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Fish Tails

"Fish Tails" refers to articles that are submitted by field staff that do not appear as a feature in the current edition of Fish Lines. These articles provide examples of the diverse work that the Service's Midwest Fisheries Program and partners perform on behalf of our aquatic resources and for the benefit of the American public.

Field Notes

"Field Notes" is an online searchable database that showcases hundreds of employee-written summaries of field activities and accomplishments of the U.S. Fish and Wildlife Service from across the nation.

Last updated: August 7, 2014

Environmental DNA Marker Workshop

BY NICHOLAS BERNDT AND EMY MONROE, WHITNEY GENETICS LAB

Whitney Genetics Laboratory team member Nikolas Grueneis carefully prepares his real-time PCR transition samples. Credit: USFWS

Researchers, biologists, and technicians from all areas of invasive carp work and water resource management visited the USGS Upper Midwest Environmental Science Center (UMESC) environmental DNA (eDNA) marker workshop. This workshop showcased cutting edge, real-time Polymerase Chain Reaction (PCR) techniques, new invasive carp marker development, and recommendations for new markers to be used to analyze 2014 eDNA samples from across the Great Lakes and Mississippi River systems. The event was co-hosted by the USFWS Whitney Genetics Laboratory (WGL), the USGS Upper Midwest Environmental Sciences Center (UMESC), and the US Army Corps of Engineers Research and Development Center (ERDC). This workshop was the result of the Marker Validation Study which was co-lead by Emy Monroe of WGL, Chris Rees of UMESC, and Rick Lance of ERDC, and the results presented were much anticipated by all in attendance.

New real-time PCR markers were developed by ERDC and UMESC where they underwent rigorous testing and optimization before becoming viable candidates for use in the monitoring program. During development, these new markers were found to have greater sensitivity then cPCR markers, were faster to process, and could even look for multiple species in one reaction. Even though these benefits were demonstrated in the development labs, in order to be implemented into the monitoring program, the markers required validation in a three-lab round-robin, double-blind study to demonstrate consistency among technicians and instrumentation and to demonstrate sensitivity and function in various carp-positive and carp-negative water sources from different locations. Thirteen new markers were developed and passed the validation criteria and the real-time markers outperformed cPCR markers for silver and bighead carp detection. They had highly reproducible results, were more sensitive and accurate than cPCR markers, and cut down on the effects of inhibition in eDNA PCR reactions. Of the 13 markers passing validation, six real-time PCR markers were proposed for use in the 2014 QAPP for the monitoring season. The new real-time markers can detect and confirm DNA presence, which saves time and money, and reduces the risk of contamination in the lab.

Once the workshop was presented, resource managers were given time to discuss the new markers, ask questions, and finally approve use of the new markers for the 2014 season. The following week, staff at WGL began training and transitioning staff that had not been part of the Marker Validation study on all the ins and outs of the real-time PCR technique. Incidentally, those staff were not part of Marker Validation, because they were busy extracting the thousands of samples (multiplied into thousands more filters) in freezers at WGL. With the switch to more sensitive and accurate real-time markers comes the need for extra vigilance in the lab and even more refined bench techniques. Similar to the transition plan executed when WGL assumed eDNA processing from ERDC in 2013, a transition plan was drafted and executed in-house at WGL. All lab personnel passed the transition look forward to utilizing the new markers. With an updated suite of genetic markers to work with, WGL will have the more refined techniques for the early detection of invasive carp, which in turn provides the best available information for our water resource managers.

Mass Marking Study Plan for Steelhead Stocked in Lakes Michigan and Huron

BY MATTHEW KORNIS, GREEN BAY FWCO

A combined 2.3 million steelhead (a.k.a. rainbow trout) are stocked each year by the Michigan, Wisconsin, Indiana and Illinois Departments of Natural Resources (DNR) to enhance sport fishing opportunities in Lakes Michigan and Huron. These four states have proposed a coordinated study with the U.S. Fish and Wildlife Service (USFWS) to mark and coded-wire tag (CWT) all stocked steelhead to improve the efficacy and impact of their steelhead stocking programs. The proposed study would be managed through the USFWS Great Lakes Fish Tag and Recovery Laboratory, which is headquartered at the Green Bay Fish and Wildlife Conservation Office and has used automated trailers and specialized staff over the past five years to mass mark other species (lake trout and Chinook salmon) within the Great Lakes basin.

A U.S. Fish and Wildlife Service employee measures an adult steelhead encountered by a fish tag recovery team based in Charlevoix, Michigan. Credit: Matt Kornis, USFWS

What does mass marking fish entail? The adipose fin (a small fin located on the back of the fish behind the larger dorsal fin) is clipped off of hatchery-raised fingerlings to distinguish them from wild fish. In addition, a CWT is injected into the cartilaginous snout of each fish. CWTs are small pieces of stainless steel wire marked with codes to identify groups of interest, such as a specific stocking location, strain, or hatchery. The Service owns four AutoFishTM SCT6 mobile trailers, manufactured by Northwest Marine Technology, that specialize in the fin clipping and CWT injection process by automatically measuring each fish and sending them through tagging equipment calibrated for a specific size range.

Dr. Matthew Kornis from the Great Lakes Fish Tag and Recovery Laboratory uses a simulated steelhead population to determine confidence in estimates of wild steelhead recruitment.

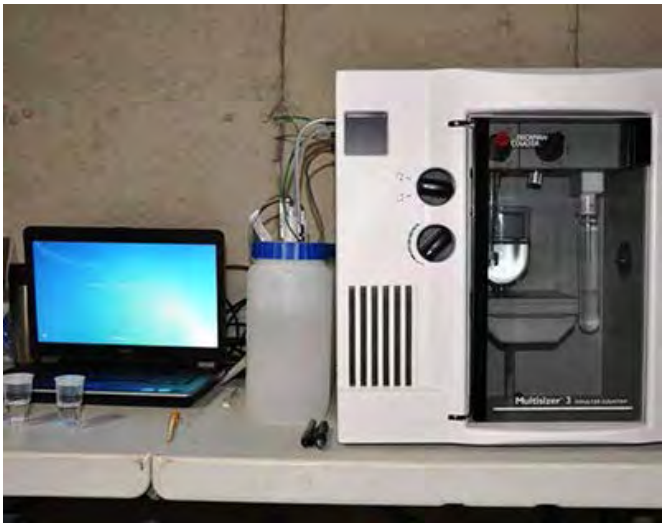
Dr. Matthew Kornis, a fish biologist and data analyst with the USFWS, recently completed an analysis demonstrating that several key objectives could be addressed by the proposed mass marking steelhead study. By marking all stocked steelhead with a fin clip, the proposed study would produce precise estimates (within ± 1 or 2 %) of the percent of steelhead populations in Lakes Michigan and Huron comprised of wild, naturally reproducing fish. These estimates would in turn provide a more accurate estimate of steelhead population size. In addition, Dr. Kornis' analysis suggested that the number of CWTs recaptured from hatchery-reared fish would be sufficient for researchers to determine the stocking sites, strains, and/or hatcheries that produce the greatest number of steelhead returning to the sport fishery. This information would help state fisheries managers improve their steelhead stocking programs by increasing return on investment.

In late July, Dr. Kornis presented his findings to the Lake Michigan Technical Committee, which is comprised of representatives from the Michigan, Wisconsin, Indiana and Illinois DNRs, USFWS and the U.S. Geological Survey. The Committee discussed the potential benefits of the study and decided to move forward with developing a detailed study plan, with a goal to start mass marking steelhead sometime in the next few years.

Why Does a Fish Hatchery Need a Particle Counter?

BY NATHAN ECKERT, GENOA NFH

Recently Genoa National Fish Hatchery (NFH) purchased a Beckman Coulter Multisizer 3 (MS3) instrument to aid with fish and mussel culture at the hatchery. A MS3 is an instrument that is capable of both counting and measuring all of the particles in a sample of water. Depending on the aperture tube installed in the instrument it can measure particles from 0.4 microns all the way up to 1.2mm.



The Multisizer 3 after installation at Genoa NFH. Credit: USFWS

The purchase of this instrument signals the beginning of a serious effort to culture juvenile freshwater mussels on-station as opposed to our previous efforts which focused almost exclusively on growing our juvenile mussels at offsite locations. Juvenile freshwater mussels feed on particles from 0 to 15 microns. In a captive culture situation we will use the MS3 to monitor the amounts of food particles available in our juvenile mussel culture systems. Maintaining appropriate food levels will decrease water quality issues that can result from over feeding, as well as preventing loss due to starvation. These improvements should increase survival of newly metamorphosed juvenile mussels in captivity, a life stage that is highly sensitive to water quality issues and prone to mortality events.

Another potential use for the MS3 at Genoa NFH is to monitor zooplankton levels in our walleye culture ponds. It is known that walleye fry grow rapidly on a diet of rotifers and cladocerans. In the past we have counted these animals from water samples by hand under a microscope. With an adjustment to the MS3 we will be able to run a sample of pond water through the instrument and determine not only the density of zooplankton in our water, but also the size range of those animals as well.
It is our hope that with the purchase of this instrument we will see gains in both fish and mussel culture at the hatchery.

Stable Isotope Analysis of Lake Michigan Salmonines

BY MATTHEW KORNIS, GREEN BAY FWCO

U.S. Fish and Wildlife Service biologist and data analyst Dr. Matthew Kornis (left) and Service employee Nick Arend (right) collect small pieces of muscle tissue from a lake trout (left) and steelhead (right) for stable isotope analysis. Credit: Michael Lancewicz and Matt Kornis, UWFWS

Fisheries managers in the Great Lakes stock between 20 and 30 million salmonines (salmon and trout) each year to control invasive fishes, restore native populations, and support sport fisheries. In Lake Michigan, five different salmonine species (i.e., lake trout, Chinook salmon, coho salmon, steelhead/rainbow trout, and brown trout) are managed through stocking and harvest regulations. Although these species appear similar, they likely occupy different niches within the Lake Michigan food web, meaning that they may rely on different prey items or forage in different areas.

Researchers from the U.S. Fish and Wildlife Service (Service) Green Bay Fish and Wildlife Conservation Office, Great Lakes Fish Tag and Recovery Lab, and the United States Geological Survey (USGS) Great Lakes Science Center recently received funding from a competitive grant to use stable isotope analysis (SIA) to better understand foraging and movement patterns of Lake Michigan salmonines as well as their potential for competition. The two-year cooperative project will be led by Dr. Matthew Kornis and Charles Bronte from the Service's Great Lakes Fish Tag and Recovery Lab and by Dr. David Bunnell from the USGS Great Lakes Science Center.

Unlike radioactive isotopes, which are harmful, stable isotopes of carbon and nitrogen are totally safe and naturally occurring in the environment. Carbon and nitrogen isotopes taken from small (grain of rice size) samples of fish muscle tissue provide unique signatures that can reveal a species' feeding ecology and habitat use. In aquatic systems, carbon stable isotope values are depleted from offshore energy sources and enriched from nearshore energy sources, thereby providing information on foraging locations. By contrast, nitrogen stable isotope values increase up the food chain, and thus can be used to determine a species' place within a food web. Combined, carbon and nitrogen isotopes can provide a clear picture of what a species eats and where a species feeds. Stable isotopes also offer a time-integrated picture of an animal's diet: conventional analysis of stomach contents provides a snapshot of what an animal has eaten over the past several hours, while stable isotopes describe the diet over the past several months.

In this study, muscle tissue samples are being collected from fish captured by anglers willing to volunteer their catch, in conjunction with an ongoing effort coordinated by the Service's Great Lakes Fish Tag and Recovery Lab to tag and recapture stocked salmonines. The research team hopes to identify size-specific patterns by collecting isotopes from small and large fish, and to pinpoint possible differences between stocked and wild lake trout and Chinook salmon by collecting isotopes from coded wire tagged and untagged fish. Using Lake Michigan as an example, the study will also compare salmonine foraging ecology from the heavily altered lower Great Lakes with the relatively intact Lake Superior food web (documented isotopically in a 2009 University of Wisconsin study). Finally, the research team will examine overlap in stable isotope signatures to determine the potential for competition among salmonines. The overlap between lake trout and other stocked salmonines will be emphasized in order to inform lake trout restoration efforts. Lake trout may occupy a relatively unique place within Lake Michigan's food web because of their reliance on bottom-oriented prey resources and their ability to consume a diverse diet throughout their native range. If this hypothesis is correct, this study's results could ease perceived conflict between the restoration of a native Service trust species, lake trout, and non-native salmonine species commonly targeted by anglers.

Sturgeon Culture

BY JORGE BUENING, GENOA NFH

Lake sturgeon using the bottom of the tank. Credit USFWS

It is typical during the culture of fishes to make changes to rearing tanks and feed sizes as the fish grow. In the case of our cold-water culture, trout species are gradually given larger and larger tanks to occupy. Basically, larger fish require larger spaces. As trout grow they also progress through larger and larger feed pellets. A fish exerts more energy and effort eating many tiny pellets as opposed to a few larger pellets. The problem is… wasting energy can result in slower growth. This would not allow us to meet the management objectives that are set in place for our stocking locations. These principles also hold true for lake sturgeon culture, except to a much higher degree.

Lake sturgeon, a cool water species, are also given more space as they grow, just like the trout. However, this process is accelerated due to the niche that sturgeon occupies. It is a species that generally inhabits the bottom of the water column. No matter how much water is above them they have maximized the capabilities of a tank when the bottom of the tank is full. From a feed perspective they are very finicky compared to their cold-water counterparts. Currently, lake sturgeon require natural diets in order to be intensively cultured. Instead of transitioning from one size feed to the next, they transition onto a completely different diet.

When lake sturgeon first hatch they absorb their yolk sac for a few days and then begin actively searching out feed sources. Initially, lake sturgeon are planktivores and eat zooplankton. During this feeding stage we provide them with brine shrimp nauplii. As they continue to grow sturgeon begin to target larger invertebrates. We alter their feed regime and introduce ground bloodworms during this stage. Eventually, the sturgeon grow large enough to eat whole bloodworms and we are able to give our food processors and meat grinders a rest. Lastly, the sturgeon are transitioned onto krill, the same stuff that some whales eat. This protein rich crustacean allows the sturgeon to really grow and beef up before the fall stockings.

Live brine shrimp are raised to provide the first food for lake sturgeon. Credit: USFWS

The science and art behind fish culture is always changing. At Genoa National Fish Hatchery we strive for efficient and quality culture practices that result in meeting all of our stocking and production requirements. We hope these standards will lead to the stocking of tens of thousands of lake sturgeon and trout in the coming year.

It's Electric! Understanding How Fish React to the Most Powerful Electric Barrier in the World

BY SAM FINNEY, CARTERVILLE FWCO

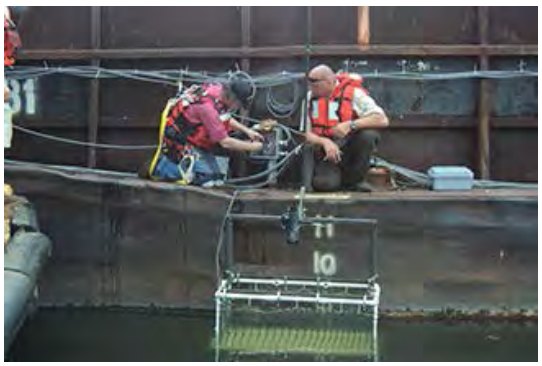
Personnel from the USFWS, USACE, and a private barge company prepare equipment for testing barge fish interactions. Credit: USFWS

Bighead and silver carps have been marching toward the Great Lakes via the Mississippi River and its tributaries since the 1970s. Both species of Asian carp are voracious eaters that can cause severe ecological damage. Silver carps pose an additional risk to recreational boaters who can be injured when silver carps become agitated by boat motors and jump out of the water. The impact of some jumping silver carps is great enough to break bones.

Concern about Asian carps invading the Great Lakes was catapulted into the spotlight in 2009 when environmental tests indicated that the leading edge of the population was perhaps farther north, and closer to the Great Lakes, than experts anticipated. Residents of the Great Lakes region are no stranger to aquatic invasive species (zebra mussels!). With local economies and the multibillion dollar Great Lakes commercial fishing industry potentially in jeopardy if a self-sustaining population of Asian carps becomes established in the Great Lakes, the U.S. Fish and Wildlife Service (Service) joined with international, federal and state partners to stop the potential invasion.

Part of the Service's work involves testing the effectiveness of electric barriers located in the Chicago Sanitary and Ship Canal southwest of Chicago, which are operated by the U.S. Army Corps of Engineers (USACE) to deter the inter-basin establishment of Asian carp and other fish through an electric field in the water. Initially, the focus of the barriers was to keep round gobies from invading the Mississippi River Basin, but the barriers' focus has shifted to keeping Asian carp out of the Great Lakes. There are currently three electric barriers that began operation in 2002, 2009, and 2011.

Recognizing the important role the electric barriers play in the fight against a potential Asian carp invasion of the Great Lakes, biologists from the Carterville Fish and Wildlife Conservation Office felt it was important to understand how the electric barriers impact fish. Thus began a series of intensive and innovative research projects to study how fish behave around these powerful electric barriers.



USFWS biologist Aaron Parker (right) helps rig video equipment to a barge set to pull caged fish through the barrier. Credit: USFWS

Studying how fish react to large electrical barriers in a canal open for navigation required biologists working on the project to be both creative and innovative. During the initial years of testing (2011-2012), biologists used sonic and video cameras to observe how fish in cages lashed to boats, and free swimming fish behaved in and around the barriers. With the exception of a few small fish, almost all of the wild fish observed with the underwater sonars seemed to be repelled by the barriers. Initial test results of fish pulled through the barrier in cages were encouraging as well. Almost all the fish tested in cages by boats were incapacitated by the electricity coming from the barriers. Despite reassuring results, biologists observed that caged fish were not shocked as easily when tested near conductive small metal boats used during research. This got biologists thinking. What about the numerous large metal barges that pass through the barrier every day? And what about the area of high electricity where some small fish failed to be repelled by the barriers during this research?

Biologists with the Service began to put their heads together with USACE to test caged fish around barges, as well as tethered free-swimming fish, as barges moved through the barrier. In some, but not all, of the areas tested around the barges, fish in cages were incapacitated. Tethered free-swimming fish ended up upstream of the barriers during up to eight percent of the

trials, and alive, when barges crossed.

Biologists also looked deeper into the fish around the area of highest electricity using crane-mounted sonar cameras, called DIDSON. During these fixed DIDSON studies, it was observed that in the area of highest electricity, 61% of the videos taken showed schools of small fish, estimated to be approximately two to four inches and not thought to be Asian carp, crossing the electrical field. With the Great Lakes potentially at risk, current research and management actions are being explored to better shore up the electrical defenses. Possibilities being explored include regulating barge configurations and speeds, or adding fish-deterring structures to barges to reduce or eliminate fish getting by with barges. A new barrier is being constructed, and this construction will incorporate what biologists have learned about fish and electricity in the canal over the past decade.

Current evidence suggests that Asian carp populations directly adjacent to the barriers are very low or nonexistent. Adult populations of Asian carp are approximately 18 miles downstream of the barriers and 55 miles from Lake Michigan. These populations have not moved upstream for several years. This creates a window of opportunity for additional actions to be taken to keep Asian carp out of the Great Lakes. Research findings have larger implications, as there are thousands of electric barriers around the country and the world. This research, and the techniques developed to study fish behavior around electric barriers, will prove invaluable in the placement and testing of electric barriers designed to stop the spread of aquatic invasive species, like Asian carp.

More details about the studies are available at: **http://www.fws.gov/midwest/fisheries/carterville/didson-barge.html**.
More details about the ongoing USACE studies and barrier operations can be found at **http://www.lrc.usace.army.mil/Missions/CivilWorksProjects/ANSPortal.aspx**

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Fish Tails

Articles submitted by field staff that do not appear as a feature within Fish Lines. These articles provide examples of the diverse work that is performed on behalf of aquatic resources.

USFWS Director Tours Alpena FWCO Mobile eDNA Lab

BY CHRIS OLDS, ALPENA FWCO

Staff from the Alpena Fish and Wildlife Conservation Office (FWCO) had the privilege of interacting with Director Dan Ashe during his recent trip to Michigan. The Director was in Michigan for several meetings and site visits, which included a stop at the Shiawassee National Wildlife Refuge (NWR). Alpena FWCO's environmental DNA (eDNA) laboratory happened to be set up at the Shiawassee NWR, since the refuge served as a central location for field crews collecting water samples in the area as part of the Region's early detection program for Asian Carps.

Alpena FWCO staff demonstrated the process of extracting eDNA from water samples, the efficiencies offered by the state-of-the-art mobile lab, and provided the Director with a brief overview of the Midwest Region's eDNA program. Specifically, the Director learned about the cross-regional collaboration between Region's 3 and 5 along with a multitude of partners including local, state, federal, provincial, and tribal agencies. This program is very complex and requires a great deal of coordination, both internally and externally, in order to be successfully delivered across the entire Great Lakes basin.

In a note of thanks received by Director Ashe, he commented that the staff's energy and enthusiasm for the work they do was obvious and inspiring, and he would long remember the day as one of the great ones of his career. Alpena FWCO staff shared the Director's sentiments and appreciated the opportunity to talk about the collaborative efforts to monitor aquatic invasive species in the Great Lakes and its tributaries.

Thanks for visiting Director Ashe!

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Midwest Region Fisheries Divisions

National Fish Hatcheries

The Region's National Fish Hatcheries (NFH) focus on native species recovery and restoration. Primary species include: lake trout, endangered pallid sturgeon, and endangered, threatened, and native mussels. Other major programs include coaster brook trout and lake sturgeon restoration, fulfilling tribal trust responsibilities for native aquatic species, and cost reimbursed rainbow trout production for recreational fishing. Hatcheries also provide technical assistance to other agencies, provide fish and eggs for research, and develop and maintain brood stocks of various species and strains.

Fish and Wildlife Conservation Offices

Fish and Wildlife Conservation Offices (FWCO) conduct assessments of fish populations to guide management decisions, play a key role in targeting and implementing native fish and habitat restoration programs; perform key monitoring and control activities related to aquatic invasive species; survey and evaluate aquatic habitats to identify restoration/rehabilitation opportunities; work with private land owners, states, local governments and watershed organizations to complete aquatic habitat restoration projects under the Service's National Fish Passage Program, National Fish Habitat Partnerships, Partners for Fish and Wildlife and the Great Lakes Coastal Programs; provide coordination and technical assistance toward the management of interjurisdictional fisheries; maintain and operate several key interagency fisheries databases; provide technical expertise to other Service programs addressing contaminants, endangered species, federal project review and hydro-power operation and relicensing; evaluate and manage fisheries on Service lands; and, provide technical support to 38 Native American tribal governments and treaty authorities.

Sea Lamprey Biological Stations

The Fish and Wildlife Service is the United States Agent for sea lamprey control, with two Biological Stations assessing and managing sea lamprey populations throughout the Great Lakes. The Great Lakes Fishery Commission administers the Sea Lamprey Management Program, with funding provided through the U.S. Department of State, U.S. Department of the Interior, and Fisheries and Oceans Canada.

Fish Health Center

The Fish Health Center provides specialized fish health evaluation and diagnostic services to federal, state and tribal hatcheries in the region; conducts extensive monitoring and evaluation of wild fish health; examines and certifies the health of captive hatchery stocks; and, performs a wide range of special services helping to coordinate fishery program offices and partner organizations. The Whitney Genetics Lab serves as a leading edge genetics laboratory and conducts environmental DNA (eDNA) sample processing for early detection of invasive species.

U.S. Fish & Wildlife Service

Fisheries, Midwest Region

Conserving America's Fisheries

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