**Calling All Bacteria, It’s Audition Time!**

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**Introduction**

Popular reality TV shows like American Idol and America’s Got Talent drive home the basic idea that you can typically find talent by allowing large groups of individuals to audition and select themselves (in or out) based on some basic judging criteria. The concept holds true in the world of microbiology. Testing for antimicrobial resistance does this all the time. We expose a bacterium to a variety of antibiotics and determine which antibiotics are the most effective at killing off that bacterium.

Unfortunately, the organisms themselves do it as well. When exposed to a threat, some bacteria die off quickly, while others survive based on differences in structure and genetics. Similarly, when given opportunities to infect and cause destruction, some bacteria excel while others do not. Typically, the stronger bacteria, or those more able to survive (and in many cases those that are more able to cause harm to other organisms) pass along the genes that allowed them to be successful, thus creating future generations that are most successful at what they are intended to do.

I propose that samples of the bodies of water that need treatment for these invasive mussels be exposed to a variety of bacteria. Those bacteria that are most effective at limiting growth in a laboratory quasi-audition environment are the ones that win the contest and are awarded the chance to be used to treat water with the nasty quagga and zebra mussels.

**Proposal**

What I propose is a deeper look at which bacteria are best suited for each environment where the mussels are thriving. While this may take more time and energy upfront, the success of the treatment would be much better in the long term. In other words, you audition the bacteria and pick the one that outperforms the others. A simple concept applied to a complex problem.

Aquariums with actively growing mussel species are neither expensive to establish nor difficult to maintain. In fact, it is the ease with which these mussels reproduce that has led to the current predicament. What I would propose is a series of aquariums for each body of water needing treatment. Recreating the average environment where the mussels are growing is important. Samples of lake bed sediment would be important in these aquariums along with water taken directly from the lake, pond or river so as to maintain pH and solute concentrations as best as possible. Native fish species and invertebrates should also be included in the aquariums to help identify potential adverse effects.

After recreating the environment and allowing the mussels to grow and reproduce, different species of bacteria (or even different strains of the same species, like the *Pseudomonas fluorescens* mentioned above) would be introduced at varying concentrations to determine what their impact on the mussels is. Mussel survivability could then be monitored to determine which bacteria are most efficient at stemming the growth of these invasive species. The goal, obviously, would be to identify the strain of bacteria that best inhibits growth or even kills living mussels without causing significant harm to other aquatic life.

**Advantages of This Approach**

1. The bacteria selected to treat the fresh water will have already been tested in conditions that are similar to those in the environment. A general idea of their efficacy will be known.
2. Potentially negative side effects will have already been observed and safeguarded against to the extent possible. This is useful for practical application as well as for submission for approval from the EPA.
3. This approach avoids the one size fits all approach that has already shown to be extremely limited. By selecting unique species and strains of bacteria for individual bodies of water you increase efficacy and decrease the need to “shotgun treat” the water.
4. The procedure for pre-treatment testing is cost effective and simple and could be performed with relatively little training and experience. The organizations specific to each area of the country looking to treat their bodies of water would be responsible for the testing and results.

**Disadvantages of This Approach**

1. The range of organisms that carry potential to limit growth or kill off living mussels is not well investigated and documented and may need additional development time.
2. The testing period prior to treatment may take a long time, especially if EPA approval is required for all species prior to treatment.
3. It is not a quick and easy solution so buy in may be harder to obtain, however it appears as though there is no quick and easy solution…otherwise this challenge wouldn’t exist.

**Summary**

Using bacteria to inhibit other organisms is not a new idea. Even using bacteria to inhibit invasive mussels has been explored to some extent. What hopefully makes my approach novel is what I consider to be a sort of audition for the bacteria.

Simply put, there are species of bacteria that have been proven to be detrimental to invasive mussels, like the quagga and zebra species. Marrone Bio was quick to jump on this idea with its product, Zequanox, which is really just cultured *Pseudomonas fluorescens* bacteria. While their bacteria have proven useful in some applications, they have their limitations and are not suitable for all environments.

Expanding on the idea that bacteria (or bacterial products) can selectively inhibit or kill invasive mussels holds great potential. By using a variety of species in a variety of aquatic environments, we will be able to best identify the bacteria that hold the greatest potential to slow or stop the spread of these mussels. Taking these bacteria, the winners of the audition, if you will, and culturing them to the point of being able to treat water with them will provide a specific, adapted, well targeted approach to the problem of invasive mussels in our bodies of fresh water.

Thank you for your consideration.