

## Activities in Controlling and Monitoring Asian Carp Movement, 2010

Asian carp movement from the Mississippi River Watershed poses an environmental risk to the Great Lakes. There are a number of potential pathways, but the Chicago Area Waterway System (CAWS) is of greatest concern (fig.1). The U.S. Environmental Protection Agency (USEPA) provided support through the Great Lakes Restoration Initiative (GLRI) funds to the U.S. Geological Survey (USGS) for several projects to assist in the control and monitoring of Asian carp movement. Significant activities were completed in Federal Fiscal Year 2010. All of these projects are outlined under the Asian Carp Control Strategy Framework prepared by the Regional Coordinating Committee's participating agencies (visit <http://www.asiancarp.org/> for more information).

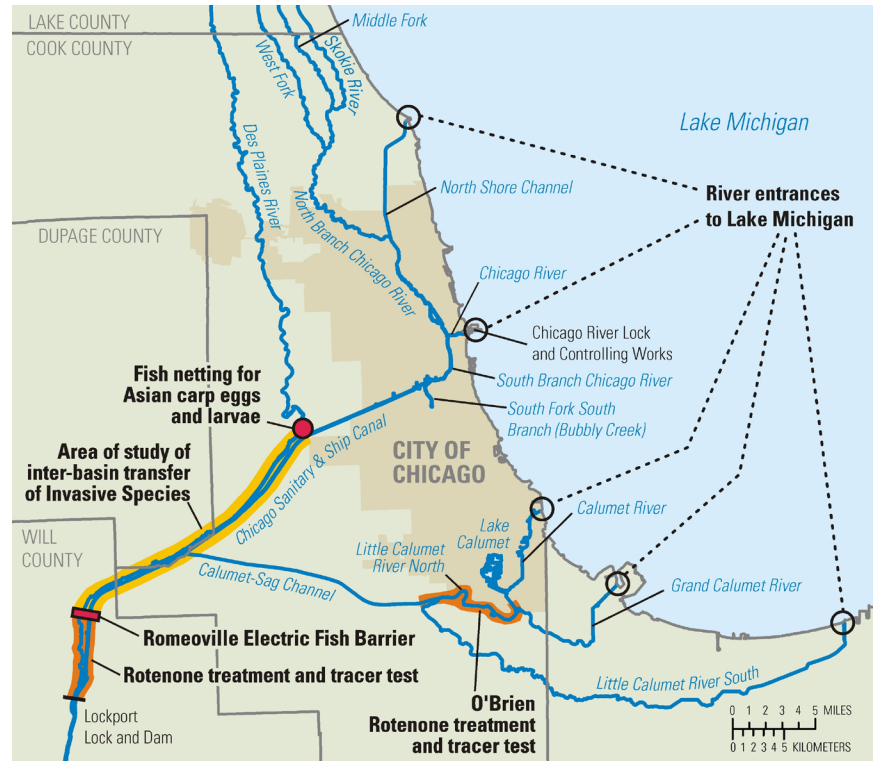


Figure 1: Map of the Chicago Area Waterway System (CAWS) with locations of rotenone treatments and tracer tests, fish netting, and area of study of inter-basin transfer of invasive species.

### Feasibility Assessment of Inter-Basin Transfer of Invasive Species

The evaluation of the potential movement of Asian carp eggs and small fry through fractured rock separating the Chicago Sanitary and Ship Canal (CSSC) and the Des Plaines River (DPR) had several components completed or significant progress has been made on these activities.

- Compilation and analysis of previously-available water quality, hydraulic, and geologic information.
- Characterization of bathymetry and composition of the bed sediment of the DPR and CSSC.
- Surveyed the walls and bed of the CSSC using a Multi-Beam Echo Sounder (MBES) and identified potential subsurface fractures in numerous locations (fig. 2). The MBES survey also identified locations of abandoned cars and other large objects, and the locations of sediment deposits in the CSSC signifying overland inflows and sloughed banks (fig. 2), and provided high-resolution bathymetry for ongoing CAWS model development. The locations of over 95 sunken vehicles and vessels have been

shared with the Metropolitan Water Reclamation District of Greater Chicago (MWRD-GC) and the U.S. Army Corps of Engineers (USACE) (fig. 2, right). These objects may pose a hazard to navigation and the electric fish barrier. Sediment mound locations were provided to the USACE to assist in the constructing the overland flow barrier between



USGS hydrologist collecting resistivity data along the CSSC and the DPR. This data was compared to the MBES and water-quality data to optimize drilling locations, June 2010.



Example of overland flow in flooding conditions along the Des Plaines River.

the DPR and the CSSC (fig. 2, left). This work was completed in partnership with the University of Illinois at Urbana-Champaign (UIUC) where researchers are currently developing a model of the CAWS that will be capture its complex hydrodynamics and that can be used to investigate future Asian carp control measures.

- ◆ Geological assessment of the area, including stratigraphy, lithology, fracture orientation, and areas where potentially important fractures are located in the CSSC and DPR.
- ◆ Measured synoptic water-quality distributions in the CSSC and identified areas where substantial groundwater inflow from the DPR to the CSSC may be occurring. In addition, performed surface

geophysical surveys at potential substantial subsurface fractures between the DPR and the CSSC. These areas have been cross-referenced and plotted to optimize data evaluation (fig. 3).

- ◆ Identified several locations for monitoring wells to be installed based on the information obtained from these field activities. These wells will be intensively tested with multiple tools and methods to assess the fracture network properties (porosity, inter-connectivity, etc.) and the pathways of fracture flow between the DPR and the CSSC.

### Great Lakes' Tributary Assessment for Asian Carp Habitat Suitability

This project is focused on determination of river characteristics required for spawning and successful recruitment of bighead and silver carp including: the minimum river length, minimum water velocity, and water temperature requirements. These characteristics will be used to assess tributaries to Lake Michigan to determine their suitability for Asian carp spawning and successful recruitment. In this initial study, the USGS is collecting hydraulic data with Acoustic Doppler Current Profilers (ADCP) and water-quality distributions with multiparameter water-quality sondes in two tributaries to Lake Michigan, the St. Joseph River and the Milwaukee River. In addition, USGS researchers have measured the physical characteristics of eggs and larvae as they develop under a range of temperatures. Using the field and laboratory data discussed above, a model will be constructed that will predict the reach lengths required for successful

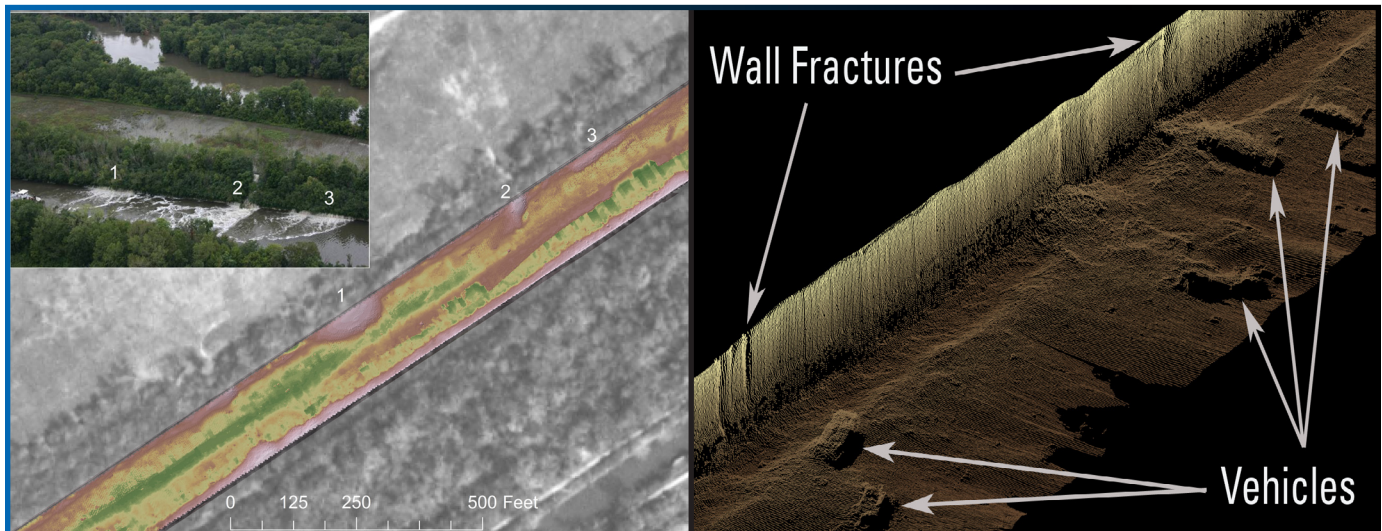
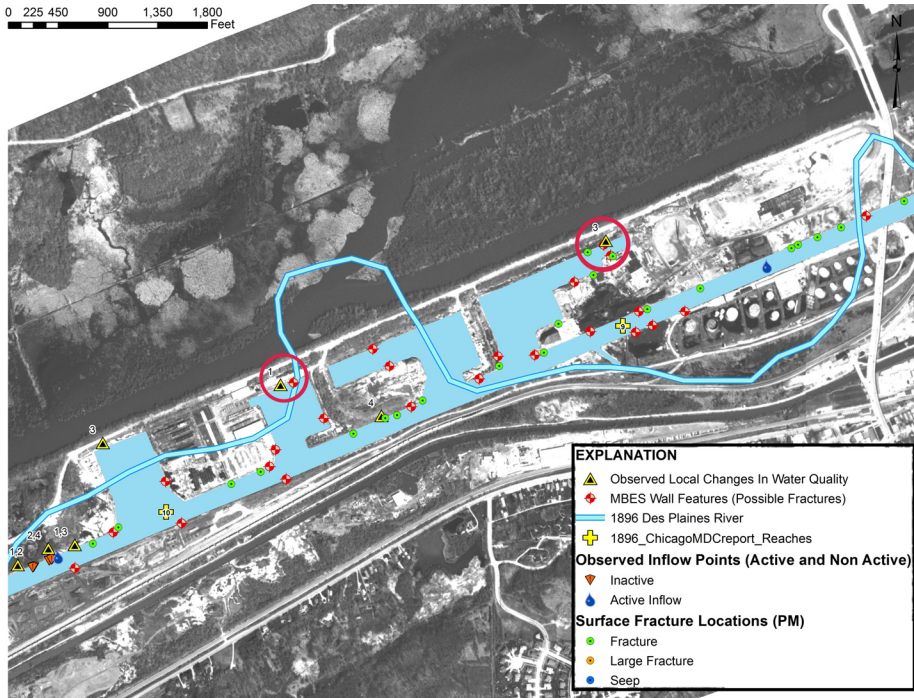


Figure 2: Examples of MBES data and potential applications. Left—Sediment mounds resulting from overland flow and sloughed banks (see inset picture; photo provided by USACE) in the CSSC upstream of Lemont using the MBES data; Right—Examples of wall fractures and sunken vehicles in the CSSC.



**Figure 3: Data compilation map showing locations of surface and subsurface fractures, changes in water quality, active inflows and seeps, and the historical course of the Des Plaines River. Locations where subsurface fractures and changes in water quality occur together (circled in red) are potential subsurface exchange points.**

water column at an earlier developmental stage than was previously assumed. Normal horizontal swimming began much later in development and coincided closely with the youngest developmental stages appearing in off-channel nursery habitats in a previous USGS study.

- ◆ Sampled the DPR, just downstream of Hofmann Dam, during three high-flow events for the presence of Asian carp eggs or larvae. None were detected.
- ◆ Completed hydraulic and water-quality data collection on the Milwaukee River.
- ◆ Similar sampling could not be completed on the St. Joseph River because of a lack of high flow events.

recruitment on each of the evaluated tributaries. The methods used in this assessment can be applied to other Great Lakes' tributaries to identify those rivers that are most suitable for Asian carp spawning and recruitment.

- ◆ Completed preliminary tests on the development series for bighead and silver carp eggs and larvae at different temperatures.
- ◆ USGS scientists found in 2010 that bighead and silver carp begin to swim vertically immediately after hatching. This new finding is important because this behavior enables them to stay suspended in the



**ADCP and water-quality data collection on the Milwaukee River in July 2010 with USGS hydrologists.**

### Hydrologic Support for Asian Carp Control

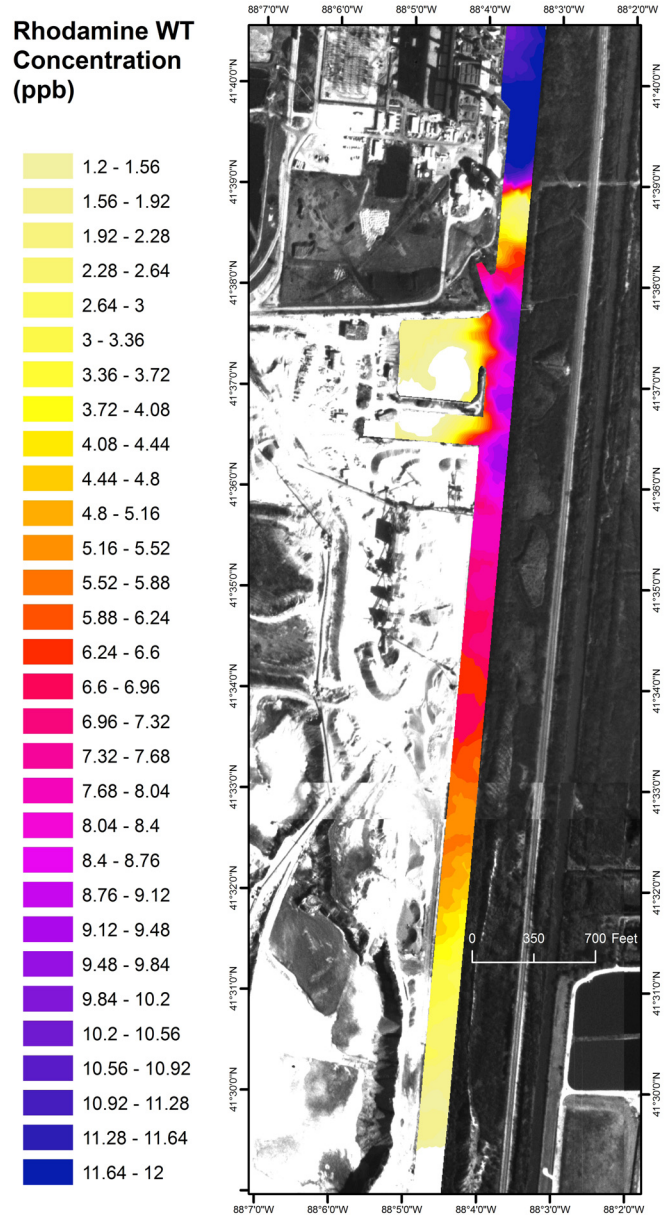
Three dye dispersion studies were conducted on the CAWS in conjunction with rotenone treatments. The first study, completed in November 2009, was used to assess the planned December 2009 rotenone treatment and identify pathways for contamination of adjacent water bodies. The second and third dye studies were completed simultaneously with the Decem-



**Rotenone Treatment near O'Brien Lock in May 2010: USGS boat with dye injection, water quality and ADCP equipment, with USGS hydrologists.**

ber 2009 and May 2010 rotenone treatments near Lockport lock and Dam and O'Brien Lock and Dam, respectively. During these dye studies, the USGS provided real-time dye position and flow data to the Illinois Department of Natural Resources (IDNR) for optimized rotenone application and neutralization within the CAWS and in adjacent water bodies (fig. 4). Real-time communication by the USGS with the IDNR during both treatments allowed decisions to be made by the Incident Commander regarding rotenone application and neutralization in response to changes in flow and the rotenone plume distribution. These tests were completed as part of a multi-agency effort, including the USEPA, USACE, U.S. Fish and Wildlife Service (USFWS), IDNR and others.

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 USGS GLRI: <http://cida.usgs.gov/glri/>  
 Asian Carp Regional Coordinating Committee:  
<http://www.asiancarp.org/>



**Figure 4: Distribution of dye during Rotentone Treatment in December 2009, 7.6 hours after dye injection.**

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