

# Technology Innovation Project



*Closing  
Project Brief*

## TIP 276: Enhanced Monitoring and Investigation of the Spread and Potential Impact of Aquatic Invasive Mussels in the Columbia River Basin, with Special Reference to Mitigation and Placement of Boat Cleaning Stations

### Context

One of the technical priorities for BPA is to adequately maintain and update hydropower equipment in the Federal Columbia River Power System (FCRPS). A major challenge to the effective operation of the FRCPS is the presence and colonization of aquatic invasive species (AIS) that can potentially reduce efficiency and require significant and costly mitigation efforts.

Zebra and quagga mussels have recently invaded many western water bodies (but not yet the Columbia River Basin (CRB)), causing extensive economic and environmental damage. Research is required to develop methods to allow early detection, for preventing the mussels' spread, and to define strategies for controlling and managing hydroelectric, irrigation and urban water facilities if the mussels are introduced to the CRB.

There is currently no comprehensive, coordinated plan in the CRB that ensures adequate monitoring of potential establishment sites or that prioritizes monitoring activities based on risk.

### Description

This project expands existing efforts by Washington State University (WSU) and the United States Geological Survey (USGS) to establish the following:

1. Enhance an integrated AIS monitoring and information system that has been developed by the USGS and WSU in collaboration with the Pacific States Marine Fisheries Commission
2. Enhance and further coordinate existing early detection efforts
3. Develop an Environmental DNA survey methodology for early detection.
4. Provide a Geographic Information System layer describing all of the river access points on the mainstem Columbia and Snake Rivers and major tributaries and research and report current understanding of the relative use of these river access points
5. Conduct research that will help to assess the cause and effects of biological invasions in the CRB
6. Train young professionals in assessing the effects of AIS on food webs.

The results of this project will have several direct applications; for example, to prioritize areas for the installation of boat cleaning stations in the CRB.

The prioritization can be based on the levels of use of a particular boat cleaning station, on the relative risk to a hydroelectric facility based on the proximity of the access point to the facility, on the risk to a particularly sensitive ecosystem, or any combination of the above.

### Benefits

Zebra and quagga mussels have caused several billion dollars of damage to water infrastructure in the Great Lakes, including municipal water supplies and agricultural irrigation facilities. If an invasion by these mussels into the CRB were to go unchecked, economic costs to BPA's hydropower infrastructure could easily climb to 10's or 100's of millions of dollars or more, along with devastating consequences for the environment.

Enhancing existing CRB AIS information system will provide up-to-date information on all monitoring activities, improve the ability to implement more cost-effective programs, and ensure that gaps in data collection are prioritized according to their relative risk of introduction and establishment.

For BPA Power Services, knowing which BPA facilities are most at risk will allow for better planning of maintenance, repair and replacement schedules. For BPA Environment, Fish and Wildlife, having a better understanding of the food web effects of AIS, and the potential impacts on listed species, such as salmon, will assist BPA and other agencies in predicting and managing these species and their habitats.

### Accomplishments

The objective of this project is to provide BPA with products and tools to help delay the arrival and spread of zebra and quagga mussels to the Columbia River Basin (CRB) so that impacts to the Federal Columbia River Power System (FCRPS) are minimized; and to improve the efficacy of boat cleaning stations once they are developed by providing a basis for prioritizing their placement.

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**Project Start Date:** October 4, 2012

**Project End Date:** December 31, 2015

## Project Cost

Total Project Cost: \$1,195,727

**Deliverables** (see next page)

## Key Conclusions

We have used the data collected during this project and combined it with data previously collected as part of a collaborative project between the WSU and USGS (Emerson et al. 2015) to conduct an assessment of the probability of detecting dreissenid mussels (and other newly introduced species) at low densities.

Our preliminary analyses suggest that the current level of effort being expended in the Bonneville, John Day, and Priest Rapids reservoirs on the Columbia and for Ice Harbor Reservoir on the Snake River does not provide for a high probability of detecting dreissenid mussel veligers at low densities (USGS, unpublished data), indicating that additional early detection sampling is needed in the future.

## Links

PSMFC's Columbia River Basin Aquatic Invasive Species (CRBAIS) website; <http://crbais.psmfc.org>

## Related Projects

TIP 233: Field Evaluation of the Service Life of Foul-Release Coatings in Columbia River

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

## For More Information Contact:

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## Participating Organizations

Washington State University Vancouver  
USGS Columbia River Research Lab



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## Deliverables

The primary deliverable of this project is **WSU-USGS BPA TI Project Final Report – December 2015** by S.Bollens and G. Rollwagen-Bollens Washington State University Vancouver

This report is available from the Technology Innovation Project Management Officer. The report describes five resulting products and their deliverables.

**Product 1:** Enhance a coordinated non-native species information system for the Columbia River Basin on the Non-indigenous Aquatic Species (NAS) website hosted by USGS.

**1a.** Georeferenced locations of all zebra mussel monitoring efforts that were conducted from 2012 – 2014, by gear type and entity performing the efforts.

**1b.** Georeferenced locations of all zebra mussel monitoring efforts planned for 2013 – 2015, by gear type and entity performing the efforts.

**Product 2:** Enhance and further coordinate existing early detection through development and implementation of new technologies for visualization and detection (FlowCam and eDNA).

**2a.** Using information derived from Product 1, we identified gaps in zebra mussel monitoring coverage.

**2b.** Once these gaps were identified, we prioritized, allocated, and conducted sampling efforts to fill the gaps using standardized collection techniques.

**2c.** Samples were then processed in two ways: i) via cross-polarized light microscopy, and ii) via a FlowCam VS-1 (Fluid Imaging, Inc., Yarmouth, ME).

**2d.** In year 3 of the project, we added a third detection method, by developing and validating species specific assays to detect eDNA of zebra and quagga mussels, as well as the surrogate species *Corbicula fluminea*.

**2e.** We generated maps of positive detections in relation to veliger sample analysis results and developed preliminary recommendations for eDNA sampling for zebra and quagga mussels in this system

**2f.** We generated quarterly and annual reports, and peer-reviewed publications describing:

i) the gaps in monitoring coverage (please see Table 1 for the list of presentations to stakeholders regarding sampling gaps for 2013, 2014, and 2015), and

ii) an assessment of the use of the FlowCam technology on CRB samples (please see Table 1 for list of presentations, and also Appendix B for manuscript describing experimental results of FlowCam efficacy experiments).

**Product 3:** Provide a Geographic Information System layer describing all of the river access points on the mainstem Columbia and Snake Rivers and major tributaries, and research and report our current understanding of the relative use of these river access points.

**3a.** We gathered all available information on river access points in the CRB and compiled this information into a GIS layer made available on the CRBAIS information system website.

**3b.** We identified and prioritized information gaps and proposed methods to address them.

**3c.** We developed a relational GIS layer that represents river access points to the Columbia and Snake Rivers and major tributaries.



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### Deliverables (continued)

**Product 4:** Conduct research that will help to assess the cause and effects of biological invasions in the CRB, building on existing WSU and USGS efforts to assess food web effects in the Columbia and Snake Rivers by documenting the seasonal dynamics of plankton populations and communities.

**4a.** We produced reports, presentations, and peer-reviewed publications reporting the results of the studies undertaken as part of this project. Please see Appendix B and Appendix C for copies of publications arising directly from this project.

**Product 5:** Provide opportunities to train young professionals in assessing the effects of AIS on CRB food webs.

**5a.** The inclusion of graduate students provided for the training of young professionals that will contribute to finding solutions to, and assessing the implications of, biological invasions – thus potentially mitigating the effects of such invasions on the FCRPS.