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*Analytical Techniques to Assess Fish Passage Connectivity & Identify Patterns & Triggers in Ecological Response to Hydrologic Processes*

**Lead PI:** David L. Smith (ERDC)

### **Project Development Team**

**(PDT):** Keith Martin, John Nestler, Tammy Threadgill, Christa Woodley (ERDC)

**District Collaborators:** Tom Maier (LRP); Mark Cornish (MVR); Jason Farmer (MVS); Andrew Roach (NAB); Larry Oliver (NAE); Curtis Miller (NWO); Brad Eppard (NWP); Derek Fryer (NWW); Joe Moran (SAC); Brian Zettle (SAM); Stanley Simpson (SAS); Mick Porter (SPA); Brian Mulvey (SPK)

**Other Partners:** John Stark (TNC)

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## Managing Movement of Threatened, Endangered, and Invasive Species Using Corps Water Resources Infrastructure<sup>1</sup>

### Research Need

Corps' river infrastructure projects have the potential to disrupt river connectivity and impede movement of desirable migratory aquatic species, many of which are threatened or endangered (T&E species). Simultaneously, river infrastructure can block the spread of aquatic nuisance species (ANS). For example, the Brandon Road Lock and Dam (L&D) is thought to block the movement of Asian Carp into the Great Lakes through the Illinois River Waterway and the Upper and Lower St. Anthony Falls L&Ds are thought to block the spread of ANS into the upper reaches of the Mississippi River. Traditional fish passage strategies to restore connectivity for T&E species now compete with strategies to block or impede movement of nuisance invasive species. Corps' river infrastructure projects could contribute to river system restoration if they could be designed or operated to serve as selective distributional controls (i.e., passage for some species and barrier to others) for highly mobile aquatic biota at either single-project or system-wide scales. Unfortunately, there are no operational guidelines or designs for selectively passing desirable migratory species or impeding nuisance species.

### Project Objectives & Plan

The goal of the proposed work is to develop planning and engineering tools for application at L&Ds that allow Corps' scientists and engineers to develop project alternatives that selectively pass desirable aquatic species and block or impede ANS. This research is intended to be conducted in parallel with a Pittsburgh District USACE ongoing navigation modernization feasibility study for three locks on the upper Ohio River and the USFWS Biological Opinion on Ohio River Navigation System operation and maintenance. Anticipated products include:

- Tech Note: Novel approach for using computation fluid dynamics (CFD) modeling to support feasibility studies.

- Software: Generalized CFD models of L&Ds for feasibility studies of proposed fish passage strategies.
- Movement rules that can be used to forecast the migratory path made by different target fish species.
- Adaptive Management Plan for application of fish passage strategies at Corps L&D's.

## Payoff

L&Ds are a major component of the Nation's navigation infrastructure and have the potential for dual use as a major contributor to the Corps ecosystem and restoration business line. The extension to dual use is possible with relatively little additional investment and either no impact or very little impact on navigation efficiency. This work, with its initial formulation at Pittsburgh District (LRP), will establish a sound foundation for the design and evaluation of selective fish passage strategies at replacement lock chambers on the Upper Ohio River to support a Great Lakes and Ohio River Division environmental commitment. This work also supports initiatives identified in the MOU executed between The Nature Conservancy and Great Lakes and Ohio River Division for cooperative projects involving dam management for native fish passage, floodplain protection, invasive species, and fish and mussel reproduction needs. It further supports initiatives of the Council on Environmental Quality and Pennsylvania Fish and Boat Commission to restrict the spread of Asian carp. Methods developed in this Work Unit will be broadly applicable to USACE navigation infrastructure nation-wide.

## Products

### White Papers

Smith, D.L. (In review). White paper: building a generalized fish passage assessment tool for application at Corps lock and dams, Technical Note. U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi.

### Project Activities

Laboratory and computational fish movement studies/simulations to assess attraction flow effectiveness; Non-physical barrier simulation at a Lock and Dam (Deterrence technology will be an important consideration for fish movement management – tools are needed to anticipate impacts and plan implementation)

<sup>1</sup>Project Alias – Work Unit Documentation Title: *Managing Movement of Threatened, Endangered, and Invasive Species Using Corps Water Resources Infrastructure*