Shallow Lakes and Ponds Are Similar

Shallow Lake Goal:
Clear water and macrophytes.

Clear

Turbid
Aquatic Plants Are Key

(Use the 40% Rule)
Web of Interactions in a Shallow Lake or Pond
Watershed Projects Are Essential

- Phosphorus fertilizer restrictions
- Rain gardens
- Stormwater ponds
Biomanipulation Is One Strategy

Biological manipulation within a lake can occur at several levels.
Watershed Projects:
Metro Area: Land of 10,000 Ponds

Stormwater Ponds Act Like Shallow Lakes

Can they be a neighborhood resource and still remove TP?
Could Fish Be a Factor In Stormwater Ponds?

(top-down effects)
Stormwater Ponds 2 to 4 feet Deep.

*Do They Support Fish?*

Stormwater ponds sampled with mini-fyke nets.
Some Stormwater Ponds: No Fish
Some Ponds: Fathead Minnows

40 pounds per net.
Shallow Urban Lake:
Powderhorn, Minneapolis, MN

11 acres

Both
Bottom-Up and
Top-Down Approaches
Bottom-Up and Top-Down Projects
Powderhorn Lake

Microbes and fish were manipulated.
Bacteria – Algae Manipulations

Add organic carbon to enhance microbial growth and outcompete algae for phosphorus.
Powderhorn Lake

Barley Straw Was Installed (350 lbs/ac).
Fish Manipulations

Benthivores (*carp*) get the attention, but omnivores (*black bullheads, fathead minnows and bluegills*) can be factors as well.
Powderhorn Lake

Channel Catfish Were Stocked by MnDNR
(10 fish/acre for several years)
Powderhorn Lake – Secchi Disc

The graph shows the Secchi Disc Transparency (m) from 1992 to 2010. The data indicates a general trend of increased transparency over time, with some fluctuations. The transparency values range from 0.4 to 2.0 meters.
Lake Projects:
Lee Lake, Lakeville, MN

• 25 acre lake
• Barley straw (350 lbs/ac)
• Fish removal 100 lbs/ac
• Alum treatment
Lee Lake

- Anglers
  - Piscivores (largemouth bass, etc.)
    - Omnivores (small fish and minnows)
      - Zooplankton and Macroinvertebrates
        - Algae and Microbes
          - Benthivores (bottom feeders)
            - Physical-Chemical Factors (nutrients, dissolved oxygen, etc.)
              - Habitat (aquatic plants, bottom conditions, etc.)
Managing Lake Monsters

Famous Lake Monsters Around the World

• Nessie: Loch Ness, Scotland
• Ogopogo: Canada
• Champ: Lake Champlain
Any Monsters in Your Lake?
Flying Carp
Chinese Mystery Snail

Source: wikipedia
Carp
Curlyleaf Pondweed
Eurasian Watermilfoil
What Can We Do?

Non-natives don’t take over every lake.
Carp Population Dynamics And Control

1. Immigration (fish barriers, etc)
2. Recruitment (predation control of eggs and fry)
3. Mortality (removal by commercial fishing)

- Hatching
- Spawning (spawning areas not generally manipulated)

Emigration
Riley Lake–Susan Lake Carp Habitat
Foreign fish dumped into ponds, lakes are removed by traditional 'kaibori' method

War on invasive species continues

The Japan Times (4/8/14)
Curlyleaf Pondweed
Early Season Scouting Challenge: (Curlyleaf Pondweed Increases in Density)

Early (single stem)  Late (runners)

(Curlyleaf pondweed puts out runners from April to May)
Curlyleaf Pondweed in Mooney Lake

April 11, 2012
(14 acres)
Mechanical Harvesting
Herbicides

Contact herbicide
Coontail: Can be a native invasive species
Zebra Mussel Life Stages

FERTILIZATION

**Veliger (0.1-0.3 mm)**
(advanced larval stage)
Develops velum - a ciliated feeding and swimming organelle.

**Trochophore (0.1 mm)**
(ciliated larvae)
No filter feeding, short-lived.

**Shell is forming 7-9 days after fertilization.**

**Pediveliger (0.4-1.0 mm)**
(final veliger stage)
Settles onto a substrate 18-90 days after fertilization

**Metamorphosis**
(gills develop)

**Male/Female (6-45 mm)**
Live for 2-3 years in temperate water. Start producing eggs when they reach ¾ inch in length (about 6 mm).

**Juvenile (1-6 mm)**
Attach to a surface (native mussels can't do this). Spend up to 240 days before reaching maturity.
Zebra Mussel Growth Characteristics

Light Growth

Heavy Growth
Growth Factors

- Shell Formation: calcium
- Food: algae
- Substrate: rock, wood, sand
Substrate – Sand/Silt
(Moderate Growth)
Substrate – Clumps Found on Sand/Silt Bottoms
Round Lake Zebra Mussel Habitat Suitability Map

Green = limited growth (low calcium)

Blue = no growth (low oxygen)
Lake Riley Zebra Mussel Habitat Suitability Map

Yellow = moderate growth (Blue-green algae)

Blue = no growth (low oxygen)
Red Rock Lake Zebra Mussel Habitat Suitability Map

Yellow = moderate growth (Blue-green algae)

Green = light growth

Blue = no growth (low oxygen)
Mitchell Lake Zebra Mussel Habitat Suitability Map

Yellow = moderate growth (Blue-green algae)

Green = light growth

Blue = no growth (low oxygen)
Can Zebra Mussels Be Controlled? (large scale: Zequanox)
Zebra Mussel Control
(large-scale: Drawdown)
Zebra Mussel Control (small scale)

Small-Scale Control Techniques Are in progress

Zebra mussel harvester is an option.
Zebra Mussel Harvester
Zebra Mussel Harvester
Summary

• Many lakes have monsters.

• Some monsters will have a worse impact in lakes compared to other lakes.