TIP 344: Use of UV Radiation Technology to Prevent Settlement of Quagga Mussel Larvae

Context

Dreissenid mussels (i.e., quagga and zebra mussels) are a non-native nuisance species in North America that can foul hard substrates (e.g., pipes and water intake screens). Biofouling is a consequence of mussel settlement and accumulated shell debris causing damage to infrastructures, which can require significant mitigation costs.

Current dreissenid mitigation strategies in once-through facilities include physical (e.g. biofiltration, pressure spray) and chemical (e.g. sodium hypochlorite) methods that remove adults from substrates and tend to be reactive measures

Chemical control options are limited in Federal Columbia River Power System (FCRPS) facilities due to the threatened and endangered species present in the Columbia River Basin (CRB). Similarly, the use of physical control strategies in once-through FCRPS facilities will be limited by the in-water work period, costs, and large volume of water passing through facilities. Ultraviolet light technology is one of the technology characteristics that BPA specified in the Aquatic Nuisance Species Prevention and Impact Mitigation roadmap, and this project compliments existing R&D programs.

Description

This project aims to demonstrate the commercial viability and effectiveness of UV technology for controlling dreissenid mussels in FCRPS hydroelectric facilities while addressing some of the technological challenges for UV implementation in the field.

The project will determine the effectiveness of UV light technology to cause mortality and prevent settlement of larval quagga mussels. Specifically, the effect of dose, specific UV spectrum wavelengths, and water transmissibility will be evaluated. The work will take place at the Lake Mead Marina in Lake Mead, Nevada. The location offers an abundant quagga mussel population and available facilities.

Experiments will be conducted using a continuous-flow system constructed on a pontoon barge, which will allow for water and larval mussels to be pumped directly from Lake Mead into the exposure system. An estimate of the operational cost for implementing UV technology in hydroelectric facilities will be determined and recommendations will be made to BPA based on the findings of this project.

Why It Matters

By investing in an energy-efficient control technology for biofouling mussels, BPA facilities can be proactive against the dreissenid mussel invasion—preventing biofouling from occurring in hydroelectric facilities and avoiding significant mitigation costs and shut-down times associated with post-invasion.

Should invasion occur, this project will reduce maintenance costs associated with mussel biofouling. O & M costs for systems installed at Hoover Dam and Davis Dam are estimated to be less than $5,000 annually.

Goals and Objectives

The goal of this project is to determine the effectiveness of commercial UV light technology to cause mortality and prevent settlement of larval quagga mussels. The proposed study will be conducted over a two-year period.

The project's specific objectives are:

1) Evaluate UV-C and UV-B radiation effects on larval mussel mortality.
2) Determine minimum UV-C radiation dose to prevent larval settlement in a continuous-flow system.
3) Evaluate the effects of water transmissibility (UV-T) on the effectiveness of the optimal UV-C dose determined in objective 2 to prevent larval settlement, with a continuous flow.
4) Determine minimum UV-B radiation dose to prevent larval settlement in a continuous-flow system.
5) Evaluate the effects of water transmissibility (UV-T) on the effectiveness of the optimal UV-B dose determined in objective 4 to prevent larval settlement in a continuous-flow system.
6) Determine approximate operation cost for implementing UV technology in hydroelectric facilities.

Deliverables

Interim and final reports, complete dataset, and recommendations.

Interim and final reports will detail project findings and a recommendation will be made to BPA regarding the installation of UV systems into FCRPS hydroelectric facilities.

A formal project close-out meeting will be held to discuss and document lessons learned, as well as describe and document next steps.

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Project Start Date: October 1, 2015

Project End Date: September 30, 2017

Reports & References

Links

Participating Organizations

Smith-Root, Inc.
Western Biological Services
KASF Consulting

Funding

Total Project Cost:	$1,222,000
BPA Share:	$609,000
BPA FY2016 Budget:	$317,000

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