Distribution of Quagga Mussels Upstream of Torch Lake

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What is our study?

We had two main questions we were trying to answer:

Are there Quagga Mussels upstream of Torch Lake?

Describe the occurrence of Zebra and Quagga Mussels upstream of Torch Lake.



What is the difference between quagga and zebra mussels?

- → zebra mussels are triangular and have a straight edge, while quagga mussels are more rounded
- → zebra mussels prefer hard substrates, quagga mussels can attach to both hard and soft substrates
- → quagga mussels have a less restrictive habitat
- → quagga mussels will populate the cold and deep areas
- → quagga mussels can have a more disruptive impact on ecology



Why are zebra and quagga mussels a problem?

- → Filter feeders
- → Take away food from native species
- → Populate very quickly
- → Bring nutrients to where they live at the bottom of the lake
- → Clear the water which brings more sunlight in water → promote algal blooms
- → Disrupts food web



Previous Studies

→ <u>Three Lakes Association Internship 2023</u>

- "We estimate that [Quagga mussels] roughly 30 billion strong and know that they are found in almost every depth and corner of Torch Lake."
- "Educate people that Quaggas are in the lake even though we can't see them. If they know that they are there then they could potentially help the problem."

→ Three Lakes Association Internship 2022

- "We did not find any quagga mussels in Lake Bellaire. They seemed to be prominent within Torch Lake."
- "Quagga Mussels could outcompete both Diporeia and Zebra Mussels. This could have a negative impact on many deepwater fish that depend on the softbody Diporeia as a food source because they cannot eat the invasive Mussels."

Elk River Chain of lakes:



Location of studies





- Ponar→ Used to collect substrate from the sea floor for samples
- GPS→Gives specific locations and marks latitude and longitude to help support future data analysis
- Go-pro/light→Helped collect video evidence and footage of the ponar going underwater.







Equipment Continued

Boats, captains→Helped with depth & time

Kayaks/ Snorkels \rightarrow Helped us with the Grass River transect

Datasheets→Helped keep track of information

Containers \rightarrow Helped preserve mussels and other species we collected from the ponar.

 $\ensuremath{\mathsf{Ruler}}\xspace \to \ensuremath{\mathsf{To}}\xspace$ measure the size of the mussels we found

Methods on Grass River

- Surface observation of woody debris and docks
 - 6 locations
 - \circ 5 with woody debris
 - 4 with docks
 - Looking for clusters and individuals

- Underwater transect
 - Double observer design
 - Snorkeling





Grass River Results

<u>Quagga</u>

Zebra

- Didn't find any
- Doesn't mean they're not there!





- Definitely there Found them on docks and woody debris (they seemed to like little crevices a lot) Mainly in clusters







Grass River: mussel growth on different substrates

Mussel species at each place

	Dock	Woody debris
GRNA Dock 1	None	
GRNA Dock 2	Zebra	Zebra
Private Dock 1	Zebra	None
Private Dock 2	None	Zebra
LWD1		Zebra
LWD2		Zebra

Mussel growth as a percentage of all substrates

	Dock	Woody Debris
Individuals	25%	60%
Clusters	50%	80%

For example, 25% of all docks had individual mussels growing on them

Method in Clam Lake



- Dropping ponar into body of water
 - Collected 6 samples
 - Used GoPro to record footage
 - Carter, Addison, and Annabelle took turns dropping ponar
 - Then strained, and processed!
 - We intentionally considered the areas we chose because of the high likelihood to find quaggas, depth wasn't put into consideration.





Clam Lake Results

Zebra Mussels:

- SO many zebras were found!
 - Found many on chara/plants
- Took 6 samples
 - Had lots of processing to do!

Quagga Mussels:

- We didn't find any quagga mussels.
 - Doesn't mean there aren't any!













Clam Lake Zebra Mussel Count/Ponar sample



Depth (ft)

Avg Number of zebra mussels/Ponar grab in Clam Lake

Average is from two grabs



Lake segment

Method in Lake Bellaire

- This method was very similar to Clam Lake, however..
 - Took 33 samples all over the lake
 - Used GoPro and light
 - We came back and sampled three different days
 - Annabelle, Carter, and/or Addison operated ponar
- We had two transects, first one we went to East to West and sampled at different depths along the way.
- Our second one was all the same depths along the Western shore where we found the first Quagga Mussel.







Zebra mussels found in Lake Bellaire, by depth

black x = no mussels found, number of mussels is per Ponar grab



Depth (ft)

Quagga mussels found in Lake Bellaire, by depth

black x = no mussels found, number of mussels is per Ponar grab



Depth (ft)

 Red diamonds are where Zebras were found.

 Purple circles are where both Zebras and Quaggas were found.

• Grey X's are where no mussels were found.



The only location that Quagga Mussels were found along the western shore.

• Zebra mussels were found all around the lake.

Size distribution of Zebra Mussels in Lake Bellaire

794 individuals, mm



Size distribution of Quagga mussels in Lake Bellaire

4 individuals, mm



Lake Bellaire Results

Zebra Mussels

- Many Zebras were found
- Multiple size categories, well established.
- They were most abundant around the the 20 to 40 ft range, especially on the shallow side of the drop-off.

Quagga Mussels

- Four total Quaggas were found
- Three separate locations all along the West side drop-off
- Two different size categories, they are established
- They are Here



These are pictures of the <u>first</u> Quagga mussels ever recorded in Lake Bellaire.

Conclusion

1. Are there Quagga Mussels upstream of Torch Lake?

Yes, we have found a four Quagga mussels in Lake Bellaire along the western shore drop-off. They are small enough that the population seems to be growing and is relatively new. This means that there could be large ecological changes for Lake Bellaire. We didn't find them in Clam Lake or in Grass River



Conclusion

2. Describe the occurrence of Zebra and Quagga mussels upstream of Torch Lake.

Zebra mussels are very common upstream and are found in all of the water bodies we sampled in. This is in stark contrast to their occurrences in Torch Lake were Zebra's are very hard to find and Quaggas are very common.



What Now?

- Monitor the Quaggas in Lake Bellaire.
- Watch for any kind of a change in the lake.
- Continue to push the Clean, Drain, Dry initiative to prevent anymore invasive species from getting into the lake and to prevent the spread of Quaggas to other water bodies.
- Educate people and homeowners that there are Quagga mussels in the lake.

Further Questions

- What is the Density of Quagga mussels in Lake Bellaire?
- Do any other water bodies in Chain of Lakes have Quagga mussels?
- Where else are the Quagga mussels in Lake Bellaire?

Settling plates

- We went to houses along Lake Bellaire, Clam Lake, Grass River, and Torch Lake to collect mussel settling plates that we put in the water in the beginning of May. We put those plates back in and we're getting them back out soon.
 - We were surprised with the result of not finding many mussels, and the ones we found were very small in size!
- We found other species too, such as crayfish, gobies, and a leach!





Crayfish Olympic Diving

TAT



Torch South

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