

# EXPLORING THE ECOLOGY OF THE ENDEMIC JACKSON LAKE SPRING SNAIL: DISTRIBUTIONS AND INTERACTIONS WITH THE INVASIVE NEW ZEALAND MUD SNAIL

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## ♦ INTRODUCTION

Endemic species make a unique contribution to global biodiversity by only existing in one or a few locations. Unfortunately, because of their limited range, endemic species are particularly susceptible to extinction from a range of disturbances, whether anthropogenic or natural. The introduction of non-native species can disrupt community interactions and accelerate extinctions for narrowly endemic species by competing with and/or preying upon native species. On a global scale, community interactions between invasive and native species have changed current patterns of biodiversity and will continue to influence the distribution of biodiversity well into the future.

Freshwater ecosystems are particularly vulnerable to the impacts of invasive species and could be the most detrimental stressor to species west of the continental divide. The New Zealand mud snail (NZMS: *Potamopyrgus antipodarum*), a worldwide freshwater invader, is now becoming a nuisance species in many areas of conservation significance. The NZMS was first recorded in streams in the western U. S. in 1987 and now has a widespread distribution, including streams within Grand Teton, Grand Canyon and Yellowstone National Parks. The NZMS is also sympatric with many endemic spring snails that

are listed as threatened or endangered in the intermountain west.

Within the Greater Yellowstone Ecosystem (GYE), the distribution of the NZMS completely overlaps with that of a closely related federal candidate-threatened species, the Jackson Lake spring snail (JLSS: *Pyrgulopsis robusta*). The current known range of the JLSS is limited to one spring stream (Polecat Creek) and an unnamed tributary (referred to here as Marmot Spring) (Map 1). Since the introduction of the NZMS, JLSS densities have declined and NZMS densities have increased to 500,000 snails/m<sup>2</sup> in some areas of Polecat Creek. While both species remain abundant in Marmot Spring, some of our previous work indicates that the NZMS competes with and slows the growth of the endemic JLSS in this tributary (Fig. 1).

Because the NZMS could eventually exclude the JLSS from the current range in Marmot Spring and Polecat Creek, we have undertaken a series of studies of the competitive interactions and long-term population trends. The goal of our 2005 field sampling was two-fold. First, we continued to monitor yearly variation in the two snail populations in Marmot Spring to predict whether the NZMS is displacing the JLSS from this tributary. The presence of the NZMS is the most likely stressor for reducing or extirpating this population.

Second, we explored the historic range of the JLSS to search for refuge populations that might still exist near springs in Jackson Lake, Wyoming (Grand Teton National Park). Historically, the main pressure on the survival of the spring snail populations in Jackson Lake included habitat modification (i.e. impoundment by the dam). However, the NZMS has not been introduced to Jackson Lake, so any JLSS populations that survived habitat changes in this lake over the past 30 years would be free from competition with the invasive species.



Map. 1 Polecat Creek and Marmot Spring (star) are located in the John D. Rockefeller Parkway between Yellowstone and Grand Teton National Parks. The northern tip of Marmot Spring crosses the south boundary of Yellowstone.

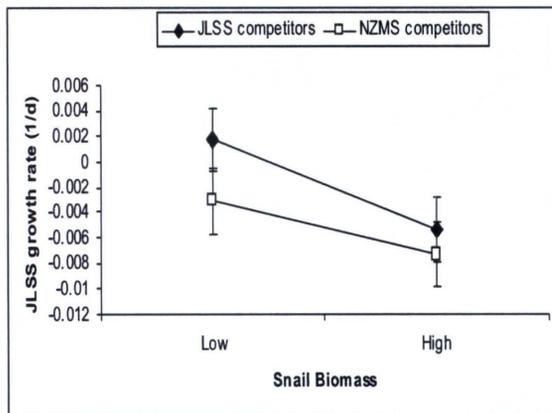


Fig.1. JLSS grows slower when competing with NXMS than when competing with conspecifics at both low and high levels of total snail biomass. Competition experiments were conducted in 2002.

In 2001, samples from aquatic vegetation in the current range of JLSS suggested that the NZMS was displacing the JLSS from Polecat Creek, but that the two species were coexisting in Marmot Spring (Fig. 2). Densities of the two species were positively correlated in Marmot Spring, but negatively correlated in the main stem of Polecat Creek. Continued sampling (sites 1 – 5, Fig. 2) through the summer of 2005 reveals that – so far – the two species are still coexisting in Marmot Spring. JLSS and NZMS abundance vary widely between years in both cobble (Fig. 3) and vegetative habitats (Fig. 4), but no consistent trends have emerged. Increases in NZMS abundance are not directly related to decreases in JLSS abundance in either habitat over this short time scale. Interestingly, though, the dynamics of the two species in vegetative habitat suggest that JLSS abundance might be increasing in 2005 in response to a decline in the NZMS in 2003 and 2005, but with a time lag (Fig. 4). Samples collected in the upcoming summer (2007) will help determine whether these two populations are indeed cycling in a predictable manner.

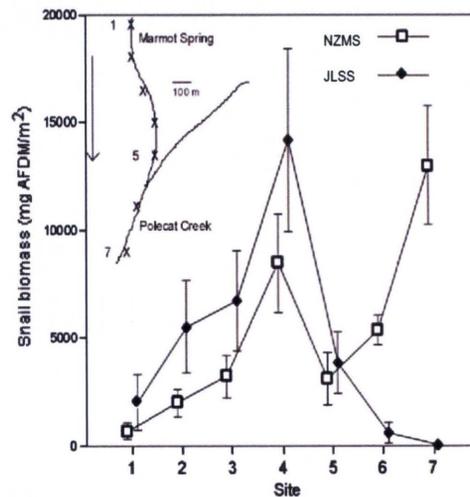


Fig. 2 JLSS and NZMS biomass are positively correlated at all sites in Marmot Spring (1-5) but negatively correlated at two sites in Polecat Creek (6-7). Samples were collected in vegetation in 2001.

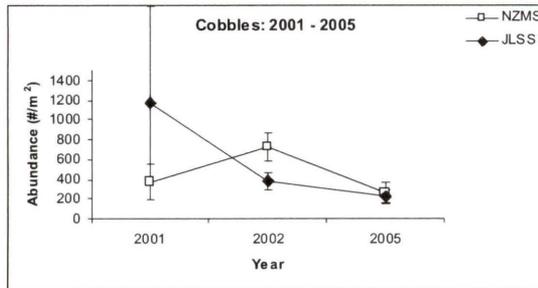


Fig. 3 NZMS and JLSS abundance are lower on cobbles than vegetation and have fluctuated each year. Note that 2003 samples are not included in this graph. Samples were collected at sites 1-5 each year and will also be collected in 2007.

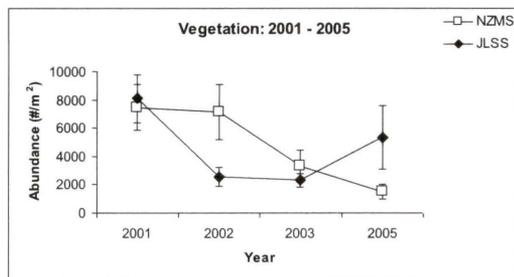


Fig. 4. NZMS and JLSS abundance have fluctuated in Marmot Spring from 2001 – 2005. Samples were collected at sites 1 – 5 each year and will also be collected in 2007.

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The current documented range of the JLSS is restricted to Polecat Creek and Marmot Spring, but the historic range of the JLSS was much larger, encompassing shoreline areas of Jackson Lake and Elk Island (located in the middle of Jackson Lake) (Map 2). No documented collections of the JLSS have occurred from any area of Jackson Lake since at least 1975. We focused efforts around Elk Island by systematically sampling six locations in July of 2005 (Map 2). We chose sites where habitat characteristics indicated a higher likelihood of finding springs (i.e. different vegetation from surrounding area, etc.). At each site, we waded with kicknets and sieves to collect invertebrates from shallow habitat. We also snorkeled in deep water, farther from the shoreline, and collected samples from the substrate with kicknets. In addition, we systematically sampled four other likely sites around Jackson Lake, where springs or streams were entering the lake (Map 2).



Map 2. Collecting sites for JLSS in the historic range represented by black dots. The large black dot represents the six sites sampled around Elk Island.

We failed to locate the JLSS at any sites in Jackson Lake, including the six locations around Elk Island and the four other sites on the shores of Jackson Lake. The North Moran Bay site on the western side of Jackson Lake was the most similar to habitat characteristics found in the current range of the JLSS (Map 2). This site consisted of three spring streams with similar riparian vegetation to Marmot Spring (i.e. *Mimulus* (monkeyflower) and *Heracleum* (cow

parsnip)). In addition, one spring had high densities of another snail, *Stagnicola* spp., suggesting that this site is capable of supporting a dense population of a similar species.

In conclusion, the current range of the JLSS is restricted to a small portion of the historic range where it competes with the NZMS. We found no evidence of the JLSS at ten sites within Jackson Lake. We cannot exclude the possibility that the JLSS might still exist in some unexplored pockets of Jackson Lake and tributaries, but it is unlikely given that many of the sites chosen were historic sampling locations. Within the current range, competition from the NZMS threatens to reduce the JLSS population. In the short term, the NZMS slows the growth of the endemic JLSS, but strong evidence for competitive displacement of the JLSS is not yet apparent and could take years to manifest. The introduction of the NZMS has disrupted stream community members in many ways, including the JLSS, but only continued sampling will reveal how this JLSS population will respond to a competitive invasive species.

#### ◆ ACKNOWLEDGEMENTS

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