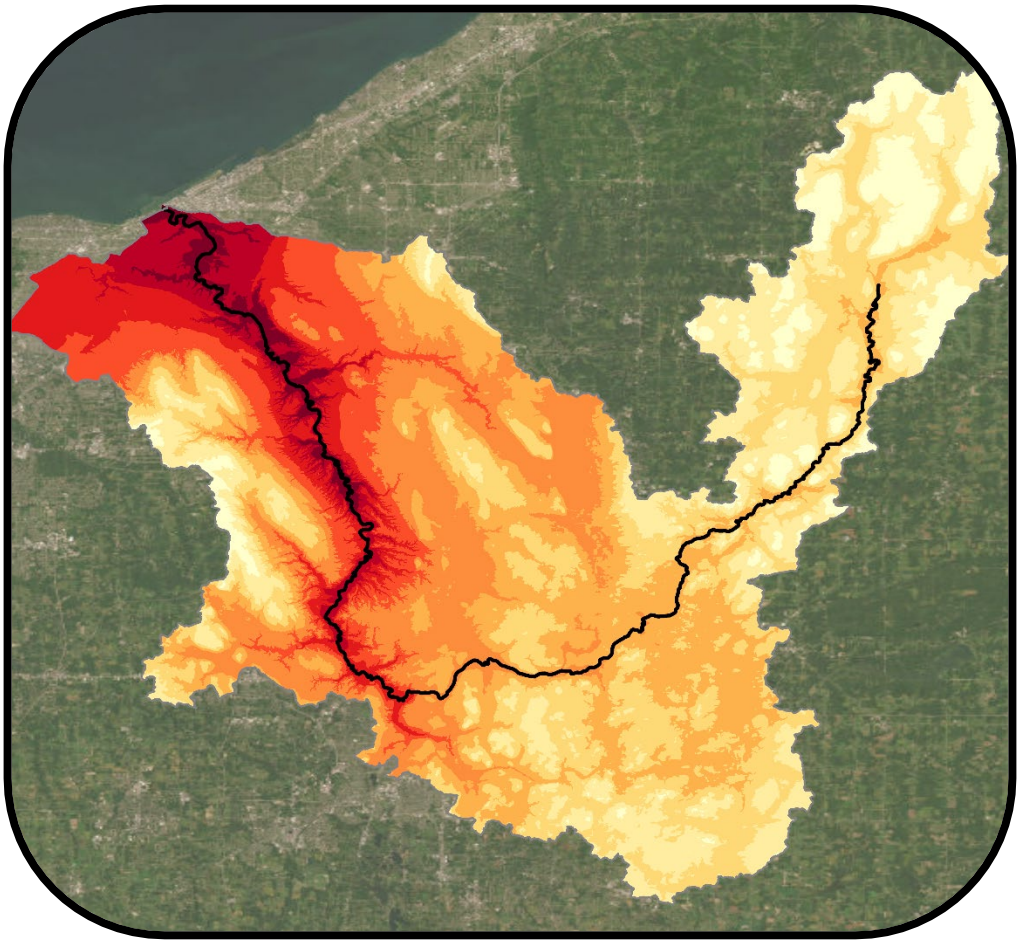
Cuyahoga River Lake Sturgeon Reintroduction Plan

Jason L. Fischer[1], Justin Chiotti[1], James Boase[1], Jesse McCarter[1], Eric Adams[1], Haley VanScoyoc[1], Eric Weimer[2], Travis Hartman[2], John Navarro[2], Ann Marie Gorman[2], Ryan Trimbath[3]

[1]U.S. Fish and Wildlife Service, Alpena Fish and Wildlife Conservation Office – Detroit River Sub Station

[2]Ohio Department of Natural Resources Division of Wildlife

[3]National Park Service, Cuyahoga Valley National Park Service



Introduction

Lake Erie currently supports two self-sustaining spawning stocks of Lake Sturgeon (Withers et al. 2019; Mettler et al. 2022), down from the 17 spawning stocks historically present throughout the lake (Goodyear et al. 1982; Collier et al. 2022)**.** The two extant spawning stocks are currently limited to the eastern and western extremes of the lake and there are no self-sustaining Lake Sturgeon spawning stocks or reintroduction efforts in the Central Basin of Lake Erie.

The Lake Erie Committee (LEC) Fish Community Objectives (Francis et al. 2020) identify Lake Sturgeon as a Rehabilitation Species, with the following Objective and Status Indicator:

> Objective for Lake Sturgeon: Support the preservation of existing spawning stock and rehabilitation of spawning stocks in historic spawning locations.
>
> Status Indicator: Maintain or increase adult abundance in existing spawning sites (SCDRS, Upper Niagara River, and Buffalo Harbor) and establish an adult spawning stock in at least one new spawning location.

Reintroduction Focus Area

The Cuyahoga River is a 136.6 km river, characterized by a U-shaped drainage (Figure 1). The river forms at the confluence of the East Branch Cuyahoga River and West Branch Cuyahoga River in Burton, Ohio, USA and flows southwest toward Akron, Ohio, USA where it turns north and flows into Lake Erie. The study area consisted of the lower 68 river km (rkm), spanning from Lake Erie to the confluence with the Little Cuyahoga River. The Cuyahoga River flows unimpeded through this stretch, with first impassable barrier at Ohio Edison Dam (also referred to as Gorge Dam) at rkm 74. The 6 km stretch between the Little Cuyahoga River confluence and Ohio Edison Dam is characterized by high gradient, steep banks, and several large rapids (class III) that prevented safely surveying this reach. The surveyed reach is a narrow (<50 m) single-thread meandering channel for most of its course, becoming wider and deeper as it approaches the navigation channel. The navigation channel is in the lower 9 rkm and represents the widest (60-100 m) and deepest portion of the river, with the channel being dredged to maintain depths over 8.6 m to facilitate shipping traffic (U.S. Army Corps of Engineers 2004).

The history of water quality issues associated with the Cuyahoga River is well documented (Stradling and Stradling 2008). Industrialization between Akron and Cleveland resulted in pollution and habitat degradation, with the river famously catching fire as recently as 1969. Conditions in the Cuyahoga River helped inspire the 1972 Clean Water Act, and the lower Cuyahoga River is considered an Area of Concern (AOC). However, decades of focus on ecosystem improvement have resulted in dramatic improvements in water quality, habitat, and biological assemblages of fish and macroinvertebrates (OEPA 2023). Improvements are such that delisting the AOC is anticipated as early as 2028.

With water quality improvements and increased connectivity in the Cuyahoga River, the system is an attractive option for re-establishing Lake Sturgeon within the Central Basin. Historical accounts indicate the river once supported a spawning stock of Lake Sturgeon (White et al. 1975; Goodyear et al. 1982), however, overharvest, habitat fragmentation, and degradation of water quality likely led to the extirpation of the species, which have not been observed in contemporary surveys. Given low straying rates of Lake Sturgeon (Homola et al. 2010; Withers et al. 2021), it is unlikely the species will naturally

recolonize the river within management timeframes. Thus, stocking would be required to re-establish a spawning stock of Lake Sturgeon within the Cuyahoga River.

As guided by the LEC Fish Community Objective for Lake Sturgeon, the intent of this reintroduction plan is to restore a self-sustaining spawning stock of 1500 mature adult Lake Sturgeon with an effective stock size (N_e) > 500 in the Cuyahoga River by 2049. Efforts to achieve this goal have or will include management actions to address the following six objectives:

1. Determine the availability and amount of adult Lake Sturgeon spawning and age-0 nursery habitat in the Cuyahoga River.
2. Annually stock up to 1500 fall fingerling Lake Sturgeon into the Cuyahoga River over a 25-year period.
3. Estimate post-stocking survival of age-0 fish over the first year of life.
4. Estimate habitat use and downstream dispersal of age-0 Lake Sturgeon over the first year post-stocking.
5. Estimate return rates of spawning-ready adult Lake Sturgeon that were stocked in the Cuyahoga River and assess natural reproduction.
6. Develop education and outreach programs to engage the community, increase awareness of native species restoration, and exemplify the ecological, recreational, and cultural significance of the Cuyahoga River.

Completed Management Actions

Efforts to address Objective 1 have already been undertaken. To determine the availability and amount of adult spawning and age-0 nursery habitat in the Cuyahoga River, habitat mapping from Lake Erie to the confluence of the Little Cuyahoga River (~70 river kilometers) was conducted in spring of 2021 and 2022. Habitat suitability was quantified based on existing indices for Lake Sturgeon, which classify habitat as good, moderate, or poor based on depth, water velocity, and substrate type (Baril et al. 2018, 2019; Collier et al. 2022). At median spring discharge, a total of 22.6 ha (15% of the study area) was classified as good spawning habitat, which includes areas with moderate water velocities (~0.5-1.5 m/s), a range of depths (~0.3-2.25 m), and coarse substrates (gravel, pebble, cobble). Good spawning habitat was identified throughout the river. Notable areas include a large patch classified as good spawning habitat at river kilometer 15 near Cuyahoga Heights. There was also a cluster of patches of good spawning habitat downriver of Boston Mills (river kilometers 33-39) and in the Akron area (river kilometers 62-65). Based on Dumont et al. (2011), there is enough good spawning habitat to support an adult spawning stock of over 1,500 individuals.

At median spring discharge, 107.7 ha of the river (70%) was classified as good age-0 habitat, which included areas with slower water velocities (~0-0.5 m/s), a range of depths (~0.2-8 m), and fine to coarse substrates (silt, sand, gravel, pebble, cobble). Good age-0 habitat was identified throughout the river, with the largest patches occurring in the lower 20 river kilometers, where there were more fine sediments and the channel tended to be wider. Spring, summer, and fall water temperatures over the last 12 years remained below the upper limits for reduced growth and survival (28° C; Lyons and Stewart 2014). During the expected spawning window (April-June), water temperatures were within the optimal temperature range for larval development (12-16° C; Wang et al. 1985) for at least some part of the spring each year. Based on the preliminary results from the habitat mapping, there is enough suitable

spawning and age-0 habitat to support a self-sustaining spawning stock of Lake Sturgeon. A complete description of habitat mapping and modeling methods will be published in the future.

Proposed Management Actions

Objective 2: To establish a spawning stock in the Cuyahoga River, up to 1,500 fall fingerling Lake Sturgeon will be stocked annually beginning in 2025. This stocking will follow the genetic guidelines for Lake Sturgeon stocking in the Great Lakes Basin (Welsh et al. 2010) and ongoing work under the Maumee River Lake Sturgeon Reintroduction Plan (Collier 2018). Gametes will be collected from the upper St. Clair River during the current collections used for the Maumee River reintroduction, and all individuals stocked in the Cuyahoga River will be hatched and reared at the Genoa National Fish Hatchery by the U.S. Fish and Wildlife Service. Success will be defined by a stocking program resulting in a spawning stock of over 1,500 adults, representing multiple year classes, following at least 25 years of stocking. Successful reintroduction will require long-term persistence of the spawning stock and will be identified by natural recruitment and the genetic contribution of spawning adults. An N_e of 500 or greater is recommended for re-established stocks (Frankham 1995). Successful reintroduction of Lake Sturgeon into the Cuyahoga River would re-establish the first self-sustaining spawning stock in the Central Basin of Lake Erie and could thus aid in the downlisting of the species in the surrounding jurisdictions.

Objectives 3-5: These objectives will be met by monitoring and evaluating the stocking program, building on similar programs in the Maumee and Saginaw rivers, using acoustic telemetry and/or similar technologies (e.g., PIT tag arrays) to assess movement and survival of stocked individuals. Currently, a pilot acoustic telemetry study is being implemented for fall of 2024 to assess movement, behavior, and post-stocking survival of juvenile Lake Sturgeon. Twenty juveniles (15 traditional acoustic transmitters and 5 acoustic transmitters with predation sensors) will be released at three different stocking locations (upstream at a Summitt County Metropark, midstream at Cuyahoga Valley National Park, and downstream at a Cleveland Metropark) to inform future large-scale stocking efforts. In the future, traditional assessment methods and PIT tag arrays could provide data to quantify return rates and spawning stock size. To assess frequency and magnitude of reproduction, surveys of egg deposition and larval drift will begin when spawning-ready adults start being documented in the river and near the river mouth.

Objective 6: Outreach and education will be conducted throughout the program duration. The outreach strategy will build on existing outreach initiatives already taking place by project partners throughout the Cuyahoga River watershed and will use Lake Sturgeon stocking events as a centerpiece. Outreach and education could occur through annual release ceremonies, public presentations highlighting the program and its research, and working with local schools, parks, and clubs to develop place-based curricula and learning modules.

Long-term Adaptive Management

There are multiple uncertainties associated with the any Lake Sturgeon stocking program (e.g., how well will fish survive, how quickly will they mature, what return rates should be expected, impacts of projected climate change) that influence the success and longevity of a program. The Cuyahoga River Lake Sturgeon reintroduction will take an adaptive management approach to improve performance and reduce uncertainties. As the program progresses, regular partnership meetings to review research and

evaluation efforts will inform changes to ensure goals are met, quantify the effectiveness of the program, and guide Lake Sturgeon management in Lake Erie.

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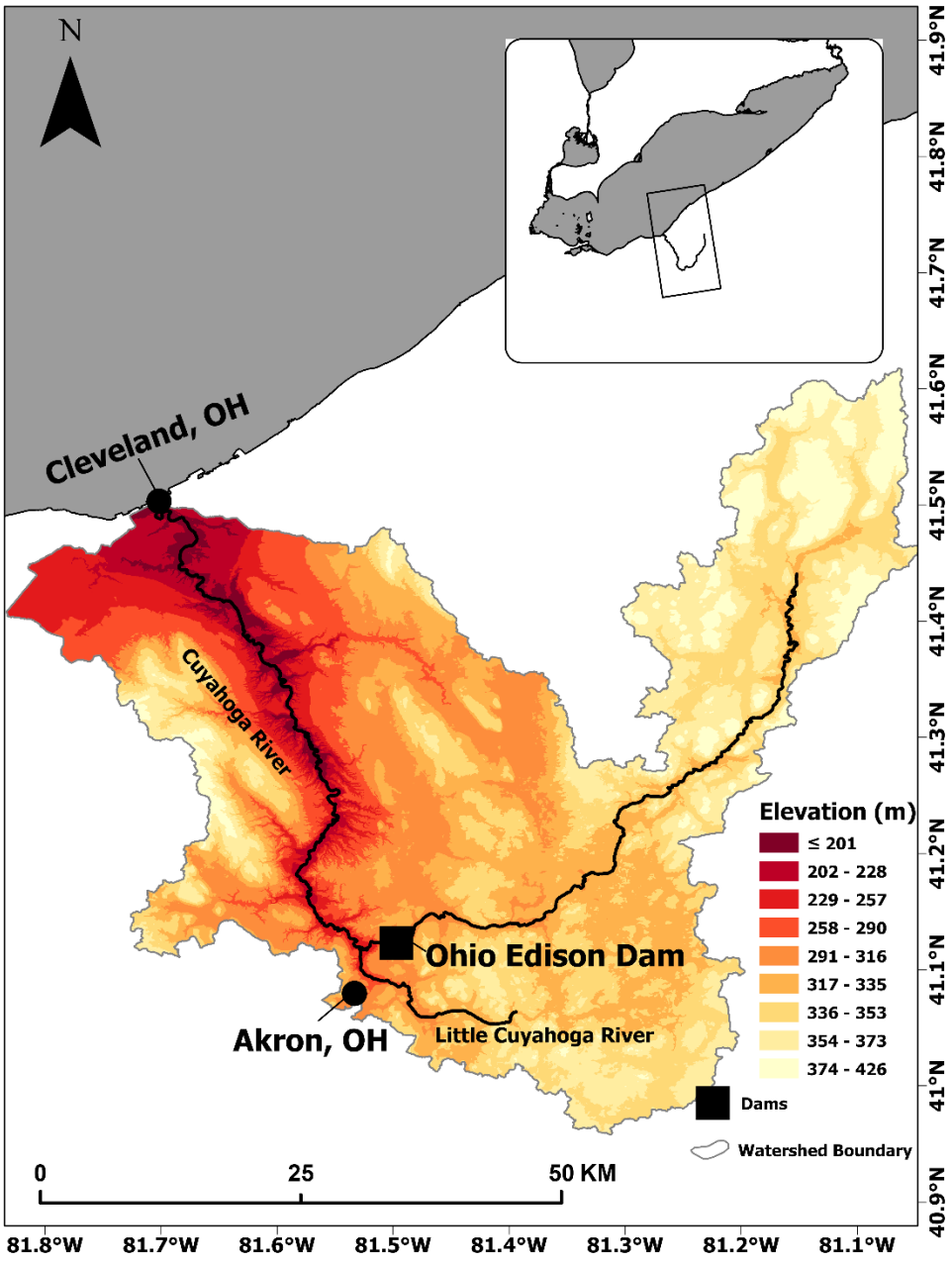

Figure 1. The Cuyahoga River watershed, including elevations, major cities, and current upstream barrier.