

PNNL-30971

# **Team Hogan – Air Bubble Curtain for Physical Exclusion – Fish Protection Prize**

CRADA 500

February 2021

Geist, David R.

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Prepared for  
the U.S. Department of Energy  
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Pacific Northwest National Laboratory  
Richland, Washington 99354

# Cooperative Research and Development Agreement (CRADA) Final Report

**Report Date: February 6, 2021**

In accordance with Requirements set forth in the terms of the CRADA, this document is the CRADA Final Report, including a list of Subject Inventions, to be provided to PNNL Information Release who will forward to the DOE Office of Scientific and Technical Information as part of the commitment to the public to demonstrate results of federally funded research.

**Parties to the Agreement:**

**PNNL/Battelle Memorial Institute**

**Neurotrophic Labs, LLC**

**PNNL CRADA Number: 499**

**CRADA Title:** Neurotrophic Labs – Fish Exclusion Using a Floating Separator – Fish Protection Prize

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**Joint Work Statement Funding Table showing DOE funding commitment:**

Estimated Costs	PNNL Shared Resources	Participant Shared Resources	Participant Funds In	Totals
Year 1	\$11,000	\$15,200	\$ 0	\$26,200
TOTALS	\$11,000	\$15,200	\$ 0	\$26,200
Fed Admin Charge on Funds-in	----	----	----	

**Executive Summary of CRADA Work:** In FY2020, the National Renewable Energy Laboratory (NREL) initiated a Prize competition with support from Pacific Northwest National Laboratory (PNNL), and sponsored by the U.S. Department of Energy Water Power Technologies Office (DOE WPTO), to support the development of innovative methods for excluding fish from water diversions and intakes: the Fish Protection Prize. Proposed solutions can include new ideas for addressing fish exclusion or improvements to existing technologies. Solutions can be applied to river and canal diversions, unscreened diversion pipes, or intakes at dams.

The Fish Protection Prize competition under this phase had three stages:

1. Concept stage (January - June 2020): WPTO announced the Prize competition, solicited submittals, and worked with NREL and PNNL to select up to 10 Finalists to advance to the second stage.
2. Incubation stage (June - September 2020): Nine finalists received up to 50 hours of voucher support each from PNNL as they prepared for the third stage.
3. Pitch Contest stage (September 2020): The 9 finalists competed in a “Pitch Contest” that occurred during the America Fisheries Society Annual Meeting in September (a virtual meeting in 2020). At the end of the Pitch Contest, the DOE WPTO Prize judges selected three Grand Prize Winners to receive up to \$700,000 of combined cash prizes and additional voucher support from PNNL to develop their proposals in FY21.

**Summary of Research Results:**

- In FY20 PNNL provided voucher support in the form of technical reviews and support, as well as graphics and presentation support, in helping the 9 finalists prepare for the Pitch Contest at the American Fisheries Society (AFS) virtual meeting.
- No subject inventions, patent applications, copyrights, and trademarks under this CRADA.
- Products Developed: Abstract and link to American Fisheries Society presentation (attached).

**Abstract Copied From AFS 2020 Meeting Website:** The technology described in this submittal is focused on the utility of the induced upward current of an air bubble curtain and the physical adhesion of bubbles for reducing entrainment of early life stages of fish (passive eggs and larvae) as well as free-floating debris into water diversions/intakes. As such, this idea represents a new application of an existing technology. We believe the bubble-induced currents associated with this proposed technology will work to exclude fish larvae from diversions and intakes because air bubbles have been used successfully to solve a number of engineering challenges, many of which are focused fundamentally on separating passive particles (e.g., suspended solids and sediment) or liquids (e.g., oil) from ambient water bodies. In addition, we believe the physical attachment of air bubbles to early life stages of fish will aid in diverting them gently towards the surface and away from the intake. This is the concept behind dissolved air floatation (DAF) in which air bubbles are introduced to flocculated seawater and attach to solid particles creating bubble-solid agglomerates that float to the surface where they are removed by surface skimmers.

**Link to presentation video at AFS 2020 Meeting website:**

<https://afs.confex.com/afs/2020/meetingapp.cgi/Paper/44434>

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