Size Distributions of Snail *Littorina sitkana* in the Rocky Intertidal Zone of Southeast Alaska

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Abstract

Gastropod shell size is associated with freeze tolerance, predation, and intertidal height. Intertidal distribution is influenced by biotic and abiotic factors. At Sunshine Cove and Bridget Cove (Figure 2) in Juneau, AK, *Littorina sitkana* were measured along a transect stretching from high tide mark to low tide mark. Our results suggest a negative correlation between distance from the high tide mark and *Littorina sitkana* shell size. This could be a result of small snails residing in favorable growing conditions found at the lower intertidal until they become larger and move up the intertidal to avoid fish predation.

Figure 1. *Littorina sitkana*

Introduction

- Abiotic factors set upper limits, biotic factors set lower limits in rocky intertidal.[1]
- Freeze tolerance and predation may influence organisms' distribution in SE Alaska.[5]
- Freeze tolerance, predator behavior, and intertidal height associated with shell size.[1, 3, 4]
- *Littorina sitkana* (Sitka periwinkle), a herbivorous gastropod, distributed in high and mid-intertidal
- Larger shells may provide size refuge from predation lower down the intertidal, smaller shells from freezing higher in the intertidal.[1, 6]
- **We hypothesized that shell size of *L. sitkana* decreases with increasing intertidal height to avoid freezing and predation.**

Figure 2. Bridget Cove

Figure 3. *Littorina sitkana* on *Fucus*

Materials and Methods

Measurements were taken in the rocky intertidal zones of Sunshine Cove and Bridget Cove in Juneau, Alaska. We measured 1,068 snails along transects determined based on the high tide mark and the current tidal height (Figure 4). Using a digital caliper, we measured each snail from the lip of the aperture to the shell apex (Figure 6). Data were analyzed using a linear regression in Microsoft Excel.

Figure 4. Transect tape

Figure 5. *Littorina sitkana*

Figure 6. Measuring *L. sitkana* with calipers

Results

There was a significant negative correlation between distance from the high tide mark and *Littorina sitkana* shell size ($F_{1,1066}$= 373, $p < 0.001$). As distance from the high tide mark increased by 1 meter, shell size decreased by 0.09 mm.

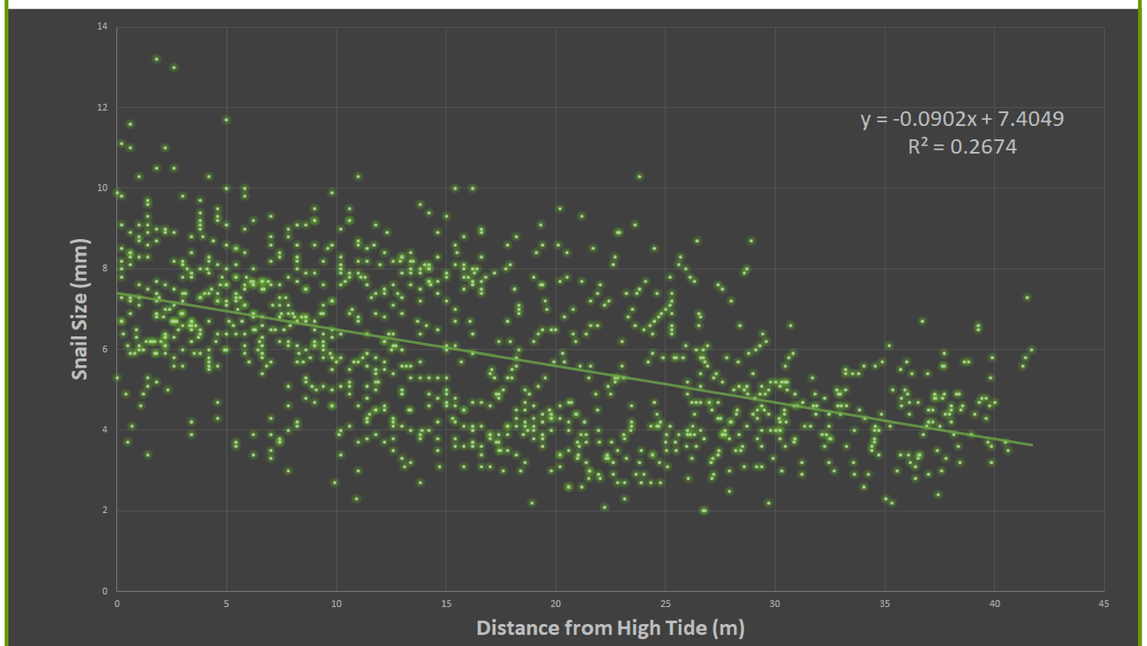

Figure 1: Snail size in the rocky intertidal zone near Juneau, AK. Snails were measured in July of 2017. There was a significant negative correlation between snail size and distance from the high tide.

Conclusions

The results indicate a strong negative correlation between tidal height and snail size distribution; larger snails are concentrated at higher tidal heights, while smaller snails are found at lower heights. The results contradict the findings of Boulding *et al.* (2016) and Wong and Lim (2017), so we propose alternative suggestions for factors influencing shell size of *Littorina sitkana* in the rocky intertidal zone.

Large snails move down to lower tidal levels to lay their egg masses in better growing conditions, and then move back up to avoid predation by fish.[3] Small snails may remain in the lower levels where growing conditions are more suitable until they are large enough to move up.[3] Future studies might mark individuals and track them throughout an entire year to monitor their movement behavior. Understanding gradients in size distribution can improve our understanding of ecological mechanisms in the rocky intertidal, and answer questions surrounding organism movements within the habitat.

Figure 7. *L. sitkana* and *Fucus*

References

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