THE NEW ZEALAND MUDSNAIL INVASION

INVESTIGATING THE SPREAD AND ECOLOGICAL IMPACTS OF A PRIORITY INVASIVE SPECIES ON SPIRIT LAKE, MOUNT ST. HELENS NATIONAL VOLCANIC MONUMENT

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Figure 1. NZMS in reference to an index finger.

BACKGROUND

- The New Zealand mudsnail (NZMS) is a priority invasive species in Washington State, first discovered along the southern shore of Spirit Lake in 2015 with rapidly growing populations (Myers et al. unpublished).
- NZMS are small aquatic Mollusks-Gastropods ranging from 4-6 mm in length (Figure 1) (CDFW 2022).
- They thrive in disturbed, nutrient-rich watersheds, however, they are highly adaptable to diverse climatic and environmental conditions (USGS 2022).
- The species' high fecundity rate allows dense populations to quickly establish, competing with and displacing native species while placing the ecosystem at risk of trophic collapse (GISD 2022).
- Once introduced, NZMS are nearly impossible to remove without damaging the ecosystem (WDFW 2022).

PURPOSE

- Further elucidate spatial extent of NZMS throughout Spirit Lake.
- Collect evidence for interspecies competition on macrophyte samples.
- Determine utilization of sediments by NZMS and native snails.

Figure 2. NZMS and periphyton in high concentrations in Leech Cove at Spirit Lake.

RESULTS

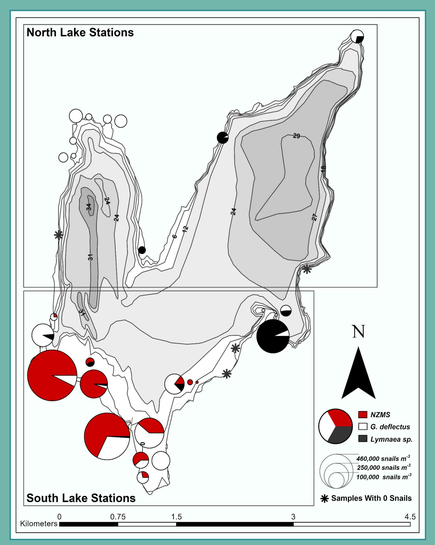
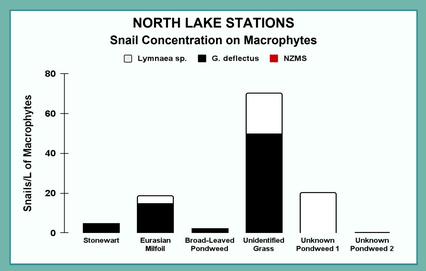


Figure 3. Spatial variability and population density of snail species.



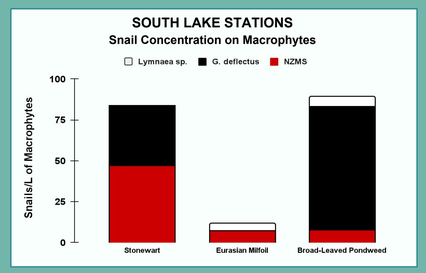


Figure 4. Snail macrophyte preference in the north versus south shores of the lake.

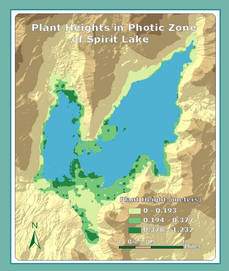


Figure 5. Aquatic macrophyte canopy height in meters recorded by sonar in 2009 and 2010. The macrophytes are significantly taller and more dense along the southern shore.

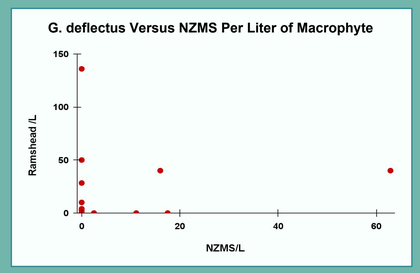


Figure 6. *G. deflectus* and NZMS populations demonstrate interspecies competition.

The spread of NZMS is of immediate concern with ongoing construction plans by the US Forest Service related to the Spirit Lake tunnel intake gate, including the construction of a shoreline staging area in the heart of NZMS-infested waters. If this moves forward this project could pose a serious threat of spreading NZMS into the Toutle River, Cowlitz River, and Columbia River drainages while causing irreparable damage to these ecosystems.

METHODS

Macrophyte Collection

- Macrophytes were collected with a weighted, double-sided plant rake with a rope attachment (Figure 12 & 13).
- Samples were placed in a plastic bin, submerged in water, agitated by hand for one minute to detach any snails (Figure 11), then removed, measured by volume, and returned to the lake.
- The remaining water in the plastic bin was then dumped through a sieve, with remaining material transferred to a centrifuge tube.

Sediment Collection

- A hollow, plastic cylinder and bottom dredge were used to sample sediment by randomly coring the lake bed at depth between 0.5-24 ft (Figure 7). Samples were then transferred to a plastic bag.

Snail Counting

- Snails were separated from the macrophyte and sediment samples using 4 mm-710 µm sieves (Figure 8), after which, they were picked out with tweezers and placed in a petri dish to be counted manually under a dissecting microscope.

Figure 7. Coring sediment along the littoral zone of the lake.

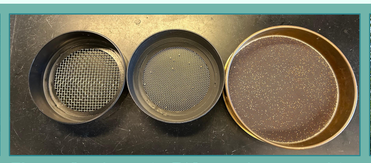


Figure 8. 4 mm to 710 µm sieves used to process samples.

Figure 9. Photo of Spirit Lake on the shore of Duck Bay.

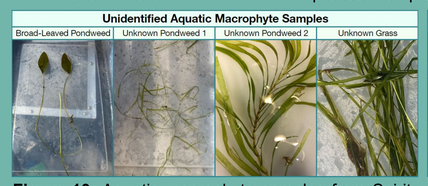


Figure 10. Aquatic macrophyte samples from Spirit Lake that need further identification.

Figure 11. macrophyte sample being agitated.

Figure 12. Sampling of macrophyte with the plant rake.

Figure 13. Macrophyte being collected from the plant rake.

DISCUSSION

- Results provide evidence of interspecies competition and habitat overlap with native species on macrophyte samples (Figure 4 & 6).
- Both NZMS and native species demonstrate macrophyte preferences (Figure 4). This may be due to higher quantities of periphyton on certain macrophytes, which is the main diet of native species, whereas NZMS prefer eating macrophytes directly (Cranston and Fox-Dobbs 2021).
- Data from north versus south lake stations suggests that NZMS may have an affect on which macrophyte species native snails utilize (Figure 4).
- NZMS were found to uniquely be utilizing sediments, possibly by grazing on periphyton.
- NZMS remain spatially isolated along the southern shore with potential expansion towards the Outlet Tunnel evidenced in sediment samples (Figure 3).
- Some bird droppings were found to have NZMS, revealing the possibility that snails can be spread to different areas of the lake or other bodies of water through the air.
- Possible barriers to NZMS spread include:
  - Lower volumes of macrophyte in deeper waters along the northern shores (Figure 5).
  - Lower fecundity rates in water at or below 8C, which is characteristic of surface waters at Spirit Lake for approximately 8 months of the year (Swanson et al. 2005; Garric et al. 2011).
- There is not enough evidence to suggest NZMS populations are growing; this is likely due to a difference in sampling methods from previous years.

ACKNOWLEDGEMENTS

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We recognize that this research was conducted on the traditional, ancestral, unceded territory of the Loowit/Louwala-Clough Monument of which The Confederated Tribes of Siletz Indians, Qwû'lh-hwai-pûm (Klickitat), Stl'pulmsh (Cowlitz) tribes are recognized original stewards.

REFERENCES

California's Invaders: New Zealand Mudsnail. 2022. California Department of Fish and Wildlife (CDFW). https://wildlife.ca.gov/Conservation/Invasives/Species/NZmudsnail.
Cranston W, Fox-Dobbs K. 2021. The Role of an Invasive Snail in the Aquatic Food Web at Spirit Lake, Mount St. Helens.
Global Invasive Species Database. 2022. Invasive Species Specialist Group (ISSG). http://www.iucngisd.org/gisd/species.php?sc=449.
Myers S, Gawel J, Fox-Dobbs K, Crisafulli C, Cranston W, Smith M. Colonization and Trophic Integration of the New Zealand Mud Snail in Spirit Lake, Mount St. Helens.
New Zealand mudsnail (Potamopyrgus antipodarum). 2022. Aquatic Invasive Species. https://wdfw.wa.gov/species-habitats/invasive/potamopyrgus-antipodarum.
Potamopyrgus antipodarum. 2022. United States Geological Survey (USGS). https://nas.er.usgs.gov/queries/factsheet.aspx?SpeciesID=1008.
Garric J, Gust M, Buronfosse T, Andre C, Mons R, Gagne F. 2011. Is exposure temperature a confounding factor for the assessment of reproductive parameters of New Zealand mudsnails Potamopyrgus antipodarum (Gray)? Aquatic Toxicology. 101(2):396–404. doi:10.1016/j.aquatox.2010.11.013. https://www.sciencedirect.com/science/article/pii/S0166445X10043037?via=ihub.
Swanson F, Crisafulli C, Yamaguchi D. 2005 Jan. Geological and Ecological Settings of Mount St. Helens Before May 18, 1980. Ecological Responses to the 1980 Eruption of Mount St Helens.:13–26. doi:10.1007/0-387-28150-9_2.
https://www.researchgate.net/figure/Climate-of-the-Mount-St-Helens-area-a-Climograph-from-Spirit-Lake-after-Walter_fig3_227227964.