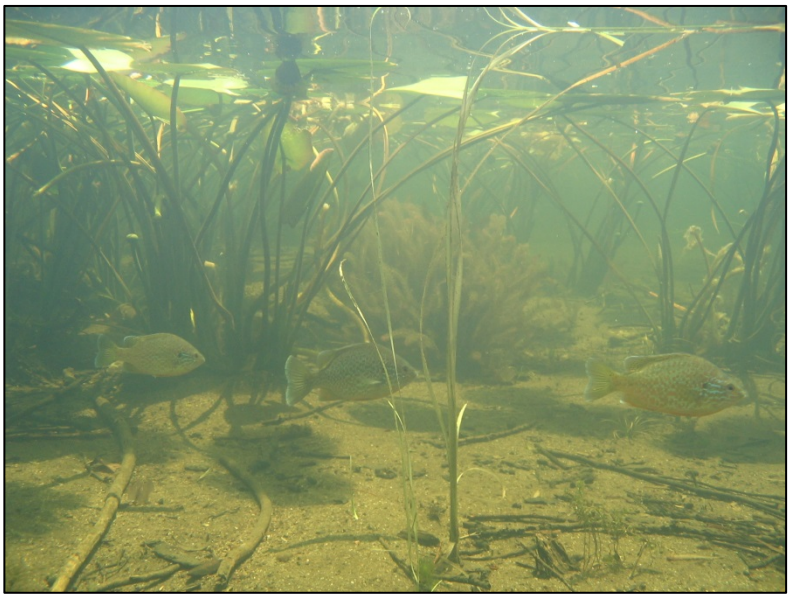
Littoral Habitat Education Display

Presenter Guidance Document

Federation of Vermont Lakes and Ponds



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Purpose

The Federation of Vermont Lakes and Ponds commissioned the development of this education display to help convey the components and importance of **littoral habitat**[1] in lakes and ponds. Littoral habitat is defined here as the natural structures in the lake, near shore, which life in lakes and ponds require for at least one part of their life cycle, recognizing that habitat needs may change throughout an organism's life. This presentation covers the basic structure and function of littoral habitat ecosystems, as well as the relation of littoral habitat to shoreland vegetation.

Target Audience

Primarily adults and lake associations. May be adapted for younger audiences if necessary.

Overview & Over-arching Themes

The module contains representations of each of the key components of a littoral habitat ecosystem common in Vermont Lakes. For each habitat component, the presenter will discuss:

- The importance of each habitat component to the lake ecosystem;
- The aquatic animals that depend on that habitat type;
- How that habitat type is connected to shoreland vegetation; and
- How the habitat type is lost with loss or degradation of shoreland vegetation.

The presentation will conclude with a discussion of the specifics of shoreland vegetation management.

Module Components (*See graphic below*):

1. Large Hard-shell case (For transport and display)
2. Fake tree branch (simulates overhanging vegetation)
3. Overhead Lamp and thermometer inside case (to simulate sun and warming effect of no vegetation)
4. Large woody structure (Coarse woody habitat – habitat for small and large fish)
5. Bundle of sticks (Medium/fine woody habitat – food and habitat for variety of organisms)
6. Leaves (leaf pack habitat – food and habitat for shredder organisms)
7. Cobble stones (habitat for macroinvertebrates and fish eggs)
8. Native plants and soft-bottomed habitat (food and habitat for macroinvertebrates, nursery grounds for young fish)

[1] All terms in **bold** are defined in the glossary at the end of this document.

Outline of Presentation:

- Begin with a discussion of littoral habitat. Questions to pose to the audience and guide discussion:
    - What do you find in the shallow areas of lakes?
        - Possible Answers: Logs, sticks, leaves, rocks, plants
    - How do aquatic animals (fish, frogs, turtles, aquatic insects, crayfish) use these structures?
        - Possible Answers: habitat (protective cover or nest-building materials), food (plants, substrate for algae, predation territories, etc.)
    - How are these structures tied to human use of the shoreland zone?
        - Possible Answers:
            - Logs, sticks, leaves all come from natural shoreland vegetation (buffers).
            - Shoreland plants also absorb nutrients and slow erosion, which keeps sediment out of the lake. Excess sediment can smother rocky habitats.
            - Cleared vegetation allows for more light in the littoral area, which may stimulate plant growth.
    - As the various components of littoral habitat are discussed, point them out in the display case. Talk about why each component is important to support the diversity of life in lakes and ponds.

- Pass out aquatic organism cards:
        - Adult fish
        - Juvenile fish
        - Aquatic insects (dragonflies, mayflies, caddisflies, beetles, midges)
        - Reptiles & Amphibians
        - Native plants
        - Non-native plants
        - Biofilm (aufwuchs)
    - After you discuss the role of each component in the littoral habitat zone (proceeding through the outline below), ask people to hold up the cards of organisms that use that habitat component. Call on individuals that hold up cards to discuss the relation of their aquatic organism group to each habitat component. <u>There will be almost no wrong associations</u>. Feel free to add to answers if something important is being overlooked.

- The presentation will proceed with a discussion of each component and how they relate to aquatic life and shore land use patterns, hopefully reinforcing the ideas discussed in the opening dialogue. Each component of the display will be removed as it is discussed (outlined below). The discussion will focus on how each component supports the functioning of the littoral zone (food, habitat, etc.), and why removing shoreland vegetation results in the alteration of littoral habitat.

    - The presentation will begin by discussing the large branch (2) and how it shades the water and keeps it cool. The starting temperature will be recorded (have someone in the audience write it down) using the thermometer inside the case. The starting temperature will be

used for comparison at the end. The branch is then removed; the light (3) is left on (clipped to the lid on the case – lid not pictured).

- The components are removed and discussed individually. Each component will have a corresponding 2-sided 8.5x11" card with it, to be held up and/or be displayed digitally on a large screen. Photos will have talking points on the back to prompt the presenter. (If the display is used as a stand-alone exhibit, these cards may provide information for a "self-guided tour" of the display.
  - Coarse Woody Habitat (4)
    - This component includes logs over 6" wide. **Coarse Woody Habitat (CWH)** provides structure for all **aquatic organisms**, from **macroinvertebrates** to algae and young and adult fish. Most notably, larger fish. CWH also provides protective cover for fish from avian predators like Great Blue Herons and Osprey. CWH that breaks the water's surface provides important basking areas for turtles. Larger structures provide substrate for the growth of **biofilm**, an important component of the food web in lakes.
      - *Presenter action: ask which aquatic organisms use CWH and how*
    - Land Use: CWH Lost from the littoral area because of lack of shoreline trees or removal by humans
      - *Presenter action: Coarse Woody Habitat is removed from module*
  - Small Woody Habitat (5)
    - This component includes branches and sticks. It provides habitat structure for **macroinvertebrates** and smaller fish. May provide forage for some **shredders** like crayfish.
      - *Presenter action: ask which aquatic organisms use small woody habitat and how*
    - Land Use: Lost from the littoral area because of lack of shoreline trees or removal by humans
      - *Presenter action: Woody Structure is removed from module*
  - Leaf Packs (6)
    - Leaves from shoreline trees. Important component of the **food web**; shredders like crayfish and aquatic insects begin the decomposition process; fine leaf particles not ingested by shredders are eaten by other aquatic organisms. Also provides habitat for certain species, especially aquatic insects like dragonflies.
      - *Presenter action: ask which aquatic organisms use leaf packs and how*
    - Land Use: Lost from the littoral area because of lack of shoreline vegetation
      - *Presenter action: Leaf pack is removed from module*
  - Rocky Substrate (7)

        - Rocks ranging in size from gravel to boulders. Provides important habitat for a large number of aquatic insects like **mayflies**, **caddisflies** and **dragonflies**. Many fish use gravel or cobblestones to build nests for breeding sites; some species of fish lay eggs in the spaces between rocks (called "**interstitial spaces**").

> *Discussion opportunity*:
> **What do people know about dragonflies?**
>
> If audience is large, have people pair or group up to discuss and then report out to the group. Many possible interesting discussion topics, including:
> - Dragonflies and damselflies (order Odonata) can live several years as aquatic macroinvertebrates, before emerging as winged adults. The adult phase usually lasts about a month, though some species live longer.
> - Odonates emerge to feed and breed. Male and female pairs of Odonates are often seen flying together; they are courting, breeding, or laying eggs.
> - Odonates are significant predators of mosquitoes and other flying insects.
> - Odonates generally live in cleaner waters; this makes them sensitive to changes in habitat and water quality problems.

        - ➢ *Presenter action: ask which aquatic organisms use rocky habitat and how*
    - Land Use: Rocky substrate is lost as viable habitat from the littoral area because of increased erosion due to removal of vegetative buffer. Fine sediment and sand, now eroding into the lake, smothers rocks and fills in interstitial spaces between rocks. Oxygen cannot reach those small habitat spaces, invertebrates cannot live there and fish eggs will die.
        - ➢ *Rocks are not removed, but covered up with a sand representative (brown felt) to show loss of habitat.*
- Native Plants (8)
    - Important habitat and cover for fish, birds, amphibians and aquatic insects, especially dragonflies. Provide critical nursery areas for young fish. Stabilize lake bottom, creating firmer substrate.
        - ➢ *Presenter action: ask which aquatic organisms use plant beds and how*
    - Land Use: Increased sunlight will allow for proliferated growth of aquatic plants. Increased disturbance from runoff and erosion due to lack of buffer may allow for invasives to move in.
        - ➢ *Native plants are removed and/or replaced with invasive plants, or some native plants are removed and a mix of native and invasives remain.*

- Once component discussion is complete, the ending temperature is checked against the starting temperature. This will illustrate the higher water temps in littoral areas without shading vegetation.

- Presentation then moves into discussing buffer widths and why width matters. Handouts will be passed out for workshop attendees to keep, and will be used as the outline for discussion. Width discussion will follow the graphic below from the Vermont Department of Environmental Conservation (VT DEC).

- The handout also includes a property self-evaluation for people to use. It's really just to give participants some guidelines for assessing the quality of lakeshore buffers.

➢ *Possible questions to initiate discussion – all subject matter here is included on the handout with the figure below:*
  - ➢ *Why do you think FOVLAP urges lakeshore property owners to replace lawns with bushes and trees?*
  - ➢ *How wide should a lake buffer be? Why so far?*
    - ➢ *(Generally, 100 ft. is the most widely-accepted answer)*
  - ➢ *What is the benefit of native vegetation on lakeshores?*
  - ➢ *Why are lawns on the immediate lakeshore bad for lakes? What about fertilzers and pesticides?*
  - ➢ *Why are vegetated banks better for littoral habitat than retaining walls?*

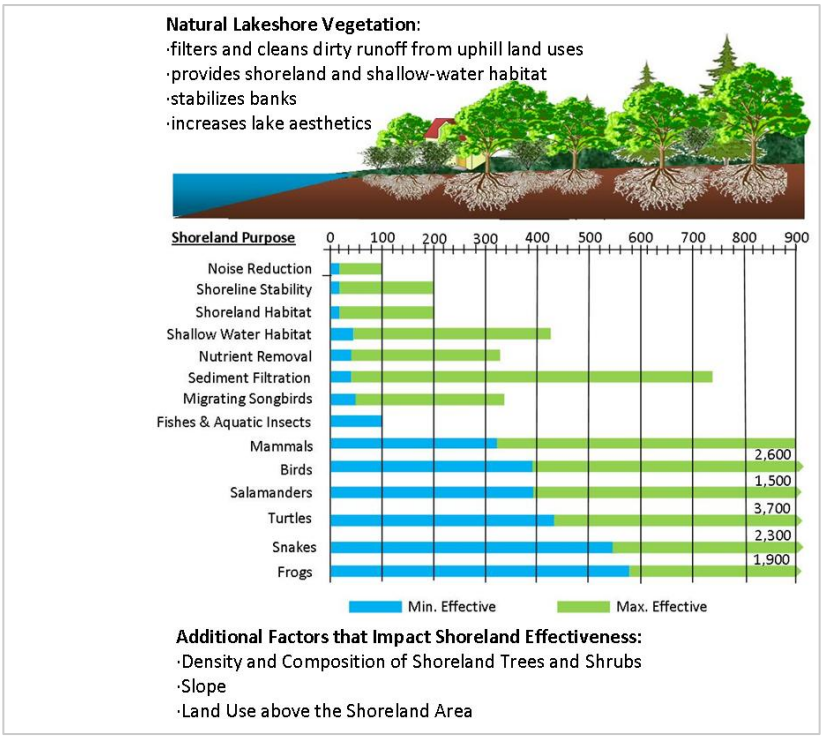

Figure 1. This figure depicts the benefits of various widths of vegetative buffers on lakeshores. The blue bars represent the minimum width a buffer needs to be to provide some benefit in each category; the green bars are indicative of the necessary requirements of each category to be in its natural state and most protected from shoreland vegetation clearing. Distances in feet. Figure courtesy of VT DEC..

GLOSSARY

Aquatic habitat – the structures that exist completely or partially in the lake that are used by aquatic organisms during any part of their life cycle.

Biofilm – also called "aufwuchs", this is the fuzzy layer of growth that can occur on hard substances like wood or rocks in lakes. It can be comprised of algae, fungus, moss and single-celled organisms. It the base of the food chain in many lakes and ponds, and is an important food source for many macroinvertebrates.

Buffer - Vegetative shoreland buffers are strips of ground covers, shrubs, and trees that are located along lakes, rivers, streams, wetlands, and ponds. They are the single most effective protection for water quality, lake ecosystems, and essential wildlife habitat. The canopy created by trees, shrubs and herbaceous vegetation moderates the impact of heavy rains, shades the shoreline to reduce water temperature, and produces organic matter and woody debris essential to shallow-water ecology (littoral habitat). Root systems give soil structure, hold soil in place, direct rainfall down into the soil instead of over the soil, and can extract nutrients and contaminates from the soil. The abundance of water and the diversity of plant communities in vegetated buffers help support a variety of aquatic and terrestrial life.

Coarse woody habitat – logs greater than one foot in diameter that provide habitat for a number of aquatic organisms

Erosion – loss of earth, mainly due to stormwater runoff, wave action or lake ice activity. When land erodes into the lake, sedimentation occurs which degrades or eliminates aquatic habitat.

Filter Feeders – Aquatic organisms that feed on small particulate matter in lake water by drawing in water, filtering out the organic matter, then expelling filtered water back into the lake. Examples: freshwater mussels (including native mussels and non-native zebra mussels).

Food web – a term used to describe the interconnectedness of aquatic organisms based on the flow of energy through the ecosystem.

Grazers - a feeding group of aquatic organisms that feeds on algae or fine particulate matter by grazing particles off of lake substrate. Examples: mayflies, caddisflies, some beetles

Interstitial spaces – the spaces that exist between rocks or other habitat components that serve as micro-habitats for many macroinvertebrates. Many species of fish also lay eggs in the interstitial spaces of rocks. These micro-habtiats are lost when they are filled by fine sediments due to erosion and runoff; sediments block light and oxygen from reaching these areas.

Littoral Habitat – the habitat that exists near the shore of lakes. The littoral zone is generally defined as the area of a lake where light can penetrate to the bottom sediments – this area can be quite large in some lakes. Habitat is loosely defined as the structures that animals use for any part of their life cycle - for protection, foraging or breeding.

Macroinvertebrates – aquatic insects (*macro* = able to be seen with the naked eye; *invertebrate* = no backbone). Aquatic insects that are common in lakes are dragonflies, damselflies, mayflies, caddisflies, some beetles and non-biting midges. Macroinvertebrates are widely used as a measure of water quality, especially in rivers and streams. They are also important food items for fish. Most species of biting insects in Vermont(such as mosquitoes and black flies) do not breed in lakes – mosquitoes most commonly breed in standing water, black flies are more common in flowing waters like streams. Common types of macroinvertebrates in lakes are:

- Beetles (order Coleoptera) – beetles are an enormously diverse group of insects, many of which have aquatic portions of their life cycle. Many beetles are predaceous and eat other aquatic insects or even small fish.
- Caddisflies (order Trichoptera) – a diverse order of insects that build their own cases from rocks, sand grains, woody pieces or plant material. They spin their own silk-like material, which they use to build their cases, and can even construct nets to catch tiny organic particles from the water. They then harvest the particles by eating the material off of the nets. Caddisflies are generally grazers, eating algae and biofilm from the lake bottom.
- Dragonflies & Damselflies (order Odonata) – can spend several years in the aquatic nymph stage, then crawl out of the lake to emerge on trees, vegetation, aqatic plants, shrubs, or in leaf litter. As both adults and aquatic juveniles, are important predators of other insects, especially mosquitoes.
- Mayflies (order Ephemeroptera) – usually spend one season as juvenile aquatic nymphs. Most mayflies are grazers, eating biofilm and algae from lake substrates. As winged adults, they live for only a few days – emerging from the lake only to breed, since they do not feed as adults. Sometimes seen in mass emergences, with thousands of insects emerging from the lake at once.

Predators - a feeding group of aquatic organisms that eats other aquatic organisms. Examples: larger fish, frogs, turtles, dragonflies, some beetles

Riparian Buffers – the vegetation (buffer) in the area adjacent to a lakeshore (riparian zone)

Sedimentation – the result of land erosion that creates and input of sediment to the lake. Sediment acts as a pollutant because it can smother the interstitial spaces that so many aquatic organisms depend on for various parts of their life cycle.

Shredders – a feeding group of aquatic organisms that feed on coarse particulate matter like leaves or wood. Important to the lake ecosystem because they break up organic matter into finer particles which makes them able to be eaten by other feeding groups, like grazers and filter feeders. Examples: crayfish, some beetles.

REFERENCES & FURTHER INFORMATION

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- VT DEC. *Water Quality Remediation, Implementation and Funding Report. Part II: Lake Shoreland Protection and Restoration Management Options*. Vermont Department of Environmental Conservation, Montpelier, VT. 2013.
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Webpages:

- Federation of Vermont Lakes and Ponds (FOVLAP): http://vermontlakes.org/
- VT DEC, Lakes and Ponds Management and Protection Section: www.vtwaterquality.org/lakes.htm