

# Vulnerability of the Okanagan Watershed Infrastructure to Dreissenid Mussel Infestation

Renata Claudi  
RNT Consulting Inc.

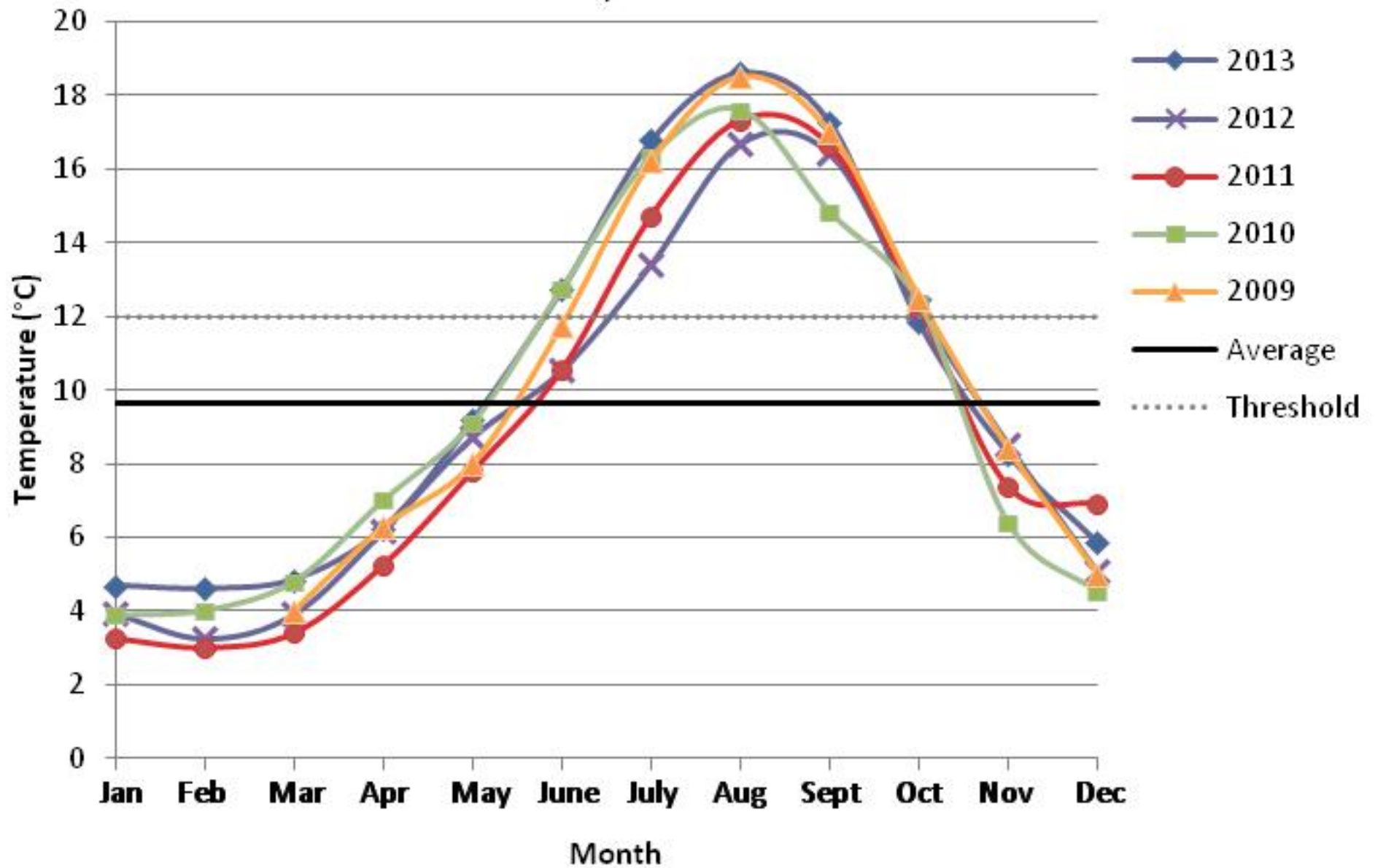


# Okanagan Lake surface water quality (Mackie 2010) vs. dreissenid mussel success

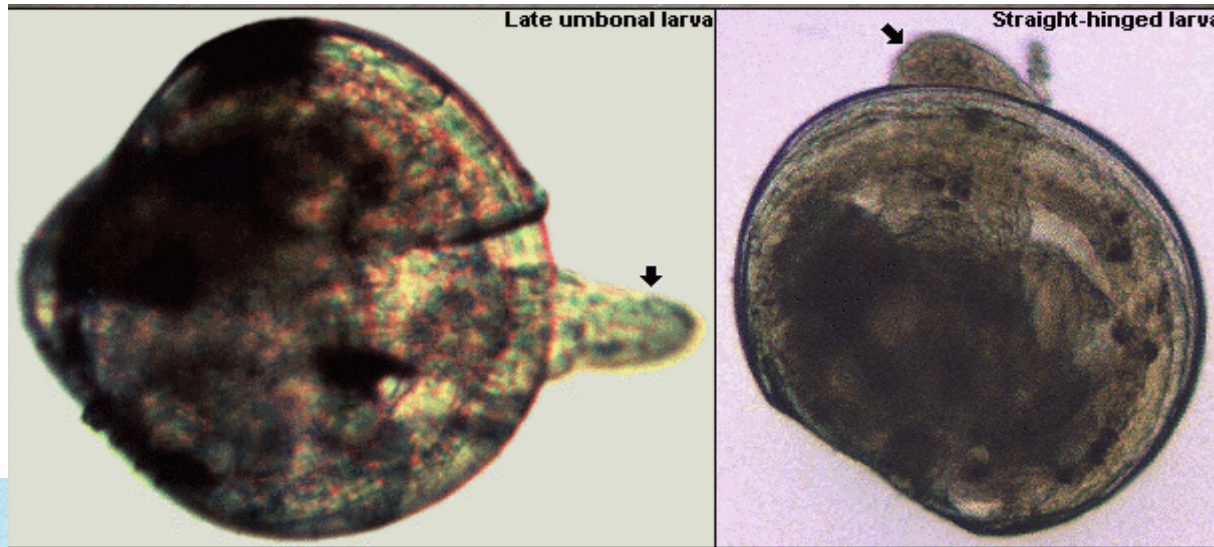
Alkalinity - total mg CaCO <sub>3</sub> /L	108-116	111.2	High
Calcium - mg/L	30.7-34.1	32.1	High
Conductivity- μS/cm	0.3-300	185.7	High
Dissolved oxygen - mg/L	8.6-13.2	10.6	High
Temperature -	1.7-23.0	18?	High
pH	7.3-8.5	7.98	Little to high?
Total phosphorous μg/L	2-100	??	
Chlorophyll a μg/L (mean summer value estimated)	0.0-1400	??	
Dissolved oxygen, % saturation,	138-141?	134?	High?

**Suggestion; collect pH, temperature, phosphorus, chlorophyll a and dissolved oxygen profiles in multiple locations (near marinas?) to determine if there is a potential mitigating factor for the mussel invasion**

# Annual Water Temperature at Waneta, Columbia River



# Problematic Features of Zebra and Quagga Mussels (Dreissenid family)



## **Risks Posed to Facilities Using Raw Water by Mussel Fouling – Reason for Mitigation**

- Decreased flow
- Potential plugging of essential components/systems
- Increased weight of components
- Increased corrosion

# Systems at Risk

All external structures and internal piping exposed to raw water which contains, mussel veligers and/or adults. The flows have to be over 1.5m/s, **continuously**, for settlement **not** to occur.



# Infrastructure of Concern

- Drinking Water Intakes (municipal and private)
- Irrigation Systems
- Floating Docks/Bridges and Buoys
- Boat Hulls
- **Fire Protection Systems?**



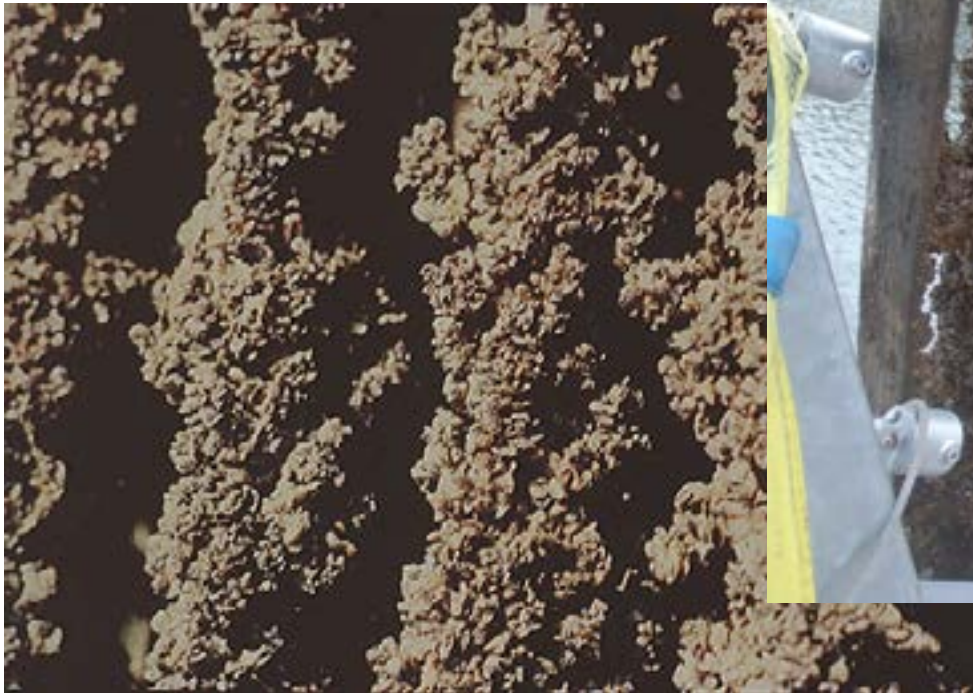
# Municipal Drinking Water Plants Components at Risk

- All intake structures
- Low lift well
- Submerged Pumps
- Raw water intake line to laboratory for water quality testing
- Direct Filtration Membranes if used
- Direct Contact Instrumentation
- Fire Protection System if using raw water

# Components of Concern

Fouling of fixed screens

Intake pipelines



## Contact Instrumentation

Any instrument in contact with raw water is vulnerable



# Level gauges



# Materials of Construction

Macrofouling by Mussels Can Enhance Metal Corrosion by;

- Mechanical Damage
- Exposure of fresh surfaces to corrosive factors
- Production of feces and pseudofeces which in turn support microorganisms

# Mitigation Options

- Sodium hypochlorite
- Chlorine dioxide
- Monochloramines
- Potassium permanganate
- Sodium permanganate
- Potassium chloride
- pH adjustment
- Copper based products
- Flocculation
- Mechanical Cleaning

# Personal Water Intakes

- Swap intake line and foot valve periodically
- Allow fouled line to dry, shake out shells
- Install sand filter prior to pressure tank

# Irrigation Systems

- Intake lines
- Irrigation Ponds
- Pipelines/Canals
- Direct Contact Instrumentation
- Spray Nozzels



# Irrigation Systems - Mitigation

- Potash
- pH adjustment
- Copper based algaecide
- Sand or self cleaning filters prior to field distribution systems (should remove all particles greater than 150 microns)
- Dewatering

# Floating Docks/Bridges and Buoys Boat Hulls

- Mechanical Cleaning
- Coatings

# Coatings

- Number of new formulations on the market in response to the ban of tributyl tin coatings in the marine industry
- Given the cost ( \$10 - \$40/sq.ft) and the extensive surface preparation required, **ask for multiyear performance data**
- Many coatings fail after 12 to 18 months
- Surface preparation is onerous but essential

## **Antifouling Coatings** - for both steel and concrete

- Non-toxic, soft silicone barrier coatings
- Toxic, copper/zinc based coatings (ablative and non-ablative) – regulatory approval may be required
- Life-span 5-7 years before topcoat needs to be refreshed



**International**



**Amercoat  
Sigmaglide**



# Ecosystem Impacts of Concern

- Drinking water quality changes
- Rise of the Macrophytes
- Changes in Fisheries
- Changes to Benthic Environment
- Impact on Tourism
- Shoreline Property Values



# Drinking water quality changes

- Fewer particles in the water, tough to floc
- Increase in blue green algae, taste and odor problems

# External fouling of other species

bivalves

snails

crayfish





# Increase in Macrophytes





# Changes in Fish Habitat

Shift of energy from pelagic zone to benthos





Macrophytes  
provide  
substrate and  
distribution  
opportunities for  
Dreissenids



Change in pollutant cycling – possible  
bioaccumulation

Botulism outbreaks have been recorded on the  
Great Lakes, primarily in Lake Erie

# Vectors of introduction

- Boating (on hulls)
- Anglers on gear or in bait buckets
- Aquaculture transfers
- Aquatic plants
- Drift



# INFORMATION FOR BOATERS

## Help **STOP** the Spread of **Aquatic Invasive Species**



Canada

## **STOP** the Spread of **AQUATIC Invasive Species**

### **BOATERS' CHECKLIST**

#### **Before leaving the boat launch:**

- ✓ Remove all aquatic plants, mussels or other visible organisms and put them in the garbage.
- ✓ Drain the water from your boat, including the motor, livewell, and bilge.
- ✓ Do not release live bait! Empty your bait bucket on land, or freeze or salt the bait to use later.
- ✓ Remove organisms you can't see on your boat, waders and gear by:
  - Rinsing with hot water, or
  - Spraying with high-pressure water, or
  - Drying in the sun for 5 days.

INVADING SPECIES HOTLINE  
**1-800-563-7711**

Manitoba 

You can stop invading species  
[www.invadingspecies.com](http://www.invadingspecies.com)



 Ontario  Canada





# Monitoring - why

- Great Lake experience useful but not necessarily accurate
- May see huge seasonal variations in population density, larval production, settling patterns
- Sites can't make good decisions without better local data

## Monitoring– to select best control options

- To determine when the breeding cycle starts, when settlement begins and ends
- How many mussels will settle and what biomass accumulates in one year/cycle
- How deep can mussels settle and what are the growth rates at different depths

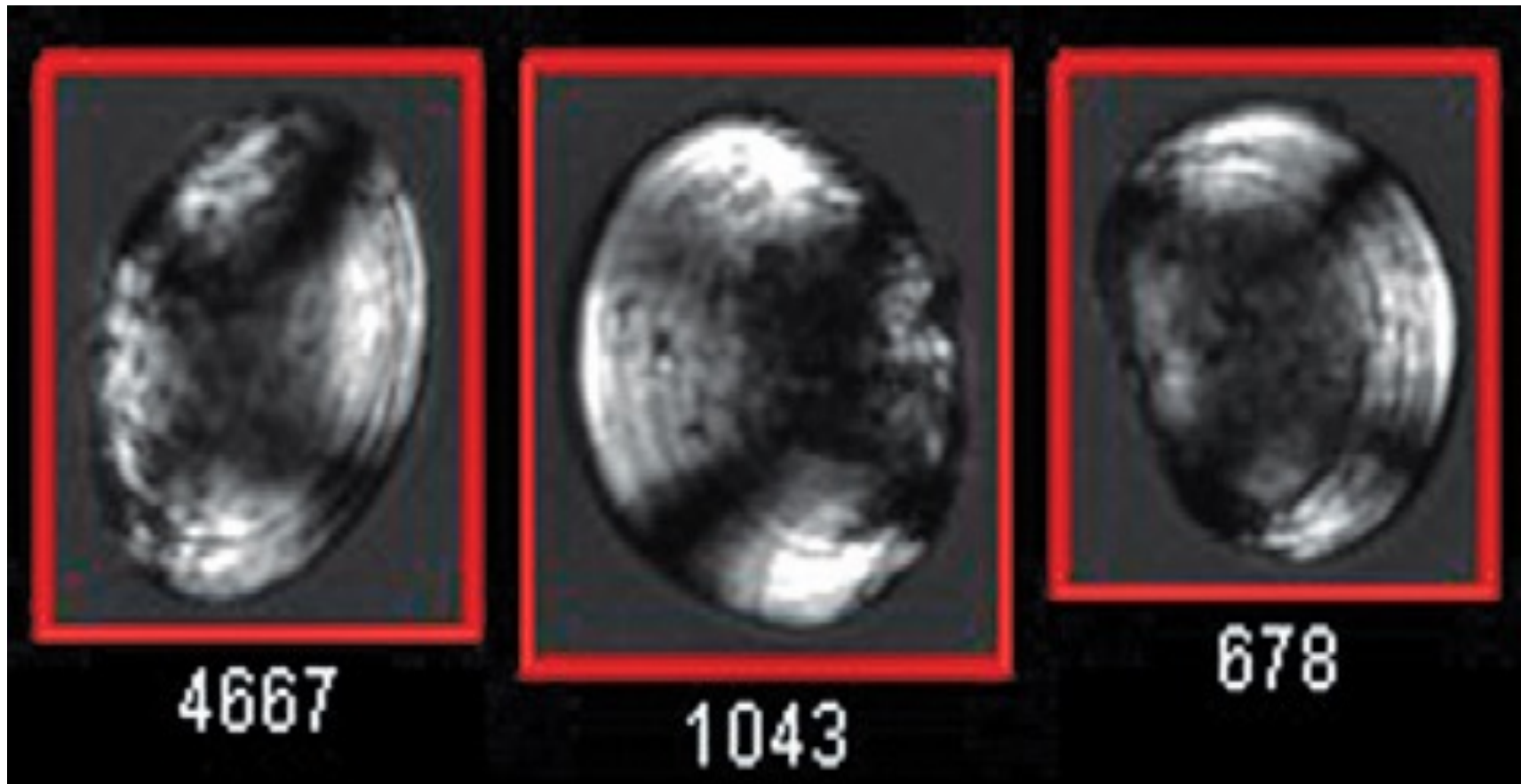
# Plankton Tows



# Plankton tows

- Quick and easy way to establish presence or absence of veligers at the beginning and end of the breeding season. Take large samples, process by “density separation” using sugar solution method
- Can be used to do actual veliger counts in the incoming water, tedious and offers limited information for the plant

# Use of Polarized Light for Veliger Detection



# Settlement monitoring



# Fast increase in population density – Lower Colorado River

**August/07**



**November/07**

