Mussel reestablishment as a best management practice: scaling their nutrient effects from the individual to the stream.

Resource Protection Group, Inc. – Reston Stream QUARTERLY PROGRESS REPORT

For Period October 1, 2024 through December 31, 2024

PROJECT NUMBER: RPG Stream RFP #6

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COOPERATOR: Resource Protection Group, Inc.

Project START DATE: October 1st, 2022

Project END DATE: September 30th, 2027

OBJECTIVES:

We will measure and analyze features of individual mussels, mussel beds, and stream reaches to describe the role mussels play in stream ecosystem function. Our fisheries management plan, focused on fish-host needs of the mussel populations, will be informed by species-specific responses of reintroduced mussels and their effectiveness in assimilating nutrients and changing physical and chemical conditions of the sediments to facilitate nitrogen removal via

denitrification.

PROGRESS DURING REPORTING PERIOD:

Field and Lab Work Accomplished Relative to Scope of Work:

1. Mussel salt experiment has been completed at the Mussel Lab at VT.

2. New PhD student is developing hypotheses on mussel-insect interactions.

3. Sondes were downloaded.

4. Mussels are being propagated at the VT mussel lab for introduction #2. The group is waiting for the completed mussels survey prior (see below) to release more mussels.

Following our last quarterly report, W. Lee Daniels forwarded several questions on behalf of the RPG Board which we respond to below.

Question: *The original proposal projected a total stocking of 35K of our little friends over a 5-year period. What are plans for the coming year? Can we "double up" on the annual rate for 2025 to get "semi-caught up"?*

Answer: I want to first provide some background and context for our mussel stocking rationale. In the summer of 2023, we collected approximately 2,800 adult mussels of Eastern Elliptio (*Elliptio complanata*) from several streams in the Potomac River system. From these mussels, we tagged and stocked about 1,600 in Snakeden Run and about 1,200 in Glade Run. These mussels were wild collected adults, meaning they are older (most >20 years old) and robust to environmental disturbance. They were measured and weighed at the lab, and in comparison, they are much larger and heavier than a typical laboratory produced juvenile mussel. Further, these larger adult mussels are strong filter feeders. And these mussels were stocked at densities (1.9 per meter squared in Snakeden and 1.5 per meter squared in Glade) that would be considered moderate to high densities depending on the habitat type. These densities would not be considered low for small stream environments like Snakeden and Glade for example. We stocked these adults for two main reasons: 1) to determine how mussels would respond to conditions in each stream, i.e., to get a rough idea of their survival and how well they would stay put in each stream, and 2) because these mussels were larger and stronger filter feeders, we were hoping they might have a more immediate and measurable effect on stream biogeochemistry than from the stocking of smaller juveniles.

Throughout 2023 and 2024, we've collectively observed some key differences between the two streams and how the mussels have been responding in them over the course of about 1.5

years. The mussels in Snakeden have been displaced during high stream discharge events and many of them have been deposited up on the stream banks where they have died. Some of these displaced mussels have also been salvaged and put back in the stream but their survival is unknown. Based on mussel monitoring in 2024, we are not even finding live mussels in the upper pools where they were originally stocked. For example, in the upper two pools of Snakeden 500 mussels were stocked, about a third of all mussels stocked in this stream in 2023. Hence, our observations after multiple surveying efforts in 2024 suggest that these mussels largely have been displaced from these two upper pools, with some dying from exposure on the stream banks, and with most likely moving unknown distances downstream. In contrast, we are not observing mussel displacement in Glade Run. Mussels appear to be staying in place and mortality also appears to be lower. We have found a few dead shells in the stream but we are not observing any mussels up on the stream banks after high discharge. The key differences between the two streams are size, discharge, gradient, and sheer stress, with all of these factors being greater in Snakeden.

Therefore, our decision to not stock propagated mussels in 2024 reared at the Freshwater Mollusk Conservation Center at Virginia Tech was based on these field observations. Mainly, we think small light weight mussels will be quickly displaced in Snakeden and mortality will be high. We think the best stocking option for 2025 is to grow the mussels at the lab to a larger size, for example >50 mm instead of the 20-30 mm size range originally stated in the proposal. Larger mussels will stay in place and survive better than smaller mussels. Further, their filtration capacity will be greater and thus their impact on site biogeochemistry greater. However, these mussels even after additional growout will still be smaller and lighter weight than the adult *Elliptio complanata* that we stocked in 2023. Importantly, how many and when propagated mussels are stocked in Snakeden in 2025 needs to be carefully thought through. Stocking, monitoring and ecological assessment of mussels in this stream has the potential to be a waste of resources if not carefully planned.

We currently have more than 10,000 propagated mussels of four species at FMCC for the project. These mussels are being held at FMCC for further growout to larger sizes, ideally to >50 mm by July-August 2025. In addition, we plan to transfer >2,000 *Ligumia nasuta* from FMCC to Maryland DNR sometime in mid to late April 2025 for growout at National Harbor, MD, which is located on the lower Potomac. Staff with the DNR can grow these mussels to larger sizes >60-70 mm over 3 months in the spring and summer, with these mussels also being available by August.

Question: *When I go back over the report, I assume that the 2023 survival estimates (really high) were based only on the observed mortalities and not the PIT tag recovery process? You've also mentioned issues with "finding the mussels and movement", so we'd like an update on that.*

Answer: Yes, that is correct. The 2023 survival estimates are based on dead shells collected from both streams during multiple trips made by several project team members, including shells found on the banks. Therefore, the 2023 survival estimates should be viewed as best case scenarios, as it is unlikely all dead shells were found during the period from summer into late fall of 2023. We initiated a mark-recapture monitoring plan in 2024, to estimate abundance and survival of tagged mussels. This monitoring plan requires that 4 passes be conducted in each stream using a crew of 3-4 people to collect and record mussels, with each pass ideally

separated by a 3-4 week time interval. In 2024, we successfully completed 3 passes but our 4th pass was not successful. Our crew made a trip on November 21st to complete this last pass but both streams were too full of leaves and the leaves had leached so much tannins that the water was too dark to even see the bottom to successfully survey the streams. Hence, that survey effort was abandoned and will be rescheduled in late winter of 2025 once the streams have hopefully been flushed cleaned by high discharge events. However, the three successful passes conducted in 2024 have allowed us to gain some initial insights into how the mussels are doing in each stream. As stated previously, mussels in Snakeden Run are being displaced by high discharge events and are moving downstream, which is resulting in mortality of the stocked mussels. In contrast, mussels in Glade Run appear generally to be remaining in place, and with lower associated mortality.

DATA COLLECTION & ANALYSIS:

1. Data from lab experiments and field experiments conducted in 2024 are being analyzed.

PLANS FOR NEXT QUARTER:

1. Begin pilot study for mussel-insect interactions.

2. Download sondes.

3. Analyze biogeochemical in situ experiments that were conducted in August 2024.