Environmental Performance Analysis and Testing Campaign for New Technologies

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Project Overview

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Overall Goal: Conduct an independent assessment of the effects of passage through a novel fish passage device, the Whooshh Fish Transport System (WFTS), on upstream migrating adult salmon and compare effects from commonly used fish passage techniques (i.e., trap and haul)

The Challenge: Technologies that Endangered Species Act (ESA)-listed fish may pass through at hydropower facilities must be approved by regulatory agencies. Approvals require defendable data produced by scientifically objective experts, which can be costly for small technology developers.

Partners: Whooshh™ Innovations (Technology Developers), Washington Department of Fish and Wildlife, Grant County Public Utility District

Next Generation Hydropower (HydroNEXT)

Optimization

- Optimize technical, environmental, and water-use efficiency of existing fleet
- Collect and disseminate data on new and existing assets
- Facilitate interagency collaboration to increase regulatory process efficiency
- Identify revenue streams for ancillary services

Growth

- Lower costs of hydropower components and civil works
- Increase power train efficiency for low-head, variable flow applications
- Facilitate mechanisms for testing and advancing new hydropower systems and components
- Reduce costs and deployment timelines of new PSH plants
- Prepare the incoming hydropower workforce

Sustainability

- Design new hydropower systems that minimize or avoid environmental impacts
- **Support development of new fish passage technologies and approaches**
- Develop technologies, tools, and strategies to evaluate and address environmental impacts
- Increase resilience to climate change

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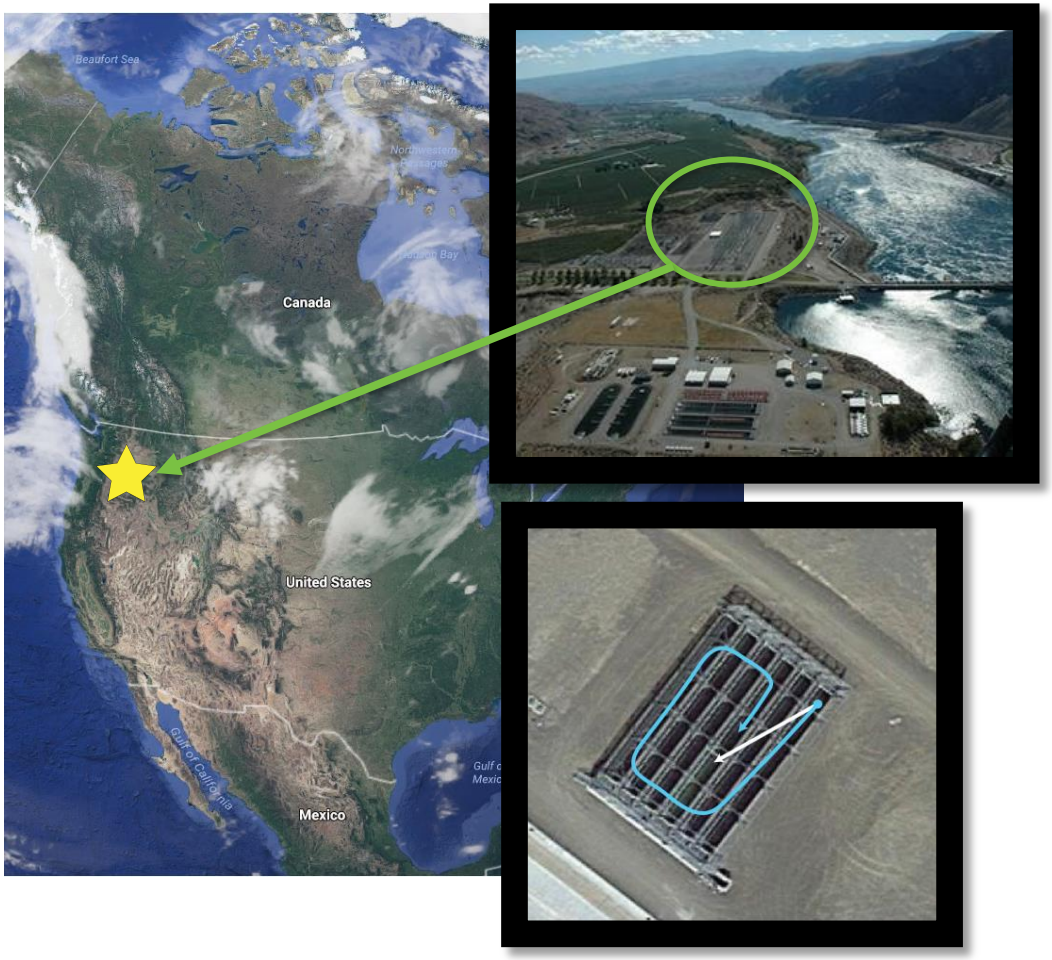
The Impacts

- Defensible data assessing the effects of passage through the WFTS compared to currently used fish passage approaches
- A pathway for technology developers to gain regulatory acceptance for novel fish passage technologies

- ***Endpoint:*** Defensible data that can be used by regulatory agencies to evaluate the WFTS for use in river systems with ESA-listed species
- ***Final Product:*** Peer-reviewed publication documenting the results of the comparative study.

Technical Approach



Technical Approach

- Measured:
  - Survival of adults
  - Acute and innate immune response (Interleukin 1-beta and Immunoglobulin M)
  - Stress (Cortisol)
  - Damage to slime coat
  - Survival of offspring.

Treatment	Number of Fish Tested
Control	36
Whooshhed 40 ft	36
Whooshhed 250 ft	39
Trap-and-haul	36

- Effects were comparable between Whooshh and trap-and-haul
  - No injury or altering of physiological functioning of mature adult fall Chinook salmon, but…
- In-river studies are needed to answer additional questions and to understand **migration effects**

Accomplishments and Progress

- First published study to demonstrate that passage through the WFTS is comparable to currently used fish passage approach (i.e., trap and haul)
- Acknowledgement from National Marine Fisheries Service that the use of the WFTS is safe for non-ESA-listed adult salmon
  - Additional information is still needed for ESA-listed species

Project Plan & Schedule

Project Funded — Aug 2014

Experiment Performed — Oct 2014

Data Collection Completed — Jan 2015

Additional Funds Received — Jun 2015

Hosted Webinar — Sep 2015

Manuscript Submitted/ Project Completed — Sep 2015

Project Budget

Budget History		
FY2014	FY2015	FY2016
DOE	DOE	DOE
$300k	$45k	n/a

- 100% of the budget has been expended and the project has been completed.
- This project does not have cost share.

Research Integration & Collaboration

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Partners, Subcontractors, and Collaborators:

- Whooshh™ Innovations
  - Technology developer
  - Subcontracted for use of system during testing
- Grant County Public Utility District
  - Site owner
- Washington Department of Fish and Wildlife
  - Hatchery manager

Communications and Technology Transfer:

- ***Publication:*** Geist et al. 2016. Physical, physiological, and reproductive effects on adult Fall Chinook salmon due to passage through a Novel Fish Transport System. Journal of Fish and Wildlife Management, accepted
  - **Outcome:** defensible data that can be used by regulatory agencies to evaluate WFTS
- ***Webinar:*** Evaluation of the Whooshh Fish Transport System. Available: https://pnnl.eventbuilder.com/event?eventid=y6s5l5
  - **Outcome:** over 170 viewed broadcast

Next Steps and Future Research

FY17/Current research:

- Whooshh Innovations awarded 2016 DOE Small Business Voucher (SBV) to address regulatory requirements for acceptance of new fish passage technology
- SBV Project Goals:
  - Working with regulatory agencies to determine their requirements for new fish passage technologies
  - Design and execute a study that meets these requirements
    - Field study planned for spring/summer 2017

Proposed future research:

- Improve the performance of the WFTS by reducing fish handling
- Evaluate the performance of the WFTS with other migratory species (e.g., American eels, American shad).