From homebodies to prolific swimmers, researchers track Chicago River fish to find out where they are going and why

September 25 2023, by Adriana Pérez, Chicago Tribune

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Under the muddy surface of the Chicago River, a bluegill swam miles upon miles, back and forth from one end of the river system to another.

Next to a quiet, unused barge slip near Bubbly Creek, another bluegill

remained safely tucked away during the same two-week span earlier this summer.

This kind of fish is not known for being a traveler. So the strikingly different behaviors have intrigued researchers from the Shedd Aquarium, Purdue University and the Illinois-Indiana Sea Grant, who are tracking the movements of 80 individual fish in the Chicago River system.

The fish were tagged and have been emitting acoustic signals every minute or so for the last few months. The signals, which are unique to each fish and sound like pings, are being picked up by more than 30 acoustic receivers throughout the river's "Wild Mile" in the North Branch, Bubbly Creek in the South Branch and by the Riverwalk in downtown Chicago.

The listening devices, in turn, allow the researchers to follow the fish as they move around these aquatic systems and to observe how they respond to new habitat restoration initiatives, flooding and sewage overflows, as well as seasonal changes.

"Do they use these barge slips that aren't used by industry anymore? Are those now important habitat for fish, either during spawning periods or as refuge during poor water quality events?" said Austin Happel, research biologist at Shedd. "I'm also really interested in what happens in the winter. Winter is a period that's understudied in general, because no one wants to be out when it's super cold."

The fish of the Chicago River

On a recent weekday morning at Park No. 571 in Bridgeport—where the South Branch of the Chicago River bisects into Bubbly Creek and the Sanitary and Ship Canal—Happel launched a long cord, submerging a

microphone under the water.

"This is a handheld microphone that will actually listen to those codes and decipher them and spit them out," he said. In an orange box, the computer connected to the underwater microphone has a GPS that tells researchers which one, if any, of the tagged fish are nearby. The louder the computer beeps, the closer the fish.

Six short pings interrupted Happel as he talked.

"So that was one," he said. "It already picked one up."

The computer indicated the tag type was one of the smaller ones the researchers used—about the size of a regular Tylenol or Advil.

"The fish itself is 17917, so I'll see if I can pull up what that one is," Happel said as he pulled out his phone to look at the database. "I don't have them memorized," he laughed, "but we'd like to name them."

This one was a largemouth bass, slightly shorter than 12 inches and probably as heavy as 14 ounces—on the smaller side for its kind. "It takes a very long time for a bass to get what would be called trophy-size," he said.

In mid-June, Happel and other researchers went to the river to net and tag the fish, including 32 largemouth bass, 24 common carp, 17 bluegill, three pumpkinseed, two black crappies, one walleye and one green sunfish.

The group is tracking bluegill and largemouth bass to learn more about fish that people like to catch for fun.

"The first day that we were tagging fish at Park No. 571, where people

go fishing, we had some anglers who were interested in what we were doing," said Luke McGill, a graduate student in Purdue's College of Agriculture and Department of Forestry and Natural Resources.

"I'm an angler myself," McGill said. "So I'm always interested to see what bass are doing and where they're hanging out and maybe even where I can catch them."

Before tagging the fish, the team had locked and chained the acoustic receivers to existing objects under a few bridges and then submerged the devices in the river.

The researchers have since gone out on the river by boat once a month to retrieve the receivers, inserting a key that lets them wirelessly download data—hundreds and hundreds of lines worth of an Excel spreadsheet—in as little as a minute.

McGill said the Chicago River is an unusual environment to do this type of work because of its urban surroundings and industrial history as opposed to more natural waterways.

"We were in the northern part of the river at the Wild Mile, and it was just a really cool backdrop, to be tagging fish and be working with carp, bass and bluegill and having the Sears Tower—the Willis Tower—in the background," he said.

Possible refuge in floating wetlands

Researchers say they aren't sure what they might learn about the movement of their subjects.

"Unlike a normal project, where we set up, like, three main questions that we want to answer, this is more like: Let's have fish tell us what

habitats are most important to them," Happel said.

Tomas Höök, a professor at Purdue's Department of Forestry and Natural Resources and the director of the Illinois-Indiana Sea Grant, said the project is largely exploratory, and he expects to be surprised with what they learn.

"I think one possibility is that we might see that these floating islands that have been constructed in the North Branch may be attracting fish during spawning," Höök said. "Maybe in the spring, we're gonna see that they're congregating in that area. Which would be suggestive that those habitat improvement projects are beneficial."

The city's aquarium and the local nonprofit Urban Rivers began installing human-made floating wetlands in the Chicago River in 2018, first in the North Branch's Wild Mile and then in the South Branch. The habitats would ideally encourage the return of native wildlife and filter contaminated water.

The new habitats and their root systems could also provide physical barriers for fish trying to shield themselves from contaminants such as sewage that can flow into the river during heavy rains.

But the floating wetlands are relatively novel, so it could take the fish a while to warm up to these habitats and begin using them.

Displaced by sewage

The month of July was particularly rainy in Illinois and countless basements and streets were flooded, prompting the local, state and federal governments to issue disaster proclamations for certain regions. The damage, however, might run deeper.

"All these news articles are like 'rain flooded this many basements," and 'it caused this sort of damage to the shoreline here,'" Happel said. "But none of them talk about what happens under the surface of the water."

When the city of Chicago experiences particularly heavy rainfall, combined rain and wastewater may overflow from sewage pipes and into local waterways before it gets to a treatment plant to be disinfected.

Sewage was discharged into the Chicago River because of heavy rains a handful of times this summer, the Metropolitan Water Reclamation District previously told the Tribune.

"One thing that we have found so far is some evidence that fish will move out of really degraded areas during sewage overflow events," said Höök.

He said when sewage flows into the river, the levels of oxygen decrease significantly. The lack of oxygen forces fish to move to other areas that are less contaminated.

"During those huge July rains and those floods, that sewage pumping station was turned on and we saw that pretty much all the fish in that creek left that area," McGill said of Bubbly Creek, which experienced sewage overflow during the July 2 rains at the Racine Avenue Pumping Station. "We had eight or nine fish one day and then we had one the next."

Because of their diets, the displacement of some of these fish can affect the food chain. Omnivores such as common carp, bluegill, crappies and green sunfish eat aquatic plants, crustaceans and small fish but can also fall prey to carnivorous largemouth bass and walleyes.

"Fish can be a really important part of a food web," Höök said. "They

are sort of the top predators in an aquatic system ... they can have all sorts of ecological effects.

"We don't know to what extent they move out. Short term, and then they come back? That's what we're hoping to learn through this project," he said.

Studying surrogate species

While studying bluegill and largemouth bass can tell researchers a lot about recreational fishing in the river, the team also chose to track common carp, a kind of carp that is considered a nuisance and has been in the country for over 100 years.

"Common carp is a nonnative carp that is so well-established throughout the United States, it's actually been introduced into every state," Höök said. "So it's everywhere, but it is technically still a nonnative species."

In the 1960s, other kinds of carp that are invasive were introduced to get rid of seaweed without chemicals in aquaculture facilities and sewage ponds. After flooding events in the 1980s and 1990s, these invasive carp escaped into the Mississippi River basin—the third largest in the world—spreading to 31 states. Some were also released after breeding experiments failed.

Silver and bighead carp have long been advancing toward Lake Michigan, inspiring numerous creative strategies from citizens and scientists to stop them from reaching the Great Lakes and potentially destroying native fish populations.

"A lot of people are aware that invasive carp are kind of at the doorstep of the Chicago River and the Great Lakes," Happel said. "So we can use these common carp kind of as a surrogate to see how invasive carp could

move around the river."

Because it is challenging to study the movements of invasive fish without introducing them to a system they are not native to, scientists wanting to track silver and bighead carp can study common carp as a biological indicator species.

"One thing that—by looking at where they move and what habitats they occupy—we might get a better sense of is, what contaminants and what various stressors they are exposed to," Höök said. "So I think that's one value in tracking native, nonnative fish and species of fish that people fish for."

Understanding what drives the movements and behavior of different kinds of freshwater fish can lead to better conservation practices that lessen the stress human activity exerts on these populations.

There is always the risk that fish in the study, especially largemouth bass and bluegill, might be caught by anglers. If this happens, the devices would stop receiving acoustic signals.

"Then we know that it's been removed from the system, which sounds really bad," Happel said, "but when we're able to tag 80 fish, and if we can tag another large amount, we can actually start to understand what's called harvest pressure—how much are people fishing and pulling out of the population, which is something that's difficult to assess."

Though the researchers don't have any rescue plans in case a fish is caught, they are relying on the goodwill of whoever might find it.

"We would hope that when they filet the fish, they would find the tag," Happel said. "Because the tag is in the body cavity, not in the meat that they're going to eat, so they should find it. Ideally, they would call the

company that's listed on it. But who knows?"