

Distribution of the Invasive New Zealand Mud Snail in Sediments of Spirit Lake, Mount St. Helens, with Comparison to Vegetation Abundance

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Introduction

- Mount St. Helens deposited large amounts of volcanic sediment into Spirit Lake, reshaping aquatic habitats (Gawel et al. 2018).
- The invasive New Zealand mud snail (*Potamopyrgus antipodarum*) was first detected in Spirit Lake in 2016 (Myers et al. 2024).
- Fine sediment can reduce feeding and growth in *P. antipodarum*, suggesting that substrate conditions may influence its distribution (Broekhuizen et al. 2001).
- How physical habitat characteristics on invertebrate distribution remain understudied in post-eruption ecosystems.

Methods

- Sediment samples were collected throughout Spirit Lake using a 6 x 6 in. Ponar dredge from a small motorboat (Figure 2).
- At each site:
 - GPS coordinates and depth were recorded
 - A subsample was collected from each dredge sample
- Sediment composition was measured using a particle size analyzer (Figure 1).
- Samples were sieved to separate organisms and examined under a dissecting microscope.
- Snails were identified and counted:
 - *Potamopyrgus antipodarum* (NZMS)
 - *Gyraulus deflectus*
 - *Lymnaea humilis*

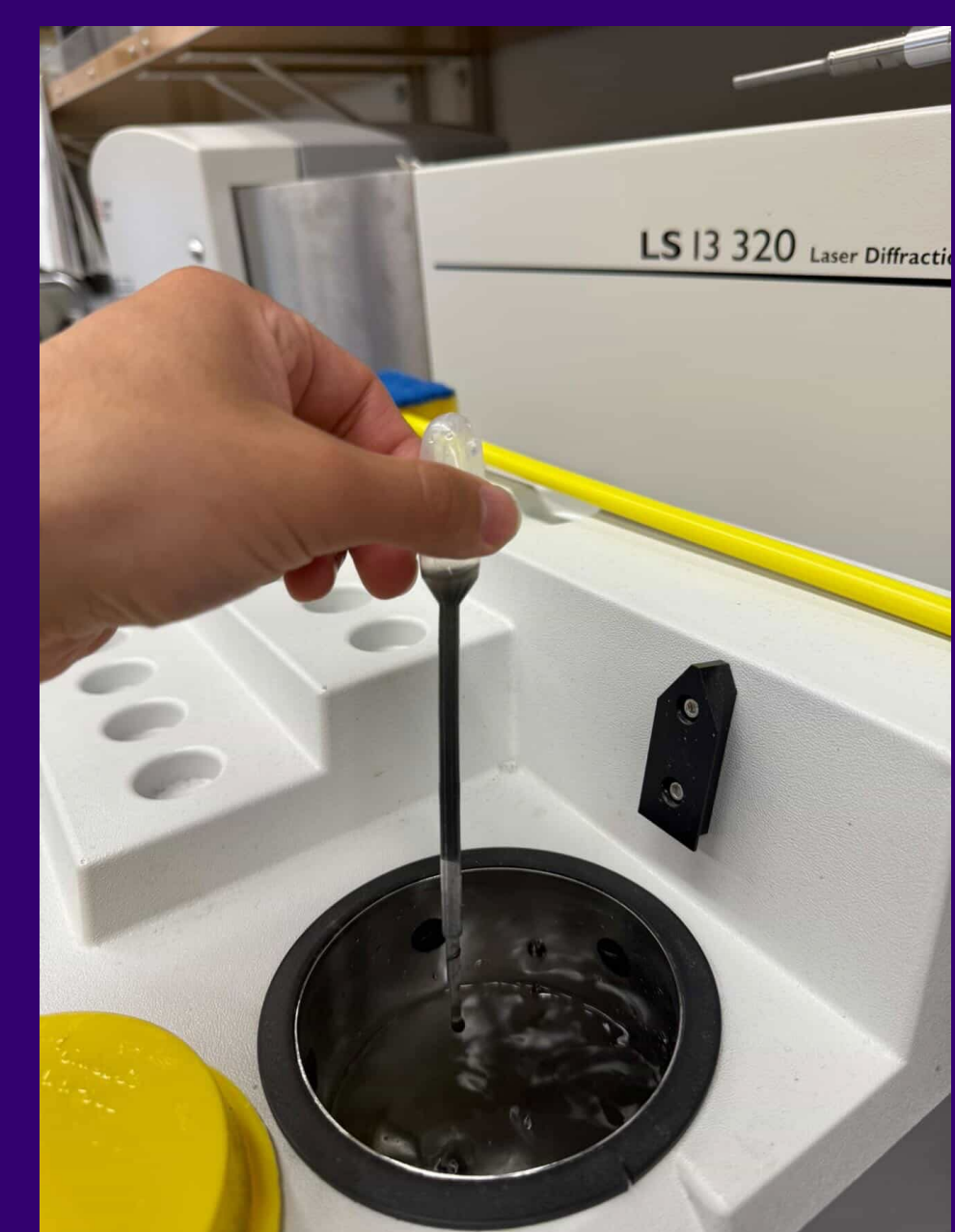


Figure 1. Sediment subsample being added to the particle size analyzer to measure sediment composition and determine median grain size for Spirit Lake sediment samples.

Results

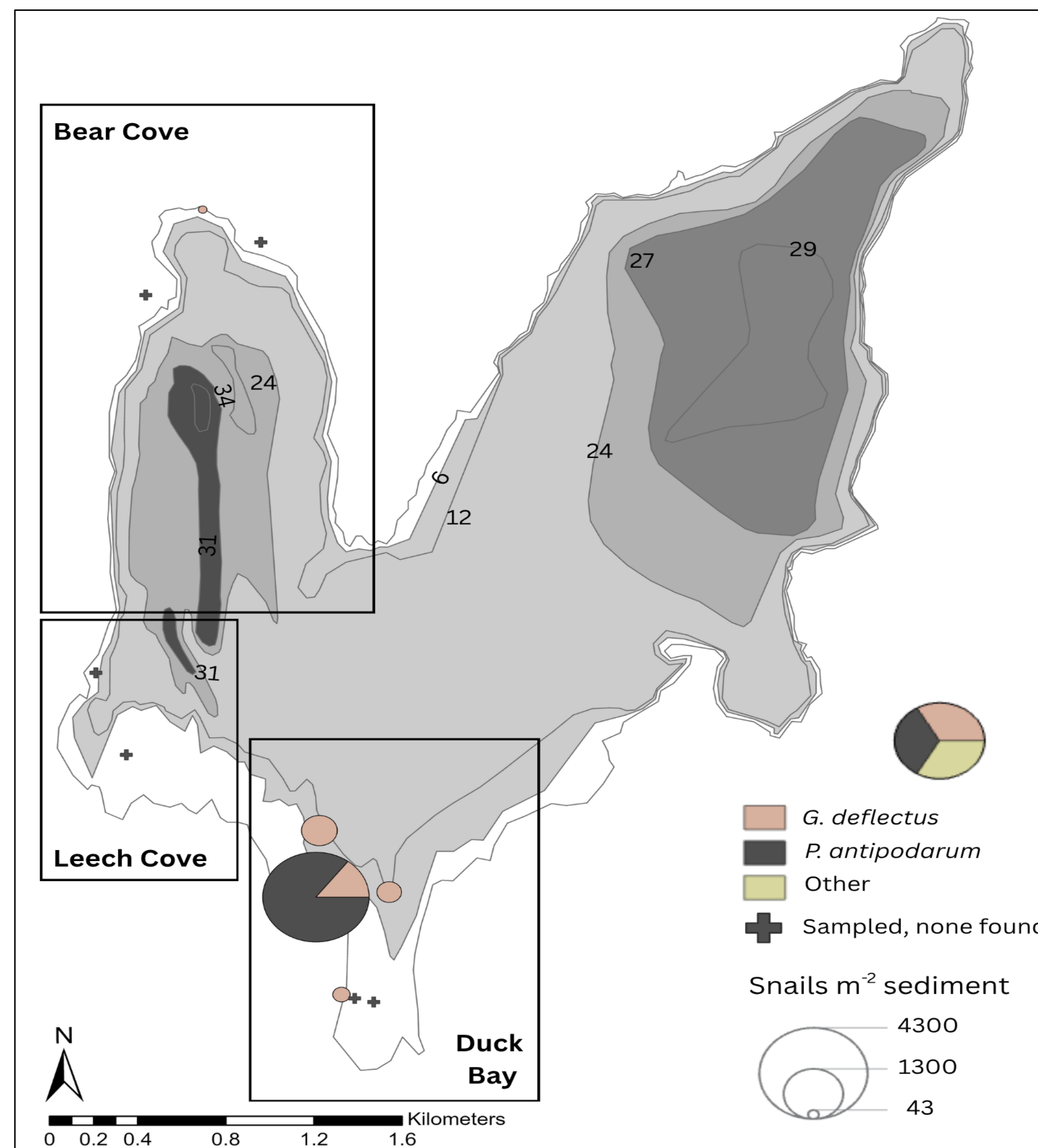


Figure 2. Spatial distribution and abundance of snails in Spirit Lake sediment samples. Pie charts show relative species composition (*G. deflectus*, *P. antipodarum*, and other taxa), with circle size proportional to total snail density (snails m^{-2}). Cross (+) indicates sites where no snails were detected. Image Credit: Kayla Mitchell

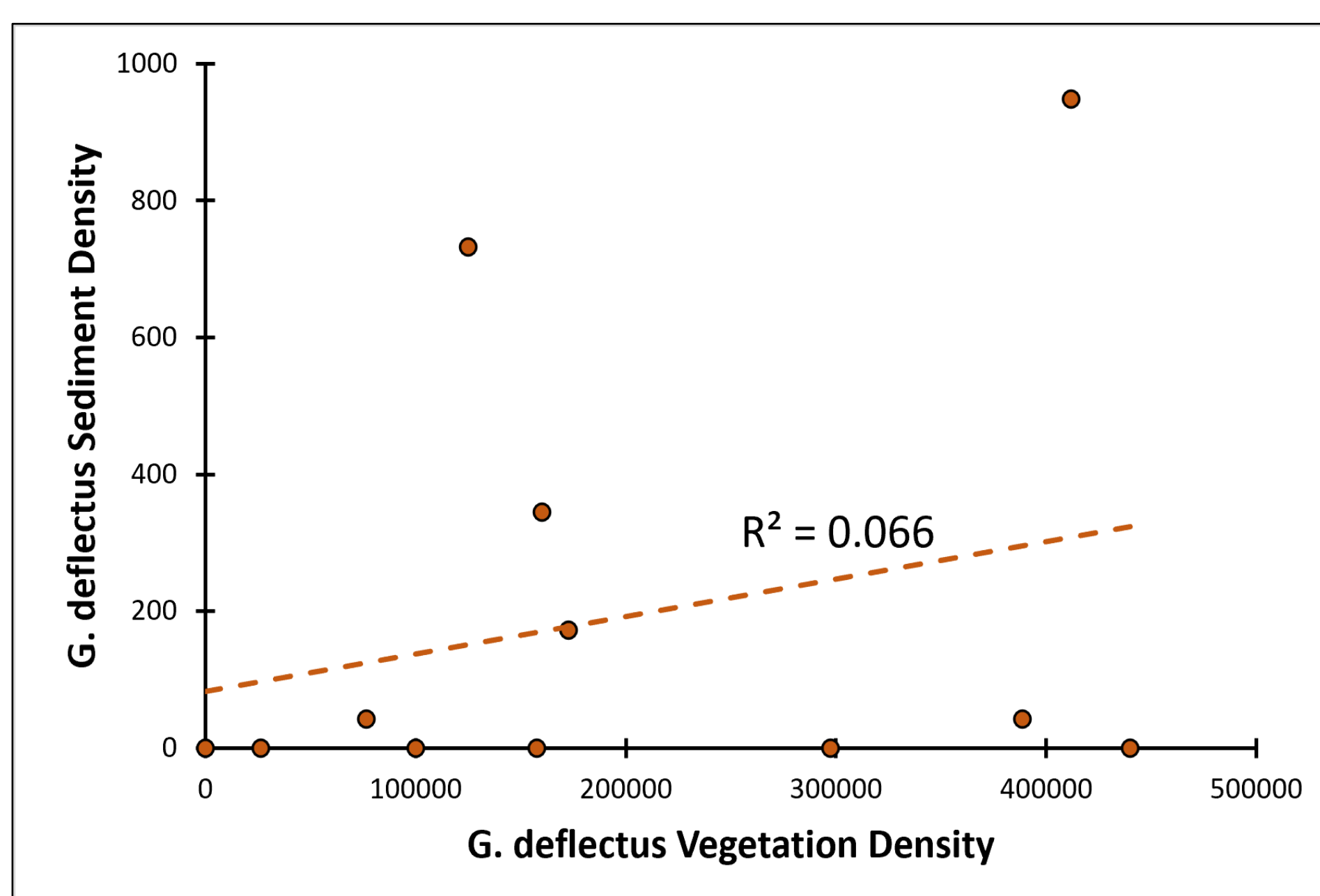


Figure 4. Comparison between *G. deflectus* densities in vegetation and sediment samples collected at the same locations. Sediment densities are reported as snails m^{-2} and vegetation densities as snails m^{-3} . Each point represents one paired sampling site. The weak positive trend ($R^2 = 0.066$) explained little variation among samples.

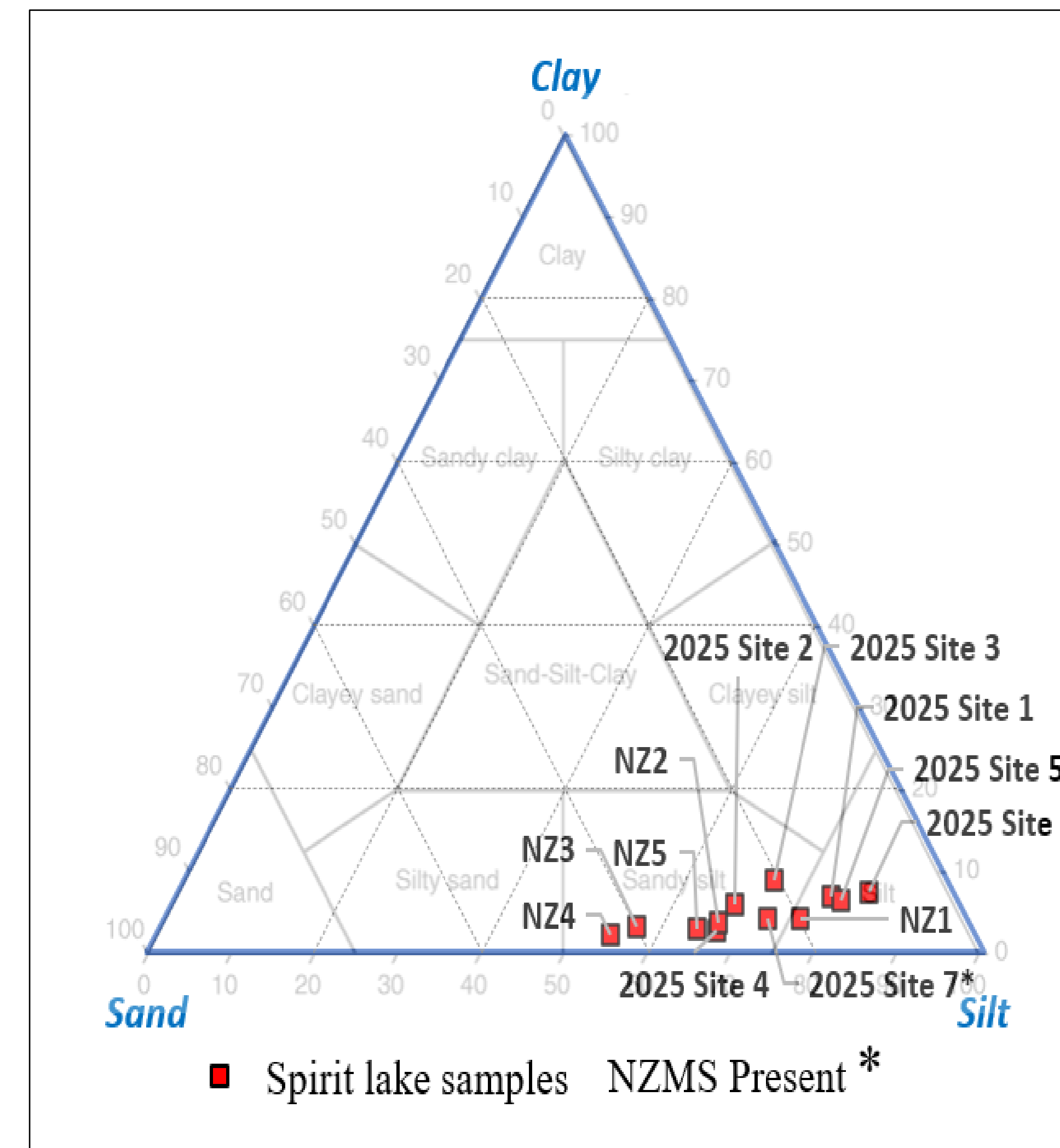


Figure 3. Sediment composition (percent sand, silt, and clay) of Spirit Lake samples. Most samples were silt-dominated, reflecting poorly sorted post-eruption sediments. Asterisks indicate samples where New Zealand mud snails were detected.

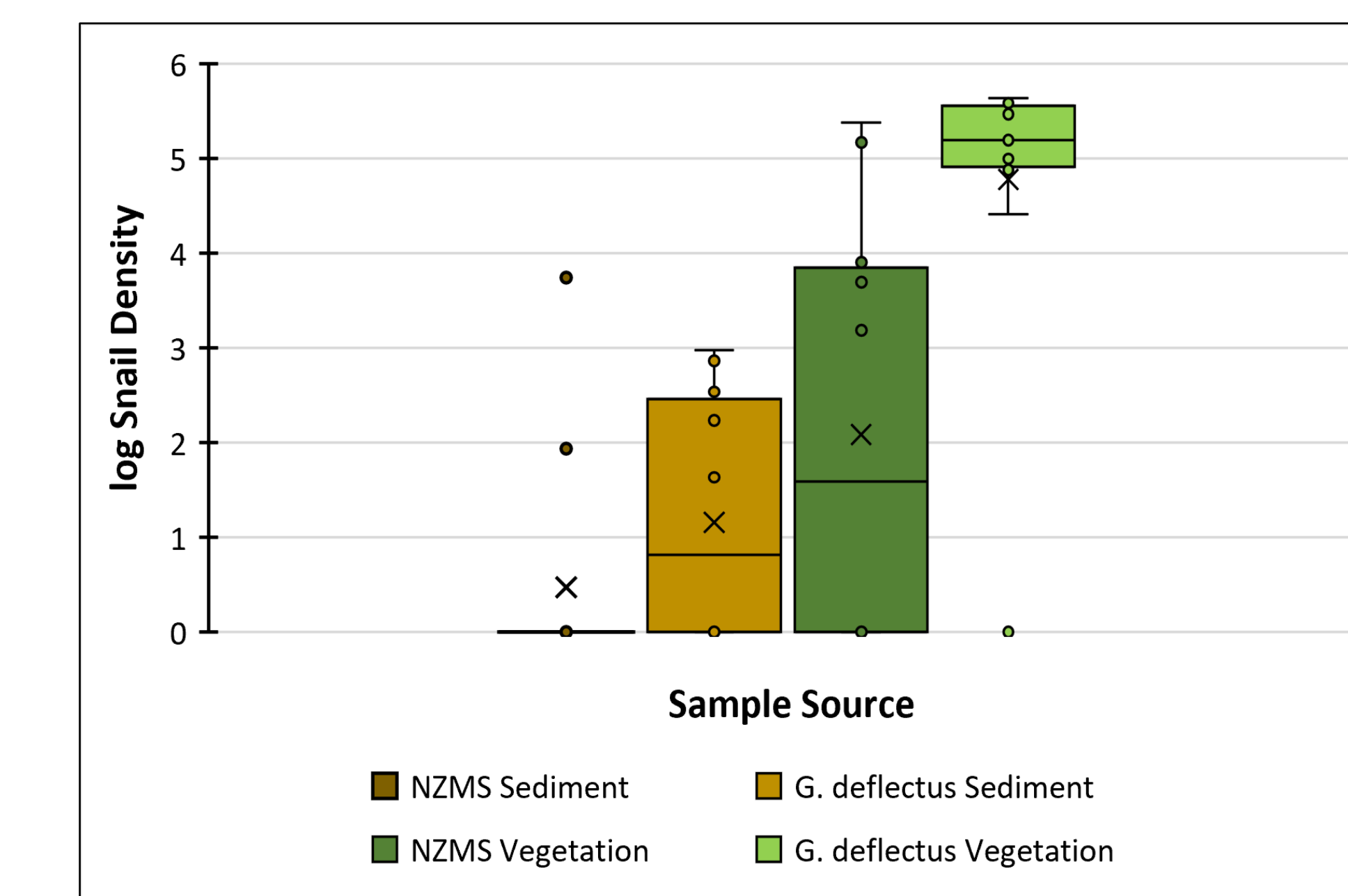


Figure 5. Log-transformed snail densities in sediment and vegetation samples collected at the same locations. Sediment densities are reported as snails m^{-2} and vegetation densities as snails m^{-3} . NZMS densities showed no strong correlation between sediment and vegetation samples ($p = 0.155$). *G. deflectus* densities showed a significant correlation between sediment and plant samples ($p = 0.00092$).

Discussion

- Sediments were poorly to very poorly sorted ($\phi = 1.71-2.44$), reflecting post-eruption conditions (Figure 3).
- No significant relationship was observed between NZMS density and median grain size ($p > 0.05$).
- NZMS were detected in a subset of sediment samples, with many locations containing no individuals (Figure 2).
- NZMS densities in paired sediment and vegetation samples were not significantly correlated ($p = 0.155$; Figure 5).
- *G. deflectus* showed significantly higher densities in vegetation samples ($p = 0.00092$; Figure 5).
- The patchy distribution of NZMS suggests that they are present but not yet broadly established across sediment habitats. This pattern is consistent with an early stage of invasion in Spirit Lake.
- Future research should continue monitoring NZMS abundance to determine whether other habitat factors better explain their distribution.

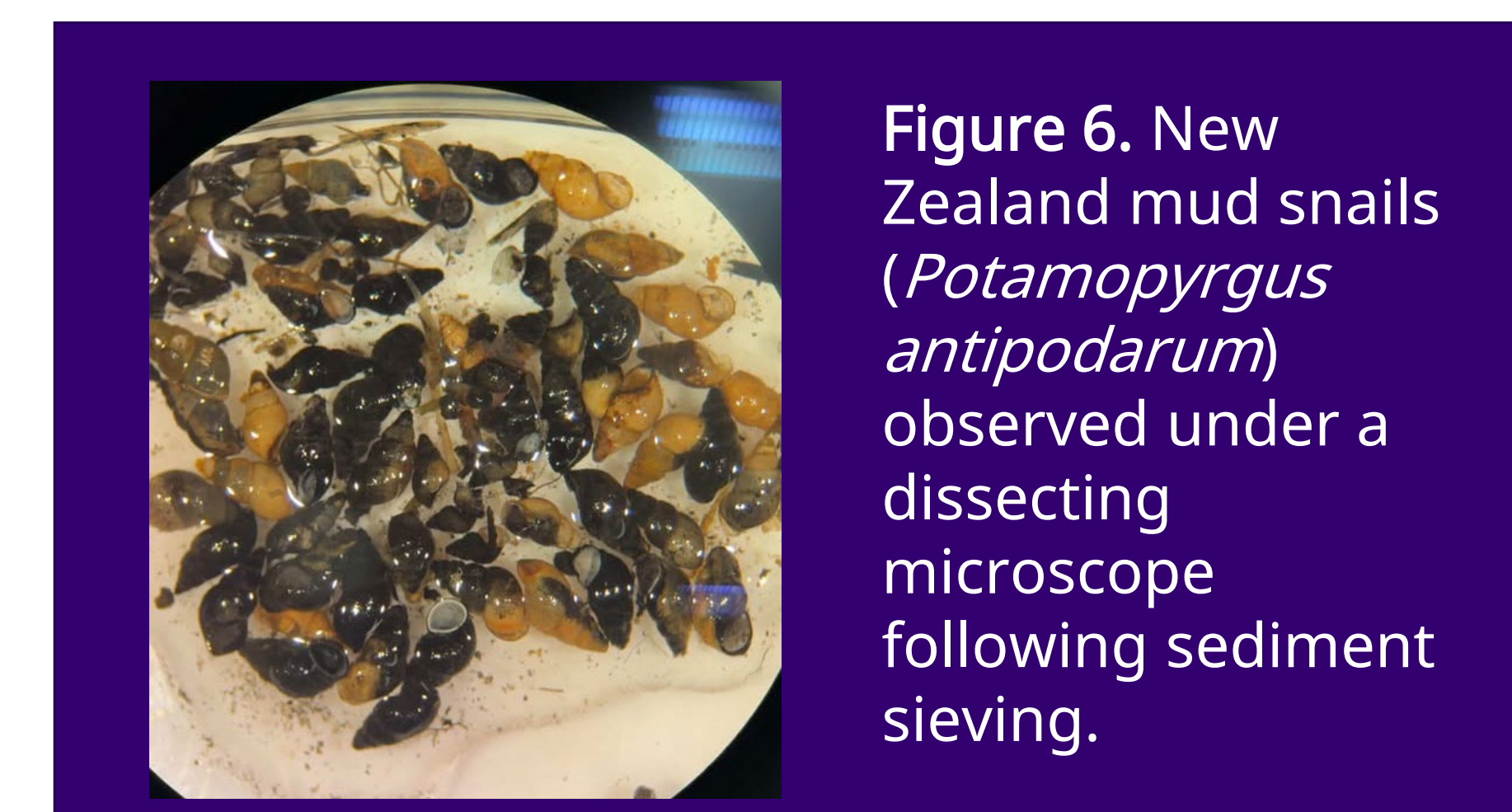


Figure 6. New Zealand mud snails (*Potamopyrgus antipodarum*) observed under a dissecting microscope following sediment sieving.

Acknowledgments

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References

