Northwest Power and Conservation Council

February 4, 2013

MEMORANDUM

TO: Council members

FROM: Jim Ruff – Manager, Mainstem Passage and River Operations

SUBJECT: Presentation on Portland State University research findings related to Dreissena mussels

Background

At the February 13, 2013, Council meeting in Portland, researchers from Portland State University (PSU) will present their findings concerning two research studies related to invasive quagga (*Dreissena bugensis)* and/or zebra mussels (*Dreissena polymorpha)*. Both zebra and quagga mussels are invasive freshwater mussels that threaten the ecosystem and infrastructure of the Columbia River Basin. The presenters will be Dr. Mark Sytsma, who is the Associate Vice President for Research at PSU, along with research assistants Brian Adair and Steve Wells.

Study 1 -- The Importance of Calcium and Temperature in Growth of Quagga Mussels in Columbia River Basin Waters

The first study relates to quagga mussel growth and survival in water samples taken from the Columbia and Willamette rivers. Presenters will be Brian Adair and Mark Sytsma.

Methods. In this study, PSU researchers assessed the influence of calcium concentration and temperature on the survival and growth of quagga mussels (*Dreissena bugensis*) in water samples taken from the Willamette and Columbia rivers. To conduct this study, four calcium treatments were prepared by amending the Columbia and Willamette water samples with calcium chloride ($CaCl_2$). For each treatment, 10 juvenile mussels were reared in individual containers. A control group of mussels was reared in untreated water. Each treatment group was repeated at four different temperature regimes.

Findings. In the Willamette River water, a positive linear relationship was observed between calcium concentration and growth of juvenile mussels. Untreated Willamette River water had an average calcium concentration of 6 mg/L and the calcium chloride treatments increased uniformly up to 25 mg/L. A quadratic relationship was observed between temperature and quagga mussel growth, with the most

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significant growth occurring between 16 and 20°C. Average change in weight for quagga mussels was negative in untreated Willamette River water at all temperatures. No trend in growth of juvenile quagga mussels was observed when tested in water from the Columbia River amended with $CaCl_2$. However, there appeared to be a threshold for optimal mussel growth between 35 and 50 mg calcium/liter. As with the Willamette River assays, a quadratic relationship between mussel growth and temperature was observed. Average change in weight for mussels in untreated Columbia River water was positive at all temperatures.

Study 2 – Field Evaluation of Service Life of Foul-Release Coatings in the Columbia River
The second PSU study pertains to evaluating the effective service life of various foul-release coatings placed on panels under ambient Columbia River conditions. Presenters will be Steve Wells and Mark Sytsma.

The purpose of this study was to determine the cost effectiveness of using foul-release coatings to mitigate the impacts of a zebra or quagga mussel infestation should these invasive species become established in the Columbia River Basin. These invasive freshwater mussels can foul hard substrates and clog water intake pipes and screens. Foul-release coatings are effective and non-toxic and may be part of an integrated control plan for these mussels at hydroelectric facilities in the Columbia River Basin. These coatings are soft, however, and there are concerns about abrasion, gouging, and adhesion failure under ambient conditions.

Methods. In this study, approximately 1,000 coated concrete and steel panels were deployed in the Columbia River in March 2012 to compare various foul-release coatings (including Intersleek 970, Sher Release, and Hempasil X3) to the coatings used presently by the U.S. Army Corps of Engineers (USACE) to protect submerged concrete (CrystalSEAL) and steel (Corps V766E), as well as bare concrete. This experiment is ongoing, and panels are removed at periodic intervals to assess physical damage and fouling resistance.

Findings to date. Panels were removed from the Columbia River after 3-month and 9-month immersion periods. Only the panels from the 3-month period have been evaluated to date. The only physical damage observed after 3 months of immersion was blistering on two Hempasil X3 panels (No. 2 Medium and No. 4 Few). All the panels were fouled by algae. Rinsing the panels with a 15-feet/second stream of water did not remove the algae from the bare concrete, from the CrystalSEAL panels, or from the Corps V766E panels. However, the water rinse did remove the algae and other soft-fouling organisms present on the foul-release coatings, and it did not damage the foul-release coatings.

Quagga mussels did not attach to any of the foul-release coatings in an *in-vitro* test. The maximum force needed to detach mussels from the panels decreased after 3 months immersion on the CrystalSEAL and bare concrete panels. A similar decrease in the mean strength of adhesion was measured, however, there was high within-treatment variation and the differences were not significant.

Panel evaluations will continue with the 9-month immersion treatment, and the 15-month immersion treatment will be removed from the Columbia River in July 2013. An *in-situ* experiment will be conducted in San Justo Reservoir, CA, which is infested with zebra mussels, to measure coating effectiveness under natural conditions. PSU will also be developing a detailed cost estimate for applying a foul-release system to a USACE Columbia River hydropower project.