Invasive Clams in Seneca Lake: An overview of the Corbicula fluminea (Asian Clams) Invasion, Implications on Lake Ecology, and Potential Treatments

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Abstract:

Corbicula fluminea (Asian Clams) are highly invasive freshwater bivalves that have established in most of the major waterways in the U.S. *Corbicula* were first reported in Seneca Lake in 1999, and have since been found in the Seneca River and Castle Creek outlet in Geneva. If *Corbicula* establishes in a system, they can have drastic effects on aquatic ecology (both biotic and structural) and water quality. In light of recent nutrient loading in Seneca Lake and concerns about changing water quality, this study examines the dynamics of the *Corbicula* invasion, their potential ecological effects, and current treatment methods. In Seneca Lake, *Corbicula* will likely function to reduce waterborne nutrients and limit the effect of external nutrient loading. However, if nitrogen and phosphorus levels drop and Seneca becomes more oligotrophic, *Corbicula* will take nutrients from the sediment and excrete nutrients in to the water column. This would contribute to nutrient loading and would be a detriment to water quality. Eradication methods vary in magnitude from expensive benthic barriers and suction harvesting to lowering lake levels and introducing natural biologic controls. Advised future action includes a complete lake survey to determine the extent of invasion, and studies on the feeding characteristic of *Corbicula* in Seneca Lake.

Ecological Implications:

Positive effects:

- **High filtration rate while filter feeding can remove nutrients from the water column, reducing eutrophication and the effects of nutrient loading.**
- Provide a food source for benthic and pelagic feeding species such as Lake Sturgeon
- High densities of dead shells create habitat for benthic organisms

Negative effects:

- Compete with native species for resources and habitat space.
- Decrease populations of native phytoplankton and zooplankton.
- **Excretion of nutrients from sediment through pedal feeding can contribute to nutrient loading in low nutrient environments.**
- Promote algal growth with increased nutrient levels and mass die-offs.

The Asian Clam (*Corbicula fluminea*)

- Small fresh water bivalves (< 55mm)
- Highly invasive due to:
- Flexible nutrient uptake
  - Filter feeding and Pedal feeding
- High reproductive rate and mobile juveniles
  - Sexual reproduction or self-fertilization
  - Multiple reproductive events/year
  - Fecundity > 68,000
  - Veligers suspend in water and can be transported by currents or humans/animals
- Environmental tolerance:
  - Temperature: 2 – 30 C
  - Depth: 2 – 40m (most common 3-10m)
  - Wide range of sediment and flow rate

Eradication Efforts:

Lake George-

- Invaded 15 acres in 4 areas in 2010 - 2011
- 50' by 7.5' PVC benthic barriers ~ 10 acres (Lake George Village and Norowal Marina)
- Suction Harvesting (Middleworth Bay)
- Cost > $630,000 (2011)
- Plans for 15 acres in 2012

Lake Tahoe-

- Similar to Lake George – oligotrophic
- In planning stage – looking at similar treatments.
- showed experimentally the negative effects on the water quality.

Owasco Lake-

- Lowered lake level in hope of freezing colonies living in shallow water
- Not successful due to warm winter temperatures

Conclusions for Seneca Lake:

- With current phosphorus and nitrogen levels, *Corbicula* would likely serve as a nutrient **sink** by filtering water during filter feeding, thus reducing the effects of nutrient loading and making the water clearer.
- If nutrient loading was limited and nutrient levels declined, *Corbicula* may become a nutrient **source** and contribute to nutrient loading.
- Dense populations would provide a food source for native fish and other predators, and habitat for benthic organisms
- Populations would also compete with native organisms for habitat space and food – high feeding rates could deplete native phytoplankton and zooplankton.
- Fish such as Carp, Lake Sturgeon, and Freshwater Drum may provide a natural control.

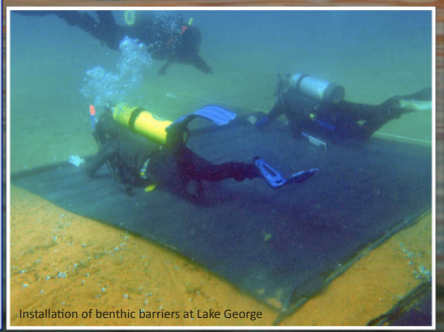
Future action:

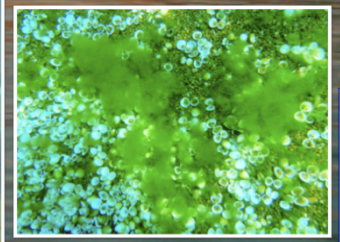
Unlike Lake George and Lake Tahoe, drastic eradication measures are not needed at the moment in Seneca Lake to maintain comparable water quality. Thus, future action should focus on determining the actual extent of *Corbicula* in Seneca through a survey of all suitable habitat and experimentally determining their feeding regime in Seneca (at current nutrient levels) in order evaluate their potential impact.

Introduction:

During the past few decades, Seneca Lake has experienced an increase in nutrient loading from agricultural and farm runoff and has showed signs of increased algal growth and a movement towards a more eutrophic state. Since maintaining high water quality is crucial for a healthy ecosystem, safe consumption, and successful use for recreation, it is important to evaluate all potential factors including invasive species. In recent years the highly invasive *Corbicula fluminea* (Asian Clam) has been reported in Seneca Lake. *Corbicula* has the potential to drastically alter lake ecology and water quality if it becomes established. As such, the objectives of this study is to:

- Overview the invasion of *Corbicula fluminea* into Seneca Lake
- Describe the ecological impact *Corbicula* has had on aquatic systems and their potential impact on Seneca Lake in its current state
- Outline recent treatment/eradication programs
- Recommend future action for dealing with *Corbicula*.


Installation of benthic barriers at Lake George


Filamentous green algae growing over *Corbicula* colonies in Lake Tahoe. Nutrient excretion allows algae to grow exclusively over the clam beds.

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