US Army Corps of Engineers
Chicago District

eDNA Surveillance Fact Sheet

Chicago Sanitary and Ship Canal – Aquatic Nuisance Species Dispersal Barrier

Overview:

The Asian Carp Regional Coordinating Committee (ACRCC) developed the Asian Carp Control Strategy Framework to prevent the introduction and establishment of Asian carp (*Hypophthalmichthys spp.)* in the Great Lakes. As part of this Framework, the RCC formed a sub-committee, the Asian Carp Monitoring and Rapid Response Work Group (MRRWG), to develop and implement a series of scientific studies to detect, monitor, and respond to the invasion before a reproducing population of Asian carp establishes in Lake Michigan. The Aquatic Nuisance Species Barrier (Barrier) is currently operating to prevent the invasion of Asian carp; and the MRRWG monitoring plan is a way to assess the risk to the Barrier and to Great Lakes invasion.

One of the tools implemented by the MRRWG to conduct monitoring of Asian carp in the Chicago Area Waterways System CAWS is eDNA surveillance. Environmental DNA (eDNA) is a genetic tool that indicates the presence or absence of species-specific DNA in the aquatic environment. Fishes, including Asian carp, release cells containing DNA into the environment from mucus, feces, and urine. DNA degrades in the environment, but this process is not instantaneous, and DNA can be held in suspension and transported. Species can be detected by filtering water samples and then extracting and amplifying short fragments of the shed DNA. This method was developed the University of Notre Dame, and through a cooperative agreement with the U.S. Army Corps of Engineers, was applied as a monitoring tool for the MRRWG Monitoring Plan.

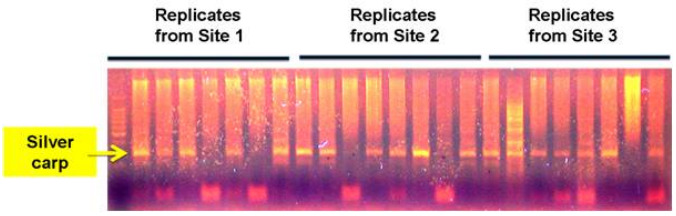
A positive eDNA sample indicates the likely presence of Asian carp DNA and the possible presence of live fish. At present, eDNA evidence cannot verify whether live Asian carp are present, the number of Asian carp in an area or whether a viable population of Asian carp are present. A positive result does not reveal how Asian carp DNA traveled to that location.

Methods:

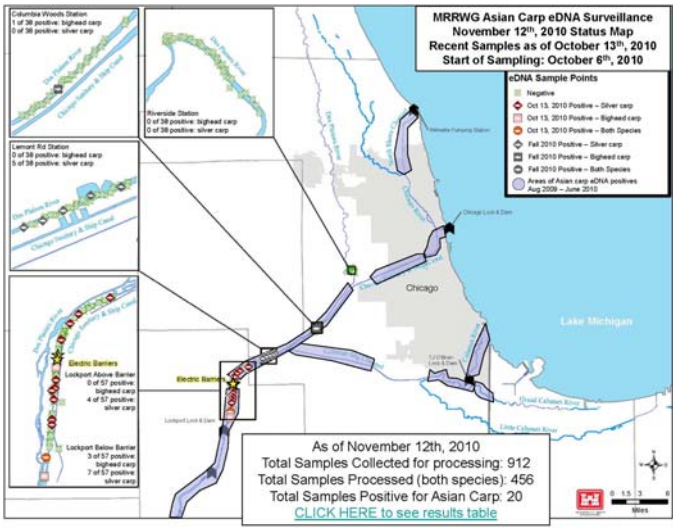
The MRRWG team (interagency team comprised of USACE-USFWS-ILDNR-USEPA) is responsible for the collection and filtration of water samples from designated sites on a weekly rotation:

- Chicago Lock
- O'Brien Lock
- Wilmette Pumping Station
- Des Plaines River (as needed)
- Lockport Pool (above and below Barrier – as needed)

Each filtered sample is then sent to the USACE Engineer Research and Development Center (ERDC) in Vicksburg, MS where a team of highly skilled geneticists analyze the samples for bighead and silver carp eDNA. The results (positives or negatives) are reported back to the MRRWG in about 10 days.



Silver carp DNA bands in gel electrophoresis (UND photo)



Results are posted weekly to: http://www.lrc.usace.army.mil/AsianCarp/

What's Next?

Marker Development and Calibration:

USACE is in the process of developing new eDNA markers as well as optimizing existing markers (developed by UND) for silver and bighead carp. Our goal is to develop markers based on real-time or quantitative polymerase chain reactions (qPCR). Development of new qPCR-based eDNA markers for Asian carp will provide for greater efficiency of eDNA processing, and may provide for a greater degree of sensitivity to eDNA at low concentrations. qPCR may also provide data on DNA abundance (minimum numbers of fish responsible for an eDNA positive hit). Calibration of eDNA will help provide context to eDNA results, such as: time until eDNA detections, eDNA decay rates, and predicting numbers and sizes of fish using eDNA detections. USACE is working with USGS and USFWS on the calibration work.