

**REPEAT SAMPLING METHOD FOR ROCK COBBLE HABITAT PREFERRED
BY THE THREATENED
BLISS RAPIDS SNAIL (*TAYLORCONCHA SERPENTICOLA*)**

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Abstract. We describe a method for repeat sampling of rock cobbles preferred by the threatened Bliss Rapids snail, *Taylorconcha serpenticola* Hershler, Frest, Johannes, Bowler, and Thompson, 1994, (Gastropoda, Hydrobiidae) in the Malad River, Idaho. We marked individual river cobbles so that the numbers of snails observed at the same location could be compared over time. Initial results indicate that cobbles can be individually marked and resampled over time with good repeatability. Sampling the same exact habitat controls for natural differences associated with substrate composition, pattern, or texture and differences related to patterns of current or velocity that can influence the presence of very small snails. Similar numbers of *T. serpenticola* were found on marked cobbles through time and these results suggest that individuals persist on cobbles that have been disturbed by marking. This method provides an indirect method for repeat sampling of snails in this habitat. We suggest a sampling scenario of 50 rocks which would have the statistical power to detect a decline of about one snail per rock, or a ~28% decline.

Key words: Method, snail sampling, repeat sampling, Bliss Rapids snail, *Taylorconcha serpenticola*, river cobble marking, Malad River, Snake River, Idaho, threatened species.

Introduction

The Endangered Species Act (ESA) requires any federally licensed facility or activity to demonstrate that no harm is done to endangered or threatened species (U.S. Fish and Wildlife Service 1973, Williams 1994). The Bliss Rapids snail (BRS) (*Taylorconcha serpenticola* Hershler, Frest, Johannes, Bowler, and Thompson, 1994, Gastropoda, Hydrobiidae) was ruled threatened under the ESA (United States Fish and Wildlife Service [USFWS] 1992). The USFWS (1995) presents a recovery plan for this species as well as four other snails listed as endangered in the middle Snake River. A recent Settlement Agreement concerning operation of hydroelectric facilities (dams) on the Mid-Snake River, Idaho, has required Idaho Power Company (IPC) and the USFWS to conduct a variety of studies including to assess dam influence on snail listed under the ESA for two modes of operation of the facilities: run of river and load following (Idaho Power Company and USFWS 2004). Run of river means that inflow equals outflow at the hydroelectric facilities and load following refers to the ability by IPC to store water in reservoirs and pass it through hydroelectric facilities at times when there is more demand for electricity. The load following scenario typically causes greater water level fluctuations in the river below the hydroelectric facilities.

Early snail collection efforts used a suction dredge to bring snails to the surface for counting. Sampling locations were located in areas of known snail populations (approximately 60-400 m² areas). Within these areas, transects were located perpendicular to shore from random start points and 1 m² quadrats were sampled with the suction dredge (Clark et al. 2007, Fore and Clark 2005). Results from analysis of these

data found that significant differences in the percentage of quadrats with snails present occurred under control (run of river) conditions. We attribute significant changes in snail numbers to patterns of colonization and movement over large spatial scales. In other words, snails appear to be sparsely distributed throughout much of the mid-Snake, but not necessarily loyal to specific locations as “colonies.” Because of the significant changes observed within the control (run of river) sample periods, any differences detected during treatment (load following) periods will not be meaningful.

New understanding of the sparse distribution of snail population over a larger area has precipitated a new consideration of the sampling methods used to assess snail populations. A related study has found that random sampling of 50 m transects located throughout the Snake River indicate that about 69% of the transects had snails present (unpublished data).

Objectives

Evaluate a new, simple sampling method for detecting change in snail counts based on revisits to marked rocks and determine the amount of change that would represent a statistically significant decline in snail populations. We also proposed to devise a simple and inexpensive method to mark rocks in the river upon which *T. serpenticola* occur, to determine if we could identify and relocate marked cobbles reliably, and to determine if *T. serpenticola* would tolerate the repeated disturbances required for repeat observations.

Methods

Data set

Our study site was located on the lower Malad River, Gooding County, Idaho, in an area where BRS were known to occur (Figure 1). The site was along the southern shore just above the bridge. The study reach was approximately 30 meters in length. Ten rocks with BRS present were selected and marked and the number of BRS on each rock recorded. The rocks were cobble size and were not measured for surface area. The rocks were located at depths up to 0.5 m. Rocks were visited at one week intervals for four weeks (December, 1, 8, 15, and 22, 2005) and the snails were counted each time on all ten rocks. We returned to the site on January 24, 2006 following a large runoff event (estimated one meter higher than during our study). Most of the small cobbles had been moved or lost, so the study was terminated at that time.

Marking cobbles

Numerous authors have reported methods for the study of stream benthos (e.g., Boulton 1985, Drake and Elliott 1982, Loeb and Spacie 1994, New 1998, and Rosenberg and Resh 1993) but none have suggested tagging individual cobbles to track snails. Cobbles had to be marked in such a way that they could be identified during revisits in deep water with low visibility. We glued livestock ear tags (Y-TEX All-American[®] visual identification tags) to wet cobbles (Figure 2) using a method that required at least two people. The selected cobble was held with the dorsal side facing up (because BRS prefer the underside). A small area (~10-25 cm²) was then cleared using a battery powered hand drill with a 1" crimped wire brush. Any remaining algae, debris, or



FIG.1. The Malad River, just above its confluence with the Snake River, Gooding County, Idaho, December 15, 2005. Cobbles along the left (south) side of the river were used in this study



FIG.2. Photo showing cobble with tag Malad River, Idaho, being examined for *Taylorconcha serpoenticola*, December 8, 2005. Bliss Rapids snails occur on the underside (side opposite the tag) of the cobble.

moisture in the cleared area on the cobble was removed with a small can of compressed air. Next Loctite® super glue gel was applied to the cleaned area of rock. The attachment area of the livestock ear tag (previously roughened with coarse sandpaper) was then sprayed with super glue (cyanoacrylate) accelerator (Insta-set™) and pushed into place. In future tagging efforts we plan to place an amount of Mr. Sticky's® Underwater Glue (epoxy) over the tab on the ear tag so that it will be covered and the epoxy bridged to the adjacent clean rock surface. The epoxy will be allowed to set a few minutes and the rock carefully replaced in the river. In the laboratory, aquarium trials with Mr. Sticky's® Underwater Glue showed promise after a few days to a few weeks use in water and should allow for greater protection of the tag. The entire cobble marking time is approximately 5-10 minutes per cobble.

Data Analysis

We used a non-parametric Wilcoxon paired test as a statistical model to compare numbers of snails found during different sample periods. The test compared the number of snails found on each rock with itself for different time periods.

The null hypothesis for this test was that the difference in the numbers of snails observed from one visit to the next was not different from zero when averaged across the rocks. We used a one-sided test to evaluate whether a decline in snail counts was significant and set $\alpha = \beta = 0.1$ to balance Type I and Type II errors (Peterman and M'Gonigle 1992, Taylor and Gerrodette 1993, Steidl et al. 1997, Dayton 1998, DiStefano

2003). The data from this pilot study were used to estimate variance in differences under control conditions, that is, when no changes in hydroelectric dam operation occurred.

Results & Discussion

The primary collection method used by IPC to sample mollusks has been the suction dredge. IPC has used the method for over 10 years (Clark et al. 2007). The method successfully collects snails from a small, intensively sampled area. For a species that is loyal to specific colony sites, this is a good method. But for a species that is sparsely distributed over a very large area, the method is labor and equipment intensive requiring a boat and several people to operate the dredge. The logistics of the dredge operation may not allow us to obtain a large enough sample size to detect changes in snail population with a reasonable level of statistical significance. Richards et al. (2005) conducted a comparison of the suction dredge method with cobble count sampling in a rocky area of the Snake River, below Hells Canyon Dam. They found significantly more snail specimens were collected by handpicking (cobble count method). While the sample size was small, this comparison suggests that the suction dredge may be more efficient in areas of finer sediment as compared to rocky areas. A variety of methods have been used in the examination of river substrates for invertebrates, including direct examination (e.g., Schwoerbel 1970, and New 1998).

We devised a simple and inexpensive method to mark rocks in the river upon which *T. serpenticola* occur and were able to easily locate these rocks later in the absence of extreme hydrologic events (Figure 3). Mean snail counts for the 10 rocks over the period of four weeks ranged from 3.5 to 4.3. Mean snail count increased slightly over the



FIG.3. Photo showing cobble with tag Malad River, Idaho, December 8, 2005. The marked cobbles are visible at distances of several meters (depending on water clarity).

four-week period although the number of snails on individual cobbles both increased and declined (Table 1). The average difference between rocks over the four-week period ranged from -0.1 to -0.8 . The standard deviation of the differences increased over the 4-week period from 2.02 to 3.94.

We used a value of 3.0 for the standard deviation in the power analysis calculations. This was the value observed for a two-week period which we anticipate would be the length of the test during hydroelectric dam operations. Based on a sample size of 10 rocks, a mean difference across rocks of 2.4 snails would have a 90% probability of being statistically significant (Table 2, Figure 4). A difference of 2.4 is quite large considering that only 3.5 snails were found on average. Therefore, a more likely sampling scenario would sample 50 rocks which would have the statistical power to detect a decline of about one snail per rock, or a $\sim 28\%$ decline.

Variance estimates were derived from a single set of 10 rocks sampled over 4 weeks; therefore, variance may be somewhat higher or lower. Similarly, the ability of a 50-rock sample to detect a decline in snail $\geq 28\%$ may also be approximate. Variance increased over the 4-week sampling period when estimates were derived from comparisons with the first week of sampling. During load following scenarios when testing will be done for the impact of dam operation on snails, the period of comparison will be approximately 2 weeks. Consequently, the increase in variance over longer periods of time is less of a concern. From a biological point of view, a decline of 28% or more seems a reasonable indication of a change in snail populations.

Table 1. Rock number, count of Bliss Rapids snails during time 1 through time 4, and difference in snail counts, Malad River, Idaho, December 2005. Average snail counts and average differences are also shown.

Rock #	Number of snails				Difference in counts			
	Week 1	Week 2	Week 3	Week 4	Week 2 v. 1	Week 3 v. 1	Week 4 v. 1	Week 3 v. 4
1	6	8	8	8	-2	-2	-2	0
2	4	5	5	3	-1	-1	1	2
3	9	5	4	2	4	5	7	2
4	6	8	13	10	-2	-7	-4	3
5	2	4	2	9	-2	0	-7	-7
6	2	0	0	1	2	2	1	-1
7	1	0	1	1	1	0	0	0
8	1	2	0	1	-1	1	0	-1
9	2	1	6	7	1	-4	-5	-1
10	2	3	2	1	-1	0	1	1
Mean	3.5	3.6	4.1	4.3	-0.1	-0.6	-0.8	-0.2
SD					2.02	3.27	3.94	2.78

Table 2. Sample size (number of rocks) needed to detect a change in the average difference between snail counts on rocks. N = the number of rocks sampled, power is the power of the test (1–beta), alpha is the probability of a false positive, beta is the probability of a false negative, mean of difference = the average of the differences between rock counts at time 1 and time 2 that would indicate a significant decline, and the standard deviation of the differences between time 1 and time 2.

<i>N</i>	<i>Power</i>	<i>Alpha</i>	<i>Beta</i>	<i>Mean of difference</i>	<i>SD</i>
10	0.9	0.1	0.1	-2.4	3.0
20	0.9	0.1	0.1	-1.7	3.0
30	0.9	0.1	0.1	-1.4	3.0
40	0.9	0.1	0.1	-1.2	3.0
50	0.9	0.1	0.1	-1.0	3.0
60	0.9	0.1	0.1	-1.0	3.0
70	0.9	0.1	0.1	-0.9	3.0
80	0.9	0.1	0.1	-0.8	3.0
90	0.9	0.1	0.1	-0.8	3.0
100	0.9	0.1	0.1	-0.7	3.0

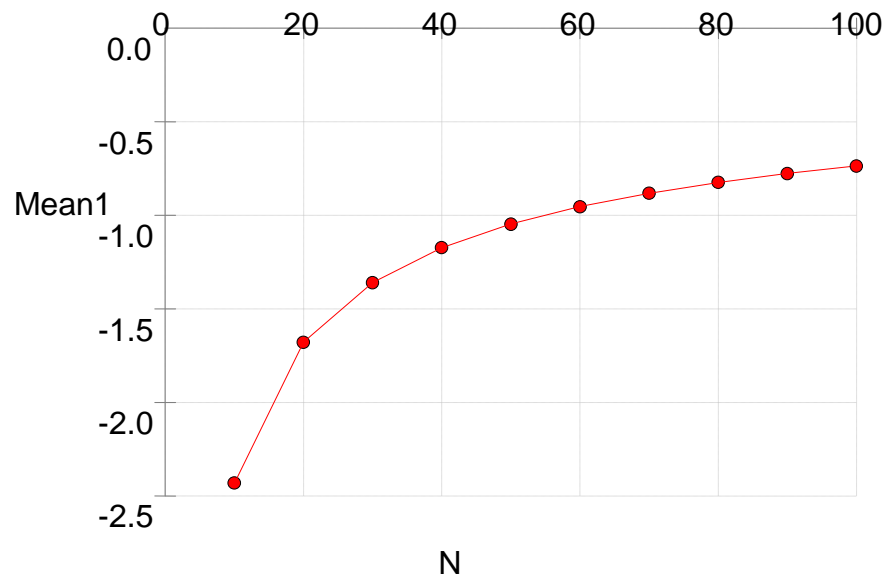


FIG. 4. Mean difference in snail counts between time 1 and time 2 that would be significantly different for different numbers of rocks (N).

This study addressed the variability of snails on rocks for a relatively limited area. A better design would select sampling locations randomly within the area of impact downstream from the dam. Some areas would be excluded from random sampling because they are too deep to safely sample or because the substrate was not appropriate for snails. Within the remaining area of available habitat, sites should be selected randomly. Randomly located sampling sites may be more difficult to find during revisits than sites located along a transect line, for example. In this situation, extra tagged rocks should be considered to insure that a minimum of 50 rocks are found on subsequent visits.

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