



Photo Credit: David Neely

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## Approach of the Loach:

### Weather Loaches (*Misgurnus anguillicaudatus*) in Georgia

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## Executive Summary

The Weather Loach (*Misgurnus anguillicaudatus*) is a potentially invasive, non-native fish species that has spread rapidly across the United States and other countries. Evidence suggests that these invasions originated from aquarium fish and food fish being released into the wild. Weather Loaches are popular in the aquarium trade for their hardy nature and are a common food fish in some cultures. Major concerns caused by non-native species, including Weather Loaches, are increased pressure on native fish species, potential economic threat, and the introduction of new diseases.

Many native fish species in Georgia are already struggling with reduced habitat and food availability, as well as water quality issues. The invasion of Weather Loaches may further complicate the survival of native fishes in streams with degraded habitat and lack of food resources, because Weather Loaches have the potential to compete with native fish for food and habitat and can eat the eggs of other fish. These stressors coupled with introduction of new non-native species raises concern for threatened and endangered fish such as the Altamaha Shiner (*Cyprinella xaenura*).

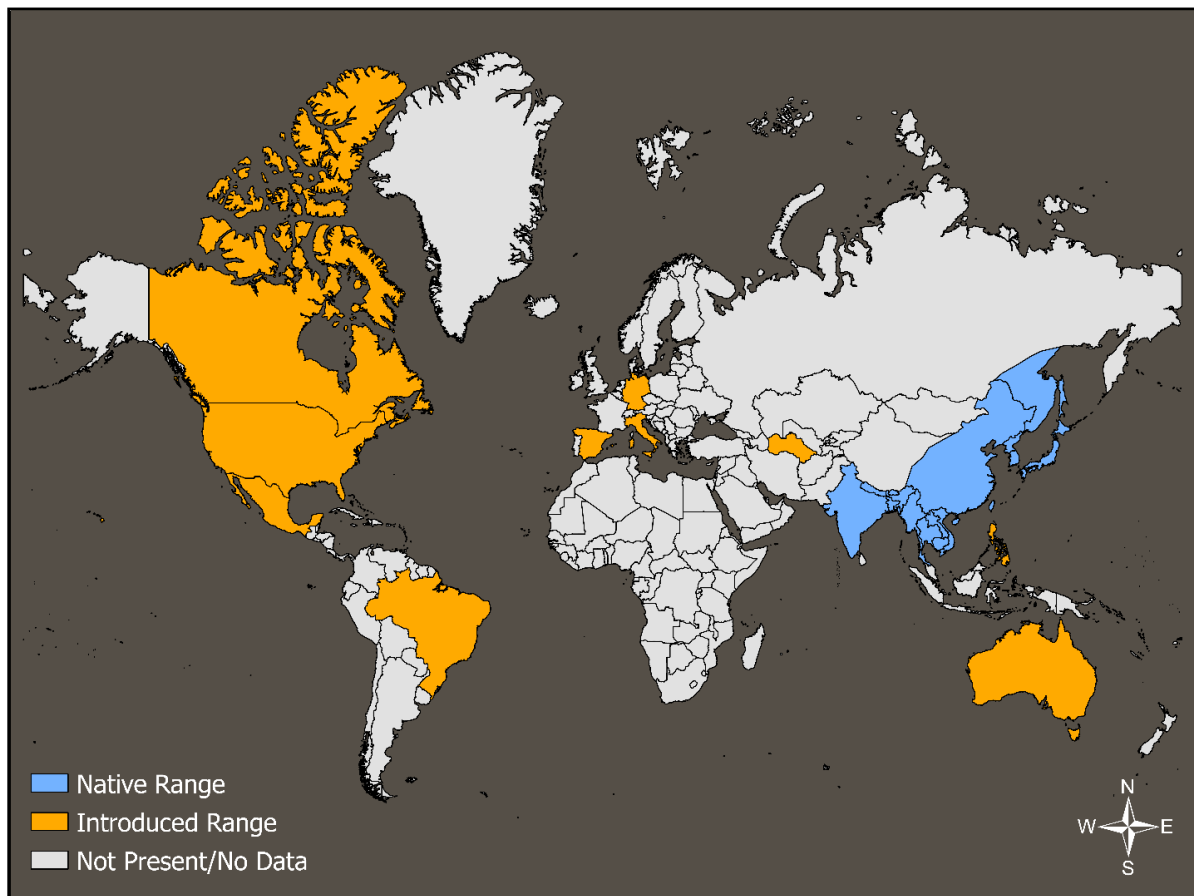
Weather Loaches pose a potential economic threat not only through their competition with native fish species, but through the diseases they carry. Weather Loaches carry a poorly understood virus that is closely related to Infectious Pancreatic Necrosis Virus (IPNV) (Chou, Lo et al. 1993) and four different types of parasites (Lintermans, Rutzou et al. 1990, Reyda, Wells et al. 2020). The potential for transmission of these diseases to native fishes or humans in Georgia is not yet understood, and merits further investigation.

Overall, the Weather Loach should cause concern in Georgia and other affected states due to its potential environmental and economic impacts. If you suspect that there are Weather Loaches in a stream or river near you, you are encouraged to contact the University of Georgia Warnell School of Forestry and Natural Resources and the Georgia Department of Natural Resources ([georgiawildlife.com/ans](http://georgiawildlife.com/ans)).



## Background

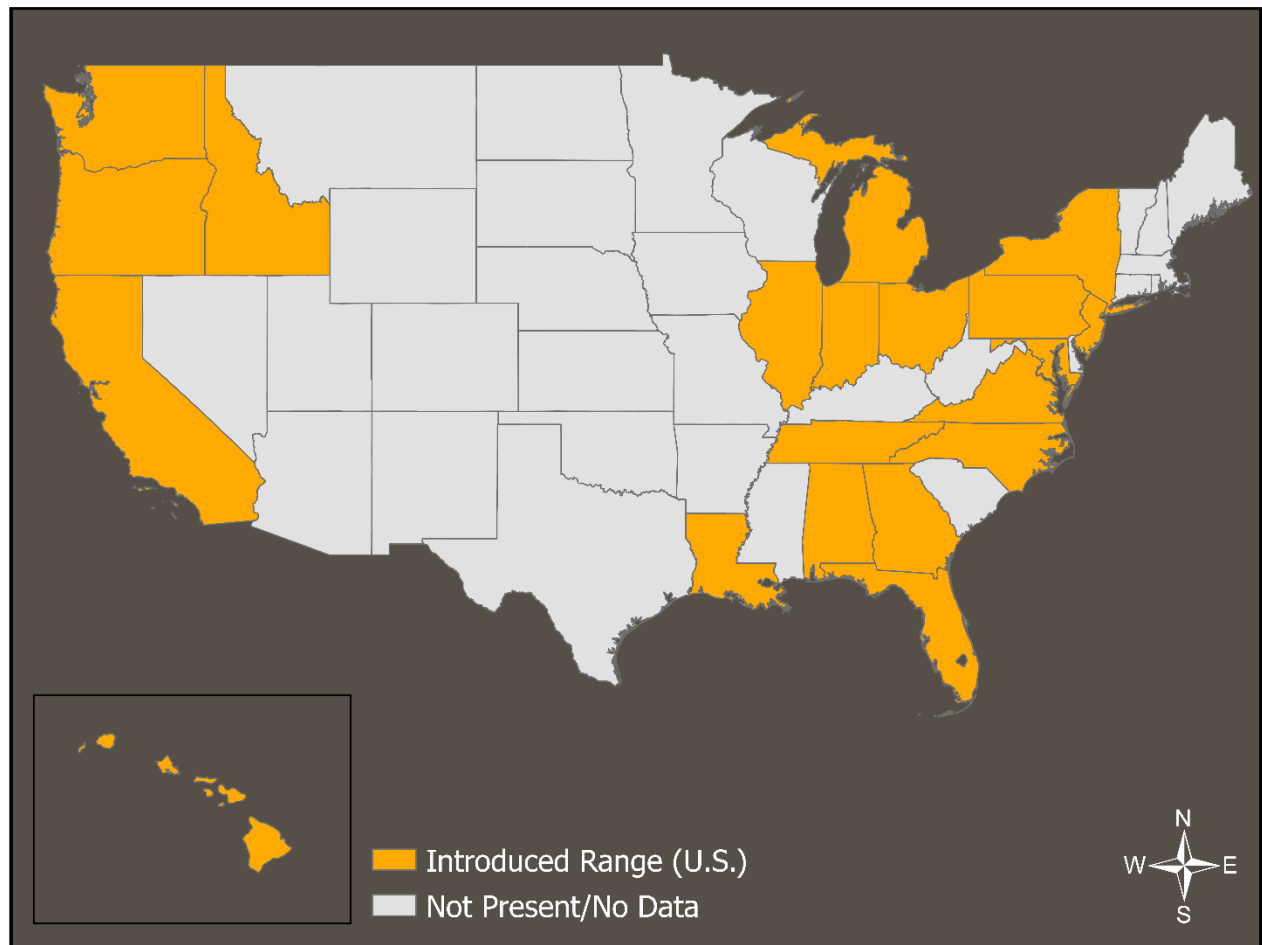
Since the 1950s, the number of exotic aquatic species has drastically increased across the United States. The southeastern United States has seen particularly high numbers of exotic fish and amphibian introductions (Mangiante, Davis et al. 2018). The potential for an exotic fish to become invasive depends directly on how closely the new habitat resembles its native habitat, or the degree to which it is a habitat generalist. An exotic fish is not native and has the potential to become invasive if they cause environmental or economic damage. Environmental damage can include damage to other fish or damage to the habitat in which they live. Some invasive fish also carry parasites that can negatively impact native fish (Cucherousset and Olden 2011). In North America, an estimated \$26 billion per year is lost to damages caused by aquatic and terrestrial invasive species (Crystal-Ornelas, Hudgins et al. 2021).



**Figure 1.** Global distribution of the Weather Loach. Prepared by Adam Musolf, University of Georgia, June 2022.



The Weather Loach (*Misgurnus anguillicaudatus*) is an exotic, potentially invasive species that has quickly spread across the United States and other countries. Also called the Dojo Loach or Pond Loach, it is a popular aquarium species native to eastern Asia (Figure 1). The earliest records of this species in the United States suggest it was introduced to Hawaiian waters in the 1800s to serve as both a food source and bait fish (Brock 1960). In the contiguous United States, it was first reported in Michigan in 1939, having likely escaped from an aquarium supply store (Schultz 1960). Weather Loaches are now found in at least 20 states and 8 countries (USGS, 2022; Figures 1 and 2).

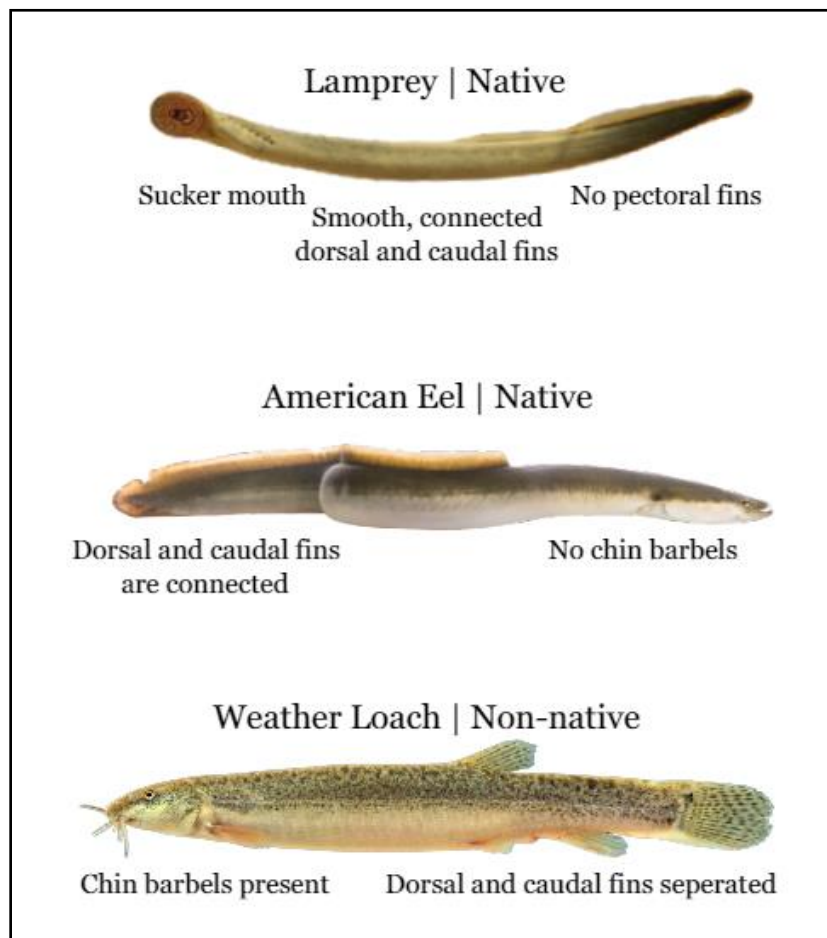


**Figure 2.** State distribution of the Weather Loach. Prepared by Adam Musolf, University of Georgia, June 2022.

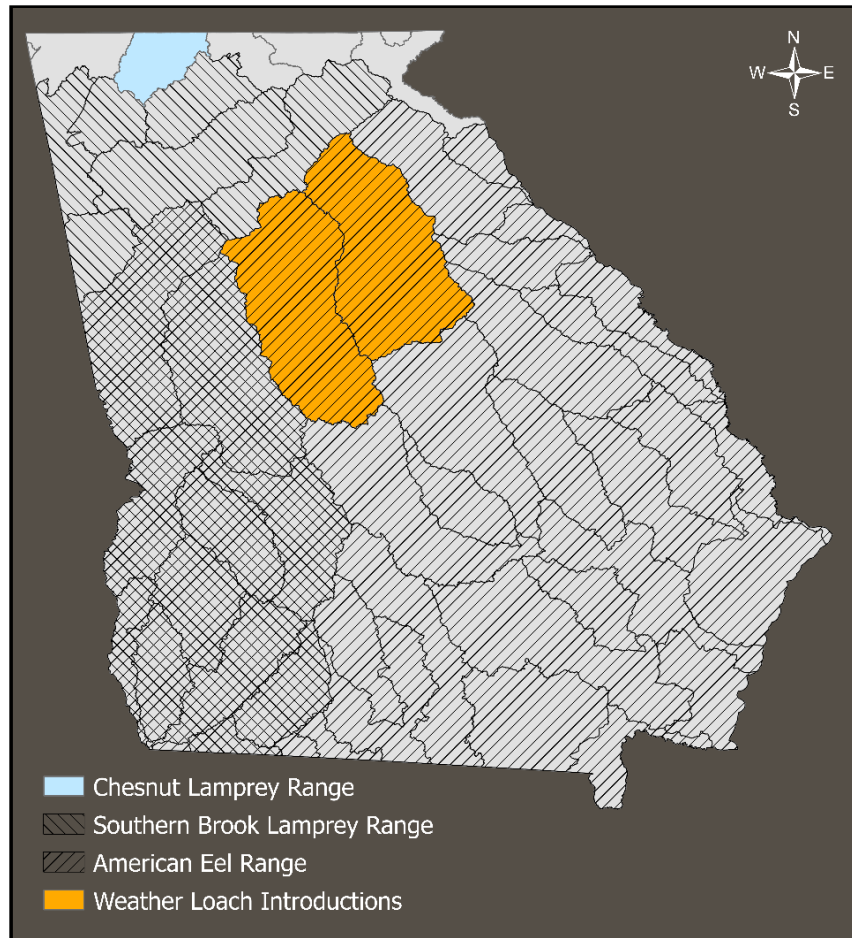


## What is the Weather Loach?

Weather Loaches are small, slender-bodied fish. Adult wild-caught fish are typically 5 to 6 inches long, but those raised in an aquarium setting can be up to 12 inches long. Wild-caught fish are mottled brown in color with lighter underbelly. They resemble two native Georgia fishes: the Lamprey, and the American Eel (**Figure 3**). All three species are nocturnal, so behavior is not a distinguishing factor. Instead, visual characteristics such as differing mouth structure and the lack of barbels should be used to distinguish American Eels and Lamprey from Weather Loaches. In Georgia, Weather Loaches have been found in the Oconee River and Ocmulgee River drainage basins, meaning there is some potential overlap with the American Eel (**Figure 4**).



**Figure 3.** Comparison of native Lamprey, native American Eel, and the non-native Weather Loach. Images courtesy of Brett Albanese (Lamprey), U.S. Fish and Wildlife Service (American Eel), and Dave Neely (Weather Loach). Graphic prepared by Sarah McNair, University of Georgia, February 2023.



**Figure 4.** Distribution of the Weather Loach, the American eel, and Georgia's native Lamprey species (Southern Brook Lamprey and Chestnut Lamprey). Prepared by Adam Musolf, University of Georgia, June 2022.

## Why don't we want Weather Loaches in our waters?

The same characteristics that make Weather Loaches a popular aquarium pet may also allow them to quickly establish themselves when released into the wild. Weather Loaches are dietary generalists, consuming primarily small aquatic insects and their larvae (Tabor, Warner et al. 2001, Schmidt and Schmidt 2014, Urquhart and Koetsier 2014). They are extremely fertile; individual females in Idaho have reportedly produced up to 40,000 eggs in a single spawning season (Urquhart 2013). Weather Loaches also possess the ability to breathe air through their gills, skin, and the posterior intestine (McMahon and Burggren 1987). As such, they are highly tolerant of poor water quality. This unique method of breathing also assists these fish in surviving outside of water for a prolonged period (Koetsier and Urquhart 2012). Weather Loaches are also tolerant of extreme water





temperatures and can survive prolonged exposure to ice (Urquhart and Koetsier 2014). This combination of characteristics makes Weather Loaches excellent invaders when they are introduced to a new environment.

## Weather Loaches in Georgia

### Introduction Pathways

Researchers at the University of Georgia suspect two potential introduction pathways: unwanted aquarium fish being released into local waterways, and fish being released so that they can reproduce and be harvested for consumption later. The first method of introduction is also suspected in other states, including Alabama (White and Meade 2015). However, it is difficult to narrow down the exact time and method of introduction without a first-hand account.

### Known Populations

The first Georgia population of Weather Loaches was discovered in 2020 in McNutt Creek, a tributary of the Middle Oconee River, located in Athens, GA (**Figure 5**). A second, larger population was found 40 miles upstream in Indian Creek in 2021. In 2022, five more streams in the Middle Oconee watershed were added to the list of streams occupied by Weather Loaches. Also in 2022, a population of Weather Loaches was discovered in Sweetwater Creek, a tributary of the Yellow, and ultimately the Ocmulgee River. Genetic analysis has confirmed that the populations in the Middle Oconee and Ocmulgee River systems resulted from two separate introductions.

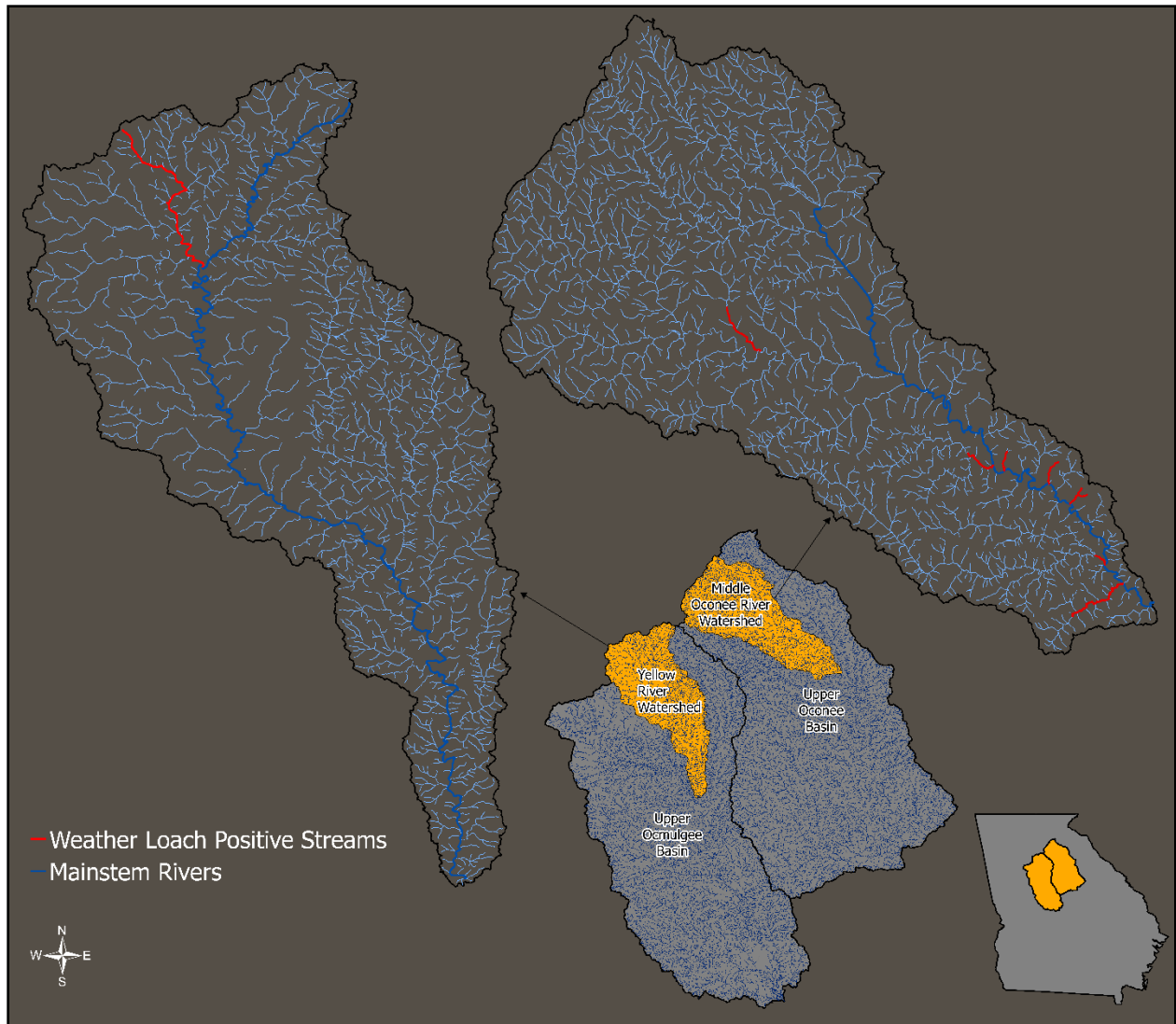
Warnell researchers maintain a Weather Loach StoryMap, which reflects the most up-to-date information about known Georgia populations.

Explore the StoryMap by scanning this QR code or by visiting [bit.ly/weatherloach](https://bit.ly/weatherloach)



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**Figure 5.** Known Weather Loach populations in Georgia as of December 2022. Map prepared by Wesley Gerrin, University of Georgia, December 2022.

## Habitat

Weather Loaches are generally found in shallow, slow-moving habitat, with woody debris or vegetative cover (**Figure 6**), often downstream of barriers to upstream movement, such as dams and bedrock cascades. They can be found less frequently in rocky pools and riffles if other habitats are not available.





**Figure 6.** Indian Creek (top left), unnamed Sweetwater Creek tributary (top right), Bear Creek (bottom left) and Calls Creek (bottom right) Weather Loach habitat. Images courtesy of Wesley Gerrin.





## Reproduction

Wild Weather Loach reproduction in Georgia was first observed in June 2022. Multiple size classes, including one- and two-year-old individuals, were collected from a rocky pool just downstream of the Sells Mill dam (**Figure 7**). These individuals were far smaller than their adult counterparts. This variation in size was not observed during the 2021 sampling event at Sells Mill dam, leading biologists to believe that Weather Loaches are actively reproducing in Georgia waters.



**Figure 7.** Evidence of wild Weather Loach reproduction in a small rock pool in below Sells Mill dam in Indian Creek. June 2022. Images courtesy of Sarah McNair.



## Potential Impacts of Weather Loaches

Invasive species can have many impacts on our natural ecosystems, some of which may not be immediately obvious. Weather Loaches can carry many non-native parasites that can negatively affect fish, birds, amphibians, and even people. The generalist diet of Weather Loaches may also be problematic for our native fishes as they compete for food and habitat. Weather Loaches are also known to carry at least four parasites and one virus (Lintermans, Rutzou et al. 1990, Reyda, Wells et al. 2020) Another concern is that the diet of Weather Loaches may be like native fish, meaning that they are competing with them for food. The Weather Loach is an opportunistic feeder that will consume almost anything (Urquhart and Koetsier 2014), from the eggs of other fish to benthic macroinvertebrates—also known as aquatic insects, worms, and crustaceans, all of whom are important food for native fish. Many of Georgia's native stream fish depend on one or more of these food items in their diets. The small body size and flexibility of the Weather Loach means that no food item is truly safe from predation, so long as it fits in its mouth. Additionally, many native fish, including the Altamaha Shiner, spawn in crevices to protect their young from predation. While this deters many species, it is possible that these eggs are vulnerable to predation by Weather Loaches due to their unique physiology.

## What Can You Do?

### **What should you do if you think there's a Weather Loach in your neighborhood?**

If you believe there are Weather Loaches in a body of water near you, you should alert the Georgia Department of Natural Resources ((GA DNR) ([georgiawildlife.com/ans](http://georgiawildlife.com/ans))) or Warnell School of Forestry and Natural Resources immediately. It is important to report Weather Loach sightings as it helps researchers discover new populations, learn about the origin of those populations, how those populations could be impacting native fish, and remove them if possible.

### **What should you do with unwanted aquarium pets?**

If you have a Weather Loach in your aquarium and no longer want it, there are several steps you can take. Contact your local aquarium store to see if they are willing to take your fish or advertise the fish for you. You can also rehome the fish on social media



platforms such as Facebook Marketplace or Craigslist. You may also take the fish to your local GA DNR office. **Never release unwanted aquarium pets into the wild.**

## Ongoing Work at University of Georgia

Weather Loach biology and management is an active area of research at the University of Georgia Warnell School of Forestry and Natural Resources. Current studies include 1) otolith microchemistry and aging studies to determine natal origins of individual Weather Loaches, 2) stable isotope and diet studies to determine their placement in the food web, 3) genetic characterization of known populations to better understand their interconnectedness and relationship to fish found in aquariums and fish markets, 4) range and spread in Georgia, and 5) public outreach to raise awareness and minimize future invasions. The results from these studies will provide anglers, fish enthusiasts, and biologists with a better understanding of what Weather Loaches are doing to our natural environment, how they were introduced, and how we can manage them.

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