Technology Innovation Project *Project Brief*

TIP 232: An Investigation of the Interaction between Calcium and Temperature as Limiting Factors for Quagga Mussel Growth in the Columbia, Snake and Willamette Rivers

Context

Dreissenid mussels are fouling organisms that grow on solid surfaces and clog screens and pipes in aquatic environments. The risk of dreissenid introduction into the Columbia River Basin has increased. Quagga mussels (*Dreissena bugensis*) has been detected in Lake Mead, NV and zebra mussels (*D. polymorpha*) detected in the Missouri River, which may provide a proximate "seed stock" that can be transferred to the Columbia River Basin through fish hatcheries and the transfer of boats between watersheds. Upon entering the Columbia and Snake River watersheds, the consequence to BPA would be a substantial degradation of hydro project life and expense to control once introduced.

Description

A number of factors determine the risk of dreissenid establishment and colonization. Once introduced, pH and calcium and magnesium concentration are likely to determine the success of the invasion.

Calcium concentration is considered a critical environmental variable for dreissenid mussel survival and growth. Environment effects on growth have been examined in zebra mussels, but no information exists on the calcium or temperature requirements of quagga mussela. Whittier and Herlihy (2007) used calcium concentration in a GIS-based model to predict that the susceptibility of much of the Pacific Northwest was variable. Drake and Bossenbroek (2004) used a Genetic Algorithm for Rule Set Production model to predict zebra mussel spread and concluded differently. Resolution of the different model predictions requires empirical testing of quagga mussel tolerance and growth in Columbia River water.

This project conducts experiments to determine the interactive effect of temperature and calcium on quagga growth rates and develop a multivariate model that can be applied to Pacific Northwest water ways to determine consequent impacts, given that introduction is likely to occur.

Why It Matters

This project has significant, critical future application. The results will provide information on growth rates of quagga mussels and allow development of a model to permit prediction of biomass accumulation rates under various ambient calcium and water temperature conditions. The results will enable facility managers to better understand the risk to the Federal Columbia River Power System and to develop proactive, cost-effective mitigation and management plans.

Follow-up investigation to evaluate turbine and water-way coating lifespan and performance is the next step. BPA is also funding surveillance and detection efforts for dreissenid mussels in the basin and participates in the Columbia Basin Team of the 100th Meridian Initiative, a coordinated effort to prevent the spread of dreissenid mussels into and within the West.

Goals and Objectives

- A two-factor experimental design incorporating water temperature and calcium concentration will be used to examine the interaction between temperature and calcium on quagga mussel growth and survival in Columbia River, Snake River and Willamette River watersheds.
- The project will result in a model to predict quagga mussel growth based on calcium concentration and water temperature that can be used inform a FCRPS management plan.

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Project Start Date: October 2010

Project End Date: June 2012

Reports & References

Links

Funding

Total Project Cost:	$268,396
BPA Share:	$222,729
External Share:	$ 45,667
BPA FY2012 Budget:	$ 96,837

Participating Organizations

Portland State University
Pacific States Marines Fisheries Commission (PSMFC)

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