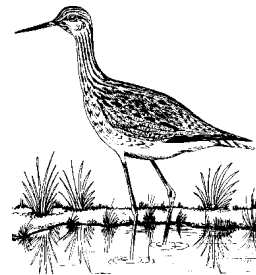
Greater Yellowlegs

The Greater Yellowlegs is a slim, grey sandpiper with yellow legs. It feeds and rests in freshwater barrier ponds during its migratory flight. Listen for its 'dear-dear-dear' call. 35 cm.



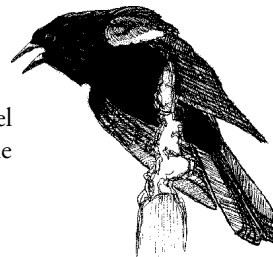
Sora

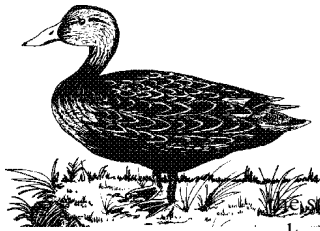
The Sora belongs to the family of rails, and resembles a chicken. It is a bird that is more often heard than seen. Its cry is a plaintive rising 'ker-wee,' a sharp 'keek,' or a descending whinny. 20-24 cm.



Red-winged Blackbird

The 'o-ka-lee' call of the Red-winged Blackbird is common in ponds. They are very gregarious and travel and roost in large groups. They build their nests in the cat-tails or reeds. 18-24 cm.



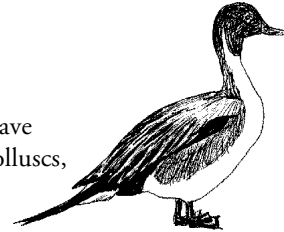


American Black Duck

The Black Duck can be identified by its metallic violet wing patch. It is a surface feeding duck and eats aquatic plants, seeds, grass, and insects. Occasionally it tips up to reach food just below the surface. It is one of the few species of ducks that can breed in salty environments. 53-63 cm.

Common Pintail

Pintails are graceful fliers. Both the male and female have a pointed tail, slender neck, and grey bill. They eat molluscs, crustaceans, and insects. 65-75 cm.



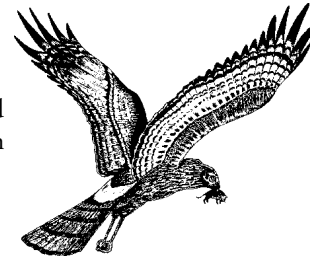
Blue and Green-winged Teals



Both teals are surface feeders and fast fliers. The Blue-winged Teal is identified by the blue patch on the forewing. The Green-winged Teal can be identified by the lack of a light wing patch. Blue-winged 38-40 cm. Green-winged 35 cm.

Northern Harrier

The Harrier (Marsh Hawk) is a slim, medium sized hawk with a white rump patch. It hunts for mice in the open country around freshwater barrier ponds. 44-60 cm.



American Bittern

American Bitterns are well-known for their unique call. They make an unusual pumping sound, 'oong-KA-chunk' that is repeated several times in one call. The call is so loud that it can be heard up to almost a kilometre away. Unlike other herons that takeoff and fly away when approached, American Bitterns choose to freeze. If you approach a bittern it will raise its head and point its bill upward. It then proceeds to imitate waving cat-tails or reeds by moving slowly from side to side. The bittern's striped breast helps it to blend in with the surrounding environment. The eyes of the bittern are well placed for this 'freezing' action. When its bill is pointed upward it can see directly in front at the approaching visitor. When the bill is pointed forward it can look down for food swimming in the pond.

It looks just like a...

The unusual habits of the American Bittern have inspired some interesting nicknames in the Maritimes and throughout North America. The next time you visit a freshwater barrier pond and see a bittern, try and decide which name best suits the bird you are observing: stake-driver, marsh hen, sky gazer, thumper pump, bog-trotter, butter-bump, thunder-pumper, or water-belcher.

Mammals

The freshwater barrier ponds that are composed of fresh water provide a source of water for many mammals. Animals also come to the pond to look for food and shelter. Raccoons search for fish, frogs, and molluscs. Mink feed on fish and even muskrats. Deer and Moose come to not only drink but also feed. In the brackish ponds they look for salt and seaweed. Muskrats live in freshwater and brackish ponds year-round. Fox encircle the edges of the pond looking for mice. In the winter months their tracks can be seen in the snow exploring the winter landscape of the pond.



Muskrats

Muskrats use cat-tail leaves and mud to build their above-water dens or they burrow holes in the banks of the pond near the water line. Their above-water dens look like miniature beaver lodges and have one or two chambers and an underwater entrance. Look for these cat-tail mounds rising out of the pond water. Muskrats eat bulrushes and frogs. About 60 cm long.

Canada's national symbol in freshwater barrier ponds

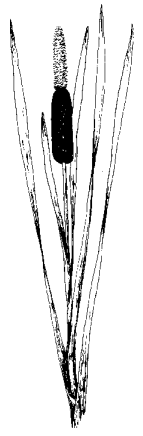
Beavers can be found in some freshwater barrier ponds that have developed into true freshwater ecosystems. In Cape Breton Islands National Park, for example, a colony of beavers is found in a small freshwater barrier pond that occasionally receives salt from sea spray during storms. Beavers build their lodges in freshwater ponds and feed on the bark and twigs of poplars, birches, and willows that grow on the landward side of the pond. The beaver kits are born in the lodge in spring. The young kits weigh 0.5 kg and will grow to weigh 18 kg when they are adults.



ECOLOGY

Stress and Survival

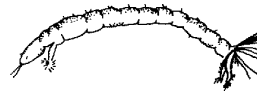
Freshwater barrier ponds share the same stresses as inland freshwater ponds. All ponds experience the stress of fluctuating temperatures and a potential lack of oxygen. Some freshwater barrier ponds have the added stress of salt. Animals and plants adapt to these extremes.



Adapting to life in a freshwater barrier pond

Life in a pond is full of extremes. There is plenty of water in places, but not always an endless supply of warmth or oxygen. There is plenty of sun, but it does not shine on all things equally. As a result, whoever colonizes the pond first and adapts to extremes in oxygen and temperature survives.

Some insects have ingenious ways of adapting to low levels of oxygen. They inhabit the surface and breath directly from the air. Others like the water boatmen rise up to the surface and trap a bubble of air to use like a diver's oxygen tank. Midge fly larvae pierce plant stems to obtain oxygen.



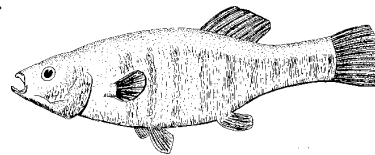
midge fly larva

Submerged aquatic plants adapt to fluctuating oxygen levels by having many air spaces on their leaves and stems so that they can absorb more oxygen from the water.

Salt affects the diversity of plant and animal life. Only those species that can survive varying degrees of salinity inhabit brackish freshwater barrier ponds.

Mummichogs are a good example of a salt-tolerant species.

Not only are they well-adapted to salt, but also to changes in temperature and oxygen levels.



Mummichog

Muskrats with their waterproof fur and partially webbed feet are well-adapted to an aquatic life. They also adapt well to an influx of salt water. In freshwater ponds they build their lodges out of cat-tails but if the water becomes too brackish and the cat-tails don't survive, they use sedges and rushes as a building material.



Productivity

Ponds are typically most productive in the spring when plant growth increases. As the water warms up there is an awakening of creatures in and around the pond ecosystem. Small aquatic insects circulate throughout the pond waters and become food for fish and birds. Migratory birds return to feed, waterfowl to nest, and mammals such as muskrats set up housekeeping.

Food Web

Food webs in freshwater barrier ponds are difficult to determine, due to the individual characteristics of each pond.

Despite this they all have one element in common concerning the development of their food webs. Food webs in all ponds can ultimately be traced back to green plants, the primary food producers. All green plants, from the tiny microscopic phytoplankton to the large emergent cat-tails, derive their energy from the sun to produce food. Energy moves from the plants outward. Herbivores such as small crustaceans and mayfly nymphs eat plants and in turn are eaten by carnivorous dragonfly nymphs and fish. These carnivores are eaten by larger carnivores.

Defining a food web in a pond is like putting together a puzzle. As you assemble the pieces, one by one, you will discover that every creature and plant in the pond has a place and all food webs begin with the green plants growing in and around the pond. When the food web puzzle is assembled many interesting relationships in the pond community reveal themselves.



Cat-tails - a popular plant in the wildlife community

The cat-tail provides food, shelter, and nesting sites for many wildlife in freshwater barrier ponds. Birds such as American Bitterns, Marsh Wrens, Swamp Sparrows, and Red-winged Blackbirds nest among their slender leaves. Canada Geese and muskrats feed regularly on the plants' underwater rhizomes.



FRESHWATER BARRIER PONDS AND US

Freshwater barrier ponds are important to people in providing a unique freshwater ecosystem to explore close to the ocean's shore. Here you can observe nature in action and look for plants and animals that may not live beyond the barrier that keeps the sea out.

Freshwater barrier ponds also provide a source of food. In the past, native peoples and early settlers discovered many ways to eat the cat-tails. The food value of cat-tails equals that of rice or corn. The starchy root stalk was ground into flour. The young stalks were eaten like asparagus, the immature flower spikes were boiled and eaten like corn on the cob, and a salad was made from the tip of the root stalk. The fibres of the plant were also used as a building material. The root was used as a natural oakum for caulking leaks in boats. The leaves were used to make floor mats and bottoms for chairs. Cat-tails were truly nature's supermarket, providing a variety of culinary delights and building materials.

Today people continue to enjoy food from some freshwater barrier ponds. Not only do they experiment with edible plants found in and around the pond but they also eat fish. In Prince Edward Island for example, Gaspereau spawn in barrier ponds and travel down streams back to the sea. People often wait for the Gaspereau to migrate and then catch them in fish traps or nets in the ocean. Gaspereau are used as lobster bait.

Problems in the Ecosystem

Like other coastal ecosystems, freshwater barrier ponds can be greatly affected by human activities. If an ecosystem close by is altered in any way it can have detrimental effects on the pond. When a barrier dune is destroyed by vehicle traffic it can severely alter the freshwater pond ecosystem located behind the dune. The pond loses its barrier of protection from the ocean and is once again at the mercy of wind and sea.



Protection of the Ecosystem

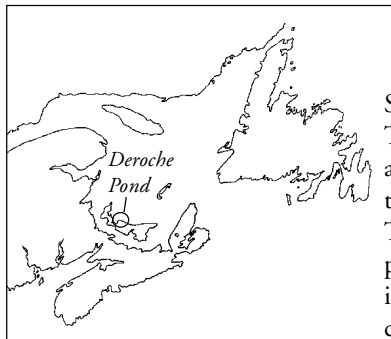
Of all our ecosystems in the coastal zone of Atlantic Canada, freshwater barrier ponds are the least studied and understood. In several provinces scientists are now doing research to better understand the geological processes at work within these ponds, the species of plants and animals that live there and how they adapt to a potential inflow of salt water.

You can help in this process. Become a guardian of freshwater barrier ponds. Begin by exploring their unique role in the coastal zone of Atlantic Canada. Work with a local naturalist group and report your findings to the various universities, provincial and federal agencies that are studying freshwater barrier ponds.

Freshwater barrier ponds provide a unique opportunity to further understand how coastal ecosystems interact with one another - how a dune, rocky shore, salt marsh, or estuary affect life in the pond. They also provide the opportunity to understand how coastal ecosystems interact with ecosystems farther inland. Freshwater barrier ponds are a stepping stone to understanding nature in your province, not only by the sea, but beyond the ocean's grasp.



The protection of one freshwater barrier pond in Prince Edward Island



Deroche Pond is a prime example of how people can work together to protect a freshwater barrier pond ecosystem. The pond is located on the North Shore of Prince Edward Island near Tracadie Bay. The area encompasses approximately 500 hectares and is part of a coastal dune/pond/wetland system that provides a very productive waterfowl habitat. The sand spit adjacent to the dune is owned and protected by Parks Canada. Much of the area is still in private hands but a significant part is provincially owned and leased to the Island Nature Trust.

Through ecological studies and education the Island Nature Trust is endeavouring to raise the awareness of the environmental importance of Deroche Pond.

SPECIES LISTS

The following lists are by no means a complete account of the organisms living in this ecosystem. Freshwater barrier ponds in the Maritimes differ greatly from each other depending on their substrate, proximity to the ocean, and marine influence. There are also great regional and local variations, and we realize the difficulty in accommodating all of these.

Plants

algae

hollow green weed

wrack

maritime lichen

marine algae

bur-reed

Three-square

Salt-marsh Bulrush

spike rush

rush

Baltic Rush

Broad-leaved cat-tail

Narrow-leaved cat-tail

Freshwater Cord-grass/Slough Grass

Widgeon Grass/Ditch Grass

sedge

pondweed

Lesser Duckweed

Star-Duckweed

sphagnum

Marsh Marigold

Bog-rosemary

Pitcher Plant

quillwort

Woodrush

Hornwort

Reed-bentgrass

Buck Bean

Arrowhead/Duck Potato

Water Parsnip

Sweet Flag

Water Smartweed

Rivularia atra

Pilayella sp.

Enteromorpha sp.

Ascophyllum sp.

Verrucaria sp.

Hildenbrandia rubra

Sparaganium sp.

Scirpus americanus

Scirpus maritimus

Eleocharis sp.

Juncus sp.

Juncus balticus

Typha latifolia

Typha angustifolia

Spartina pectinata

Ruppia maritima

Carex sp.

Potamogeton sp.

Lemna minor

Lemna trisulca

Sphagnum sp.

Caltha palustris

Andromeda polifolia

Sarracenia purpurea

Isoetes sp.

Luzula parviflora

Ceratophyllum demersum

Calamagrostis stricta

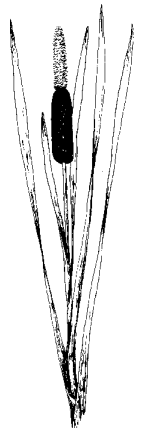
Menyanthes trifoliata

Sagittaria latifolia

Sium suave

Acorus calamus

Polygonum amphibium



bladderwort
Marsh Cinquefoil
water milfoil
Pond Lily
Giant Bur-reed
Sweet Gale
Poverty-grass
Arrow-grass
Yellow-eyed Grass

Utricularia sp.
Potentilla palustris
Myriophyllum sp.
Nuphar variegatum
Sparganium eurycarpum
Myrica gale
Corema conradii
Triglochin gaspense
Xyris montana

Molluscs

Soft-shelled Clam
Eastern River Pearl Mussel
Eastern Elliptio
Newfoundland Floater
Yellow Lump Mussel
Ubiquitous Pea Clam
Alewife Float
Ribbed Valve Snail
Flatly Coiled Gyraulus
Two-ridged Ramshorn
Bell-mouthed Ramshorn

Mya arenaria
Margaritifera margaritifera
Elliptio complanata
Anodonta cataracta fragilis
Lampsilis cariosa
Pisidium casertanulum
Anodonta implicata
Valvata sincera sincera
Gyraulus circumstriatus
Helisoma anceps anceps
Helisoma campanulatum
campanulatum

Insects

water boatman
dragonflies
midges
mosquitoes
mayflies
caddisflies
predacious diving beetle
water striders
Whirligig Beetle
giant water bug
water mites

Family *Corixidae*
Family *Aeshnidae*
Family *Chironomidae*
Aedese sp.
Family *Baetidae*
Order *Trichoptera*
Family *Dytiscidae*
Gerris sp.
Dineutus americanus
Lethocercus sp.
Order *Acariformes*

Crustaceans

seed shrimp
copepods
amphipods

Cypridiopsis sp.
Class *Copepoda*
Gammarus sp.

Worms

terebellid worm
nematode

Amphitrite sp.
Chronogaster sp.

Fish

Brook Trout
Gaspereau
Threespine Stickleback
Fourspine Stickleback
Mummichog
Banded Killifish
American Eel
Atlantic Silverside
Yellow Perch

Salvelinus fontinalis
Alosa pseudoharengus
Gasterosteus aculeatus
Apeltes quadracus
Fundulus heteroclitus
Fundulus diaphanus
Anguilla rostrata
Menidia menidia
Perca fluviatilis

Amphibians

American Toad
Spring Peeper
Green Frog
Leopard Frog

Bufo americanus
Pseudoacris crucifer
Rana clamitans
Rana pipiens

Birds

Common Loon
Black Duck
Mallard
Kingfisher
Sora
Lesser Yellowlegs
Greater Yellowlegs
Great Black-backed Gull
Herring Gull
Ring-billed Gull
Common Tern
Northern Harrier
Great Blue Heron
Black-crowned Night Heron
Merlin
Common Pintail
Pied-billed Grebe

Gavia immer
Anas rubripes
Anas platyrhynchos
Ceryle alcyon
Porzana carolina
Tringa flavipes
Tringa melanoleuca
Larus marinus
Larus argentatus
Larus delawarensis
Sterna hirundo
Circus cyaneus
Ardea herodias
Nycticorax nycticorax
Falco columbarius
Anas acuta
Podilymbus podiceps

Horned Grebe
American Bitten
Red-winged Blackbird
Common Yellowthroat
Swamp Sparrow
Green-winged Teal
Blue-winged Teal
Double-crested Cormorant
Bank Swallow
American Wigeon

Podiceps auritus
Botaurus lentiginosus
Aeglaia phoeniceus
Geothlypis trichas
Melospiza georgiana
Anas crecca
Anas discors
Phalacrocorax auritus
Riparia riparia
Anas americana

Mammals

Muskrat
Beaver
Raccoon
White-tailed Deer
Moose
Red Fox
Mink

Ondatra zibethicus
Castor canadensis
Procyon lotor
Odocoileus virginianus
Alces alces
Vulpes vulpes
Mustela vison