

Mapping the Spread and Ecological Integration of the Invasive New Zealand Mud Snail in Spirit Lake

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Figure 1: Image of Spirit Lake in front of Mount St. Helens.

Introduction

The New Zealand mud snail (NZMS; *Potamopyrgus antipodarum*) is an aquatic mollusk (4-6mm in length) commonly spread by infested recreational equipment and machinery². They are grazers, primarily feeding on aquatic plants, fungi, and algae, and tend to thrive in recently disturbed environments. NZMS were first visually observed along the southern shoreline of Spirit Lake in 2016 and found in local rainbow trout (*Oncorhynchus mykiss*) gut contents starting in 2015. This species of snail is parthenogenic – they reproduce through cloning – and can achieve densities up to 500,000/m²³; one single snail can colonize an entire ecosystem. This study aimed to log NZMS and native snails on aquatic plant species throughout Spirit Lake to generate spatial distribution and abundance maps, to investigate potential interspecies competition, and examine rainbow trout gut contents for NZMS presence.

Methods

- Macrophytes and snails were gathered using a plant rake at water depths ranging from 0.9-3.0m (Fig 2). Samples were agitated by hand in water to remove any attached snails. Remaining macrophytes and detached snails were transferred to plastic bags on ice for transport to UW Tacoma.
- Snails, native and nonnative, were separated from any remaining plant material and manually counted under magnification (Fig 3).
- Rainbow trout were sampled from 2000-2021 using hook and line and gillnet methods. Snails were separated from the gut contents and counted under magnification.

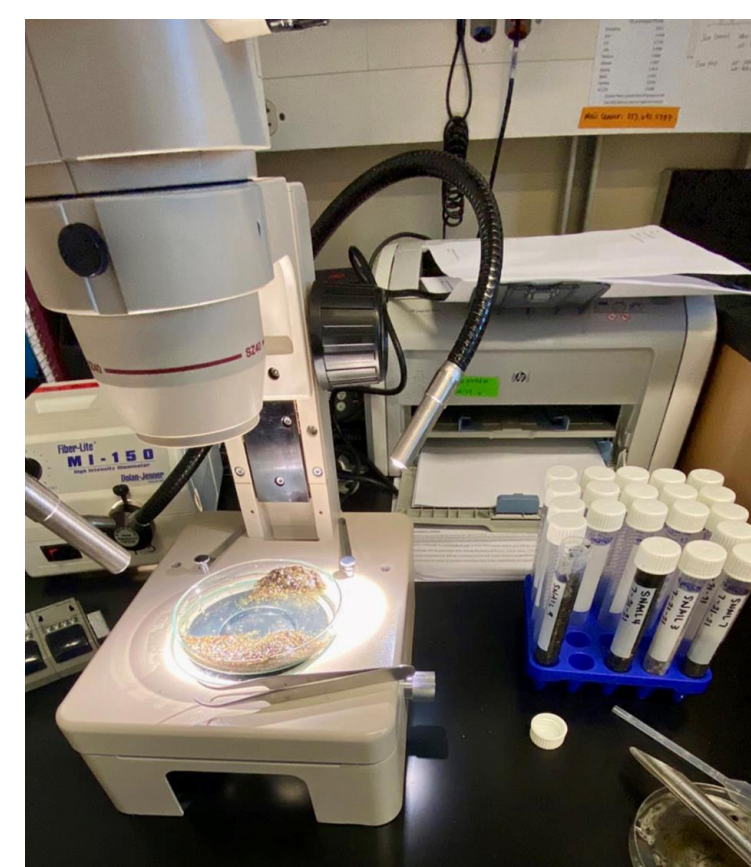


Figure 2 (Left): Image of macrophyte sampling using a plant rake.
Figure 3 (Right): Image of snail processing at UW Tacoma.

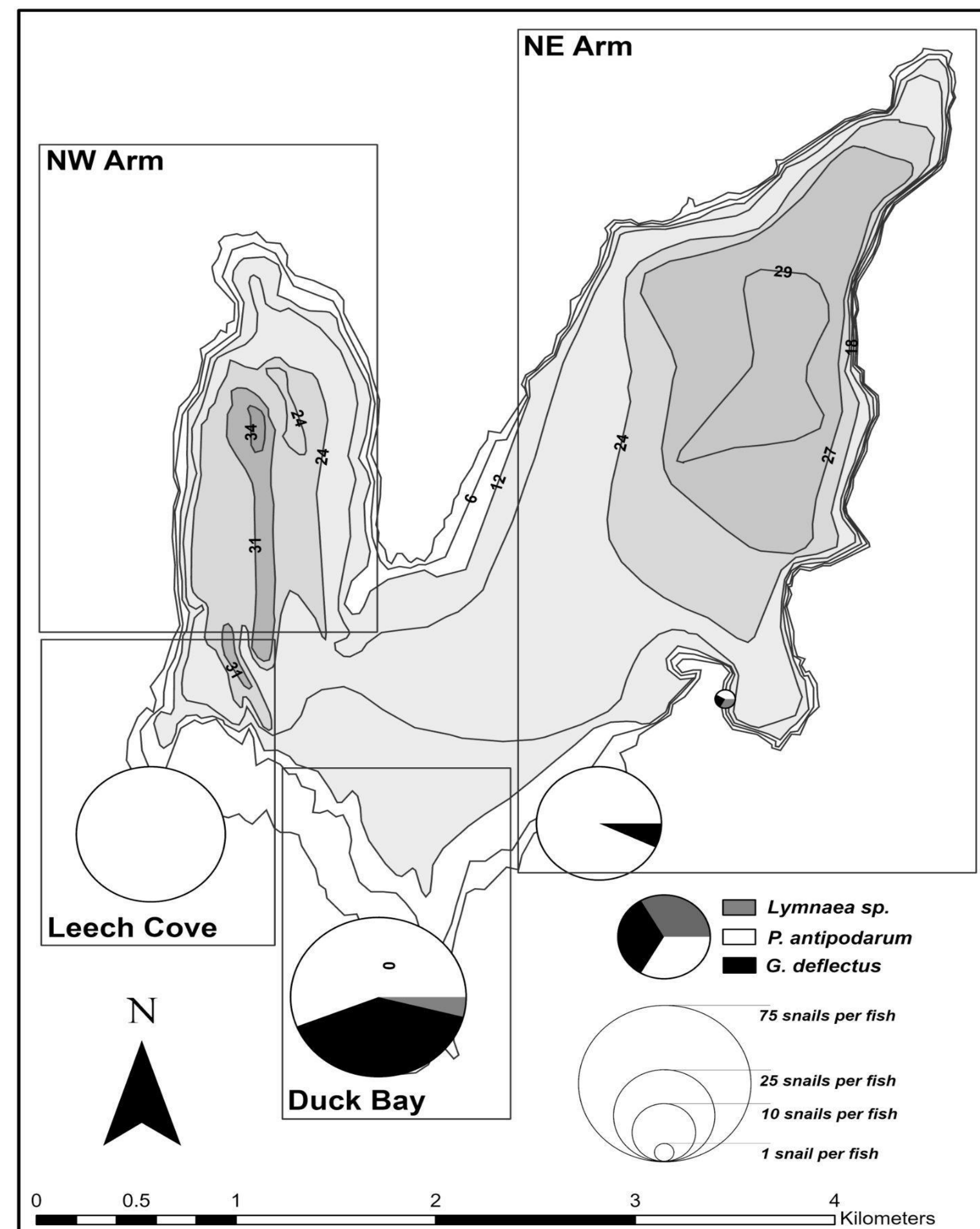


Figure 4: Mean snail abundance (snail individuals per fish) in rainbow trout (*O. mykiss*) gut contents collected at four locations in Spirit Lake in 2021¹.

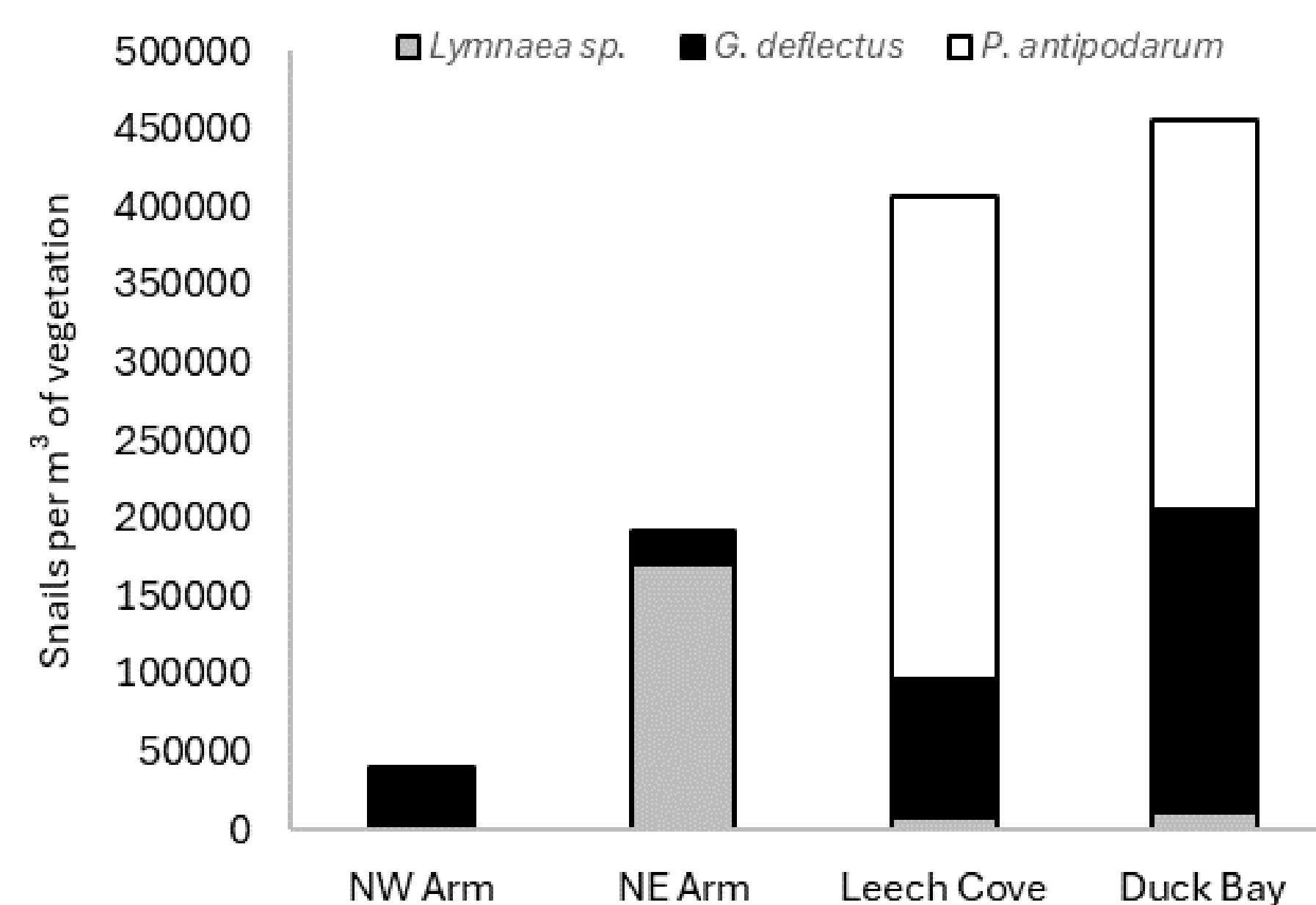


Figure 6: Snail concentrations, by species, per m³ of vegetation.

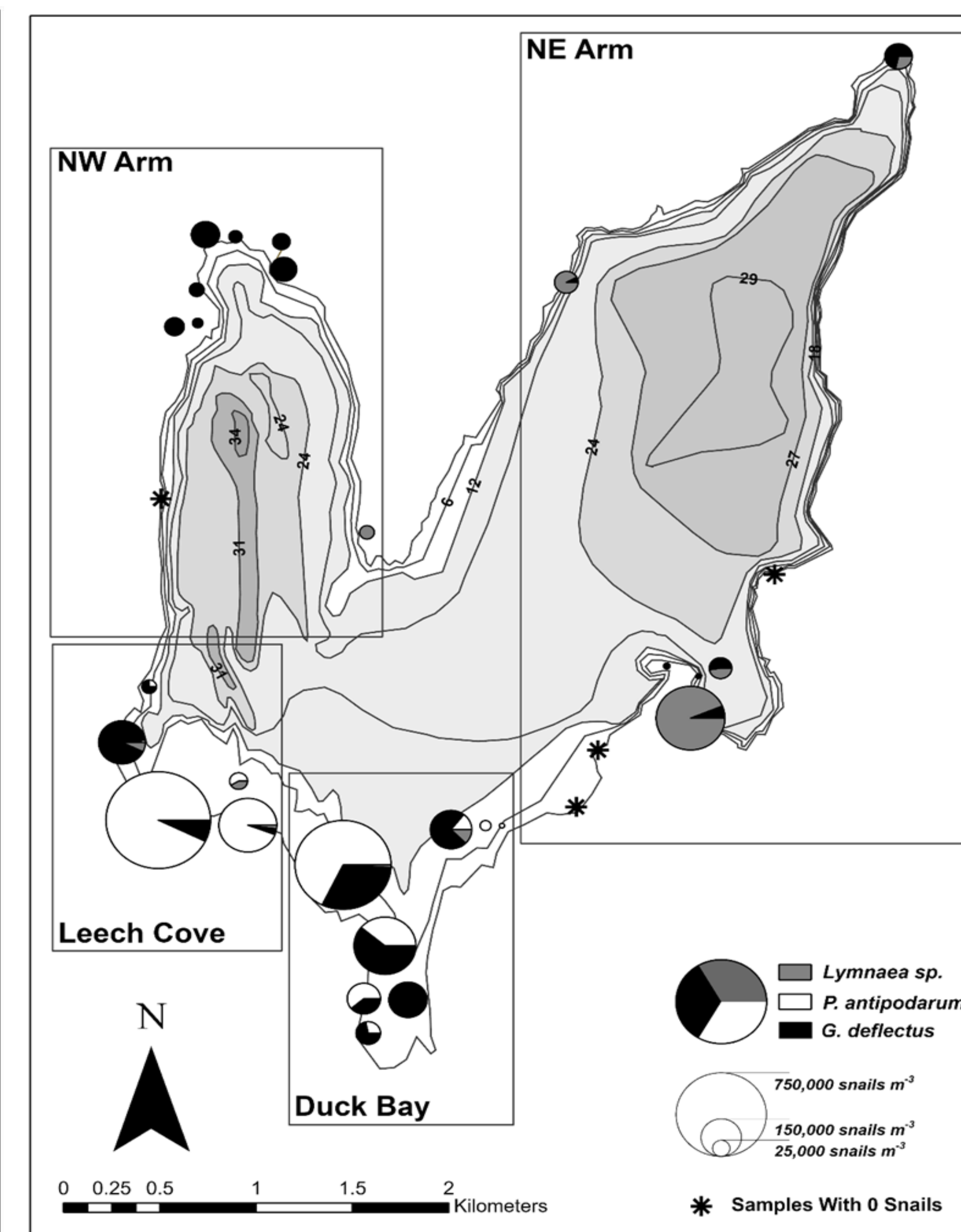


Figure 5: Spirit Lake bathymetric map with aquatic vegetation sampling locations for snail abundance (snail individuals m⁻³ fresh vegetation)¹.

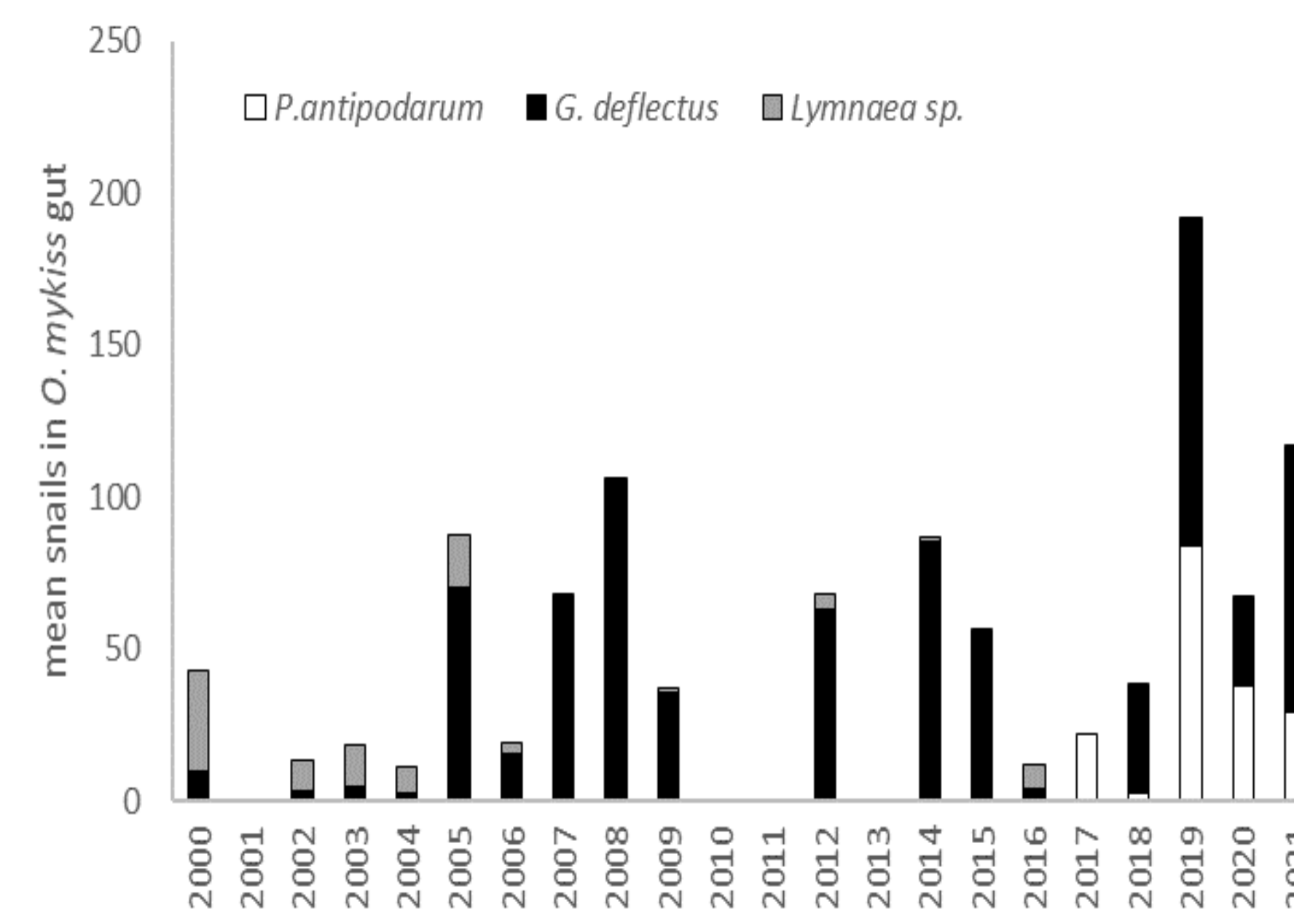


Figure 7: Mean number of snails by species in rainbow trout (*O. mykiss*) gut collected in Duck Bay¹.

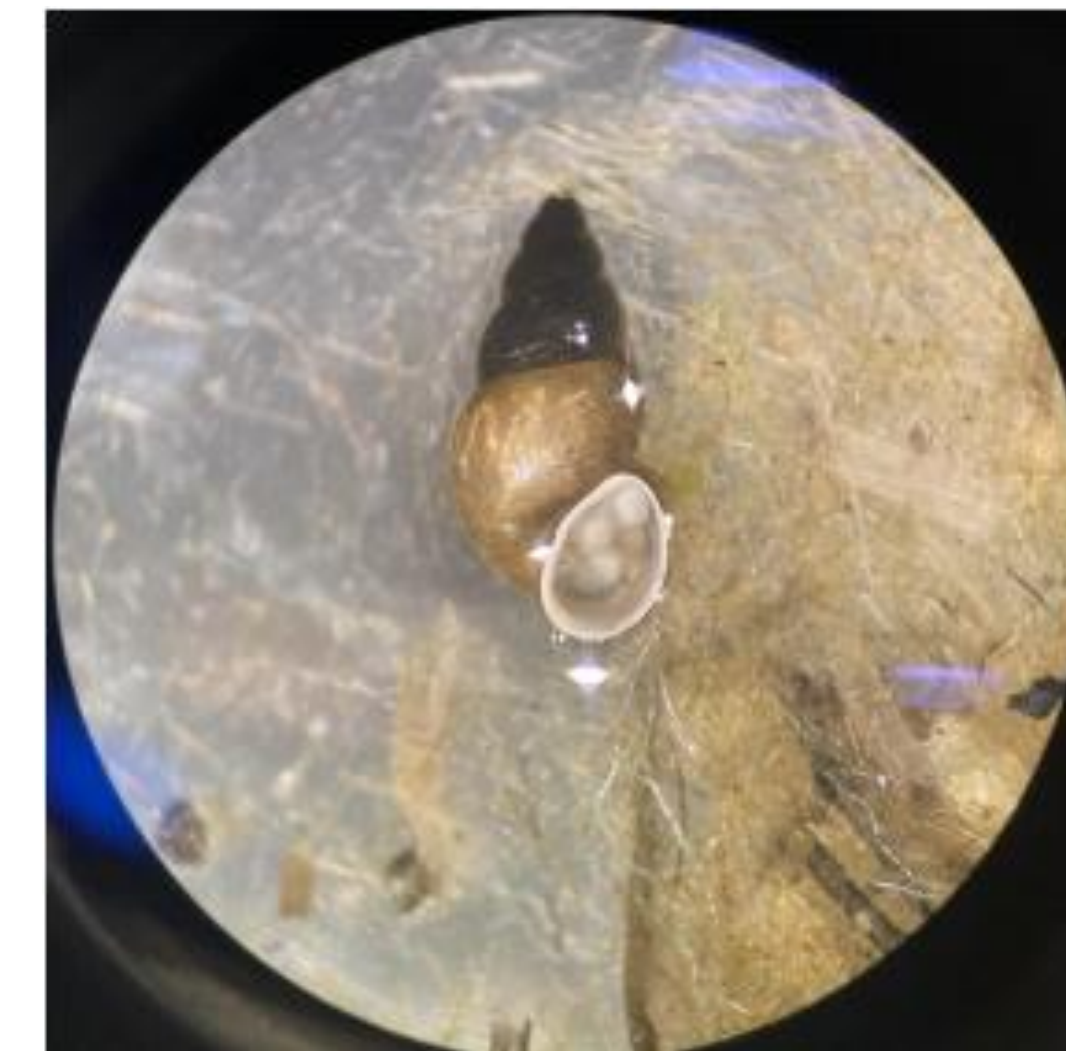


Figure 8 (Left): An image of a NZMS on a fingertip.
Figure 9 (Right): An image of a NZMS under magnification during processing.

Results and Conclusions

- NZMS were found at their highest densities in the SW shoreline of Spirit Lake (Fig 5) - the hypothesized location of introduction for the snails in 2015.
- NZMS were not detected on any macrophytes in NW or NE Arms, suggesting a habitat or resource barrier isolating NZMS to more shallow and densely vegetated areas of the lake (Fig 5).
- NZMS abundance in rainbow trout guts is consistent with macrophyte sampling data – elevated quantities of NZMS were found in rainbow trout sampled from the southern shorelines of Spirit Lake, and the lowest abundance of NZMS in fish sampled from Donnybrook Cove where no NZMS were found during vegetation sampling (Fig 4).
- No evidence of interspecies competitive exclusion was found between native and nonnative snails – comparable densities of NZMS and native *G. deflectus* were found on all macrophyte species during sampling (Fig 5, Fig 6).
- NZMS and *G. deflectus* were found with their highest densities on aquatic coontail, suggesting there may be potential for future interspecies competition between the snails.
- While NZMS have yet to colonize downstream of Spirit Lake, the recently proposed US Forest Service in-water maintenance staging area may act as a vector.
- Long-term effects of NZMS on Spirit Lake ecology remains unknown, but actions for limiting the spread of this species must be fully considered during future management decisions.

References

- ¹ Myers SR, Germeau H, McCann M, Cranston W, Crisafulli CM, Fox-Dobbs K, Gawel JE. 2024. In Review. Establishment and ecological integration of the New Zealand mud snail in Spirit Lake, Mount St. Helens, Washington State, USA.
- ² Oregon Sea Grant. 2011. New Zealand Mud snail, Aquatic Invasions! A Menace to the West. [accessed 2024 April 10]. https://seagrant.oregonstate.edu/sites/seagrant.oregonstate.edu/files/invasive-species/toolkit/nz_mudsnail.pdf.

- ³ 2021. New Zealand Mud snail. Washington Department of Fish & Wildlife. [accessed 2024 April 10]. <https://wdfw.wa.gov/species-habitats/invasive/potamopyrgus-antipodarum>.

Acknowledgements

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