Inventory of Distribution, Composition, and Relative Abundance of Fish at Hopewell Culture National Historical Park

[1]Myra Harumi Vick
[2]Anthony C. Minamyer

[1]Hopewell Culture National Historical Park
Chillicothe, OH 45601-8694

[2]Aquatic Biologist
39270 Maysville-Greendale Rd
Logan, OH 43138

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Heartland Network
Inventory and Monitoring Program
National Park Service
6424 W. Farm Rd. 182
Republic, MO 65738

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Summary

An inventory of permanent aquatic sites at Hopewell Culture National Historical Park and adjacent waters was conducted to determine fish species presence/absence. The inventory was conducted in October 2003 at two sites: Dry Run, an intermittent stream located at Hopeton Earthworks and a pond at Hopewell Mound Group. Fifteen of the 84 species on the original expected species (18%) were documented by the inventory. An expected species list was then developed from surveys on streams adjacent to the park. These lists will act as a baseline inventory of fish species present and adjacent to the park.

Results of the surveys on non-park waters added seven names to the list; this brings the total number of species to 91. These streams are the Scioto River, Paint Creek, and North Fork of Paint Creek. Species diversity was highest in the mainstem of Paint Creek with 62 species, followed closely by the North Fork of Paint Creek with 60 species, and the mainstem of the Scioto River with 54 species.

This data can be incorporated into park monitoring and management plans in order to successfully manage for healthy and diverse populations of fish and aid in any mitigation concerning fish of adjacent streams.

Six species of management concern were observed by the additional surveys: Ohio State Endangered goldeye (*Hiodon alosoides*), Ohio State Threatened bluebreast darter (*Etheostoma camurum*) and Tippecanoe darter (*E. tippecanoe*), and Ohio State Species of Concern river redhorse (*Moxostoma carinatum*), Eastern sand darter (*Etheostoma pellucidum*), and least darter (*Etheostoma microperca*).

Acknowledgements

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Introduction

The U.S. Congress passed the 1998 National Parks Omnibus Management Act in response to concerns about the condition of natural resources within the national parks. The act requires each park to gather baseline inventory data on pertinent natural resources, data that will provide a pivotal step toward establishing an effective monitoring program, and further our ability to effectively manage and protect park resources. The National Park Service (NPS) responded with the Natural Resource Challenge program, including the establishment of biome-based inventory and monitoring networks. The Heartland Network, as part of the NPS Inventory and Monitoring (I&M) program, has undertaken inventories of vascular plants and vertebrates within fifteen parks in eight Midwestern states.

Hopewell Culture National Historical Park was established to preserve, protect, and interpret the remnants of the Hopewell, thereby increasing understanding of their culture. Since the establishment of the park in 1923, focus has been on the archeological remnants of the Hopewell culture. Work and study of the natural resources in the park however, has been limited and incomplete.

Throughout the state of Ohio there are 162 species of fish that utilize more than 256,000 km (160,000 mi) of streams, almost a million hectare (> two million ac) of Lake Erie and in-land water, and 720 km (450 mi) of the Ohio River (Sanders 2002). A comprehensive survey of the fish that may utilize Hopewell Culture National Historical Park was initiated to determine species diversity and create a baseline inventory of what fish species are present in and adjacent to the park. The collection of this information will then be incorporated into park monitoring and management plans in order to successfully manage for healthy and diverse populations of fish.

The Scioto River, Paint Creek, and North Fork of Paint Creek border park property, however are not included within the legislated boundaries. Because land management and practices can impact water quality and habitat, existing surveys and data regarding these streams are included in the results portion of this report. Sources of data are from the Ohio Environmental Protection Agency, Division of Surface Water and the Ohio State University, Division of Fishes.

The goal of the inventory is to document 90% of the species that are reasonably expected to occur at the park. This inventory is a census of the five park units and will provide data on fish species composition, distribution, and relative abundance.

Study Area

Hopewell Culture National Historical Park is composed of five non-contiguous park units totaling more than 460.5 ha (1,138 ac) in size (Table 1). The park units are Mound City Group, Hopeton Earthworks, Hopewell Mound Group, High Bank Works, and Seip Earthworks (Figures 1-6) and are located around the town of Chillicothe in Ross County, Ohio. Here two phytogeographic regions of Ohio meet along a NE/SW line. The northwest portion of the park and Ross County is composed of calcareous, glaciated till plain, while the southeast is made up of non-glaciated area (Braun 1989). The meeting of two regions may result in higher diversity of flora and fauna.

Two park units contain surface water within park boundaries, an intermittent stream, Dry Run at Hopeton Earthworks, and a pond at Hopewell Mound Group (Table 2). In addition, larger streams border park property, and include the Scioto River, Paint Creek, and North Fork of Paint Creek.

A portion of Dry Run flows through Hopeton Earthworks (Hopeton) for approximately 0.7 km (.4 miles). The creek flows through 5.5 ha (13.6 ac) of early successional mixed deciduous open forest, and eventually flows into the Scioto River. This park unit is located at the 1100 block of Hopeton Road, Chillicothe. Hopeton is one of the largest parcels encompassing approximately 151.9 ha (375.4 ac). The majority of the area, 96.0 ha (237.3 ac), is mainly composed of orchard grass (*Dactylis glomerata*) and alfalfa (*Medicago sativa*) and has been harvested for hay in the recent past. A relatively young fence row bisects the property and is composed mainly of hackberry (*Celtis occidentalis*), with some wild black cherry (*Prunus serotina*). Currently there is an active gravel mining operation located on the western half of the property. The Scioto River flows along a portion of the western side of the gravel mining operation. In addition, a no-till corn/soybean field owned by the park is located on the western side of the mining operation. Another 1.6 ha (4 ac) contains mowed grass and black walnut (*Juglans nigra*) trees.

The pond at Hopewell Mound Group (Hopewell) is located at 4731 Sulphur Lick Road, Chillicothe. The 0.20-ha (0.5 ac) impoundment in located in the northern portion of the property. The surrounding area includes 33.6 ha (83.0 ac) of semi-mature mixed mesophytic forest. An intermittent stream, Sulphur Lick, runs near the northern and eastern boundary of this 125.6 ha (310 ac) site. Currently the majority of the property is mainly composed of 73.0 ha (180.4 ac) of orchard grass pasture that has been allowed to go fallow since 2003.

The Scioto River flows along the eastern edge of Mound City Group (Mound City) and the western edge of High Bank Works (High Bank). The river is known to contain a wide diversity of aquatic and riparian habitats. Severe erosion occurs in many areas of this river, in part due to the six dams in its upper reaches. Based on the extensive surveys conducted by the Ohio Environmental Protection Agency (OEPA) for more than 20 years, the designated aquatic use of the river improved from “Modified” to “Exceptional” warmwater (ODSW 2002). The attainment of “Exceptional” warmwater is based on the increase in species diversity, composition, and functional organization of fish and invertebrates.

The river flows approximately nine-tenths of a kilometer (0.6 mi) along the boundary of Mound City, with a portion causing extensive erosion. Some areas along the river are flooded periodically, while others are located at upper terraces.

The Scioto River also flows along the western border of High Bank, but further downstream from Mound City and along a 0.45 km (0.28 mi) stretch of the of the property. This is the largest riparian parcel in the entire park, extending 11.7 ha (28.9 ac), and also contains an ox-bow that is periodically flooded. The width of the riparian area ranges from 130-290 m (426-951 ft), and is located on the lower terrace. The canopy in this area is extensive and composed of sycamore (*Platanus occidentalis*), cottonwood (*Populus deltoides*) and silver maple (*Acer saccharinum*). Hackberry and box elder (*Acer negundo*) dominate the sub-canopy, with some Ohio buckeye (*Aesculus pavia*) and younger silver maple interspersed. Young Ohio buckeye is also the only component in the shrub layer. The herbaceous layer is mostly tall fescue (*Festuca* spp.), Canadian woodnettle (*Laportea canadensis*), jewelweed (*Impatiens capensis*), and garlic mustard (*Alliara petiolata*).

Paint Creek is a tributary to the Scioto River and the lower portion flows along the southern edge of the 5.9 ha (14.6 ac) wooded riparian corridor of Seip Earthworks (Seip). Approximately 0.84 km (0.52 mi) of Seip is bordered by Paint Creek. According to the Ohio EPA's 2004 Integrated Report for Large River Assessment Units, the lower portion of Paint Creek is among the highest quality large rivers in the state. The incredible fish diversity in this portion of the stream, 91 species, reveals the excellent habitat and water quality evident in the stream (Cavender and Kibbey 1999). The designated aquatic life use is considered Exceptional Warm Water habitat and the eastern hellbender (*Cryptobranchus alleghaniensis*), a state endangered species and Federal Species of Concern, has been found in this watershed (Pfingsten and Downs 1989).

Seip is located on US 50 bordering Seip State Memorial, near Paint Valley High School, Bainbridge. The property is divided into two parcels, with Ohio Historical Society land located between the units, and the unit spans 67.0 ha (165.6 ac). The canopy for the riparian area is composed of a few sycamore, box elder, silver maple, and hackberry. The sub-canopy consists of smaller box elder and hackberry, and paw-paw (*Asimina triloba*). The only plant contributing to the shrub layer was paw-paw, whereas the herbaceous layer was mainly composed of Canadian woodnettle. Other plants contributing to the riparian floor was garlic mustard, common blue violet (*Viola* sp.), smooth sweet cicely (*Osmorhiza longistylis*), and tall fescue.

The North Fork of Paint Creek borders the southern edge of Hopewell Mound Group for approximately 0.35 km (0.22 mi). Currently the property bordering the creek is a 6.3 ha (32.0 ac) field. Most of the site had been planted in winter wheat (*Triticum aestivum*) in 2002; however, since then, the field has been left fallow. Therefore a mix of shepherd's purse (*Capsella bursa-pastoris*), common goldenrod (*Solidagocanadensis*), eastern daisy fleabane (*Erigeron anuus*), and Canadian horseweed (*Conyza canadensis*) are evident. Establishment of native grasses and forbs has also been done on a 6-acre plot on the eastern portion of this area in 2004. Along the edge of the field, white oak (*Quercus alba*) makes up the canopy, with hackberry in the sub-canopy. Extensive erosion has been observed along this area with the park currently determining the proper course of action.

Methods

Fish surveys at Dry Run in Hopeton Earthworks (Hopeton) and in the pond at Hopewell Mound Group (Hopewell) were conducted on 13 October 2003. Researchers walked 150 meters of the stream and used pulsed DC electrofishing equipment at 6-8 amps to sample the fish. At the Hopewell pond, researchers used a tote-barge electrofishing boat to sample the area.

Each individual fish was identified, counted, and released, with voucher specimens collected and preserved for each species. All habitat types were sampled in the stream and pond. Biological sampling methods in Dry Run followed the Ohio Environmental Protection Agency (Ohio EPA) standard protocols for sampling fish assemblages (Ohio EPA 1987a, b, 1989a, b). Habitat quality was also evaluated using the Qualitative Habitat Evaluation Index (Rankin 1989). GPS data was collected according to Topozone using WGS84/NAD83.

The Ohio Environmental Protection Agency, Division of Surface Water (DSW) monitors fish abundance and diversity following the Biological Criteria for the Protection of Aquatic Life (Ohio EPA 1987a, b, 1989a, b). The DSW regularly samples the Scioto River, Paint Creek, and North Fork of Paint every 5 years. Results from these studies are printed every two years, with the most recent compilation in 2004. Sampling results were collected from river miles that lay close to park units.

The Ohio State University, Division of Fishes funded a study from 1997 to 1999 on the Paint Creek Drainage of the fish diversity, distribution and richness.

An expected species list was provided before survey work began to be used as a search list (Boetsch et al 2000, see table 3). Fish nomenclature was based on Page and Burr (1991).

Results

Expected Species

As a result of the inventory, 15 of the 84 expected species (18%) were documented. Dry Run resulted with 14 species and the man-made pond at Hopewell Mound Group contained only small-sized bluegill (*Lepomis macrochirus*) that had been stocked by previous landowners. The Dry Run survey resulted in the addition of one species not initially expected: southern redbelly dace (*Phoxinus erythrogaster*) (Tables 3 and 4).

Results from fish surveys conducted on adjacent Scioto River, Paint Creek, and North Fork of Paint Creek have documented 78 of the 84 expected species (Table 4). These surveys add three additional species not initially expected, walleye (*Stizostedion vitreum*), goldeye, and least darter. The six species not documented but still expected in the adjacent streams include: bigmouth buffalo (*Ictiobus cyprinellus*), grass carp (*Ctenopharyngodon idella*), grass pickerel (*Esox americanus*), pumpkinseed (*Lepomis gibbosus*), black bullhead (*Ameiurus melas, syn. Ictalurus melas*), and tadpole madtom (*Noturus gyrinus*).

Based on the results of these additional surveys, six species of management concern were observed in adjacent streams: Ohio State Endangered goldeye, Ohio State Threatened bluebreast darter and Tippecanoe darter, and Ohio State Species of Concern river redhorse, Eastern sand darter, and least darter (ODOW 2002).

Species Richness and Abundance

Dry Run contained 14 species, and 606 individuals. The most abundant species was blacknose dace (209 individuals) followed by northern creek chub (159 individuals). The least abundant species (one each) were rainbow darter (*Etheostoma caeruleum*) and green sunfish (*Lepomis cyanellus*). While the abundance categories for some of the species were found to be rare or occasional on site, all of the fish species in Dry Run are commonly found throughout the state of Ohio (Trautman 1981).

The Index of Biotic Integrity (IBI) was calculated for Dry Run and was found to be 42 which fully meet Ohio's Water Quality Standards warmwater habitat (WWH) aquatic life use. The Qualitative Habitat Evaluation Index (QHEI) score was 67. A score greater than 60 typically indicates that a WWH community could be supported.

The fish community found in Dry Run represents the typical resident species during low flow summer conditions. It is possible that other fish species from the Scioto River use Dry Run as a refuge during high flow events and in the spring for spawning purposes. However because the stream has such a small drainage area (4.1 square miles) and often has intermittent or interstitial flow, it would not support a viable population of large riverine fish such as those found in the Scioto River.

Bluegill sunfish was the only species that was encountered at the pond. A total of 32 were found and the species appears to be very abundant in the pond. From May 2002 to June 2003,

Christina Wieg used minnow traps within the pond at the Hopewell Mound Group to conduct a herpetofaunal inventory at the park (Wieg 2004). During that time, the only fish species that Wieg encountered in the minnow traps were also bluegill sunfish (Wieg, 2003 personal correspondence). There is a possibility that other fish species that are typically found in pond environments could be in this pond such as large mouth bass (*Micropterus salmoides*) and yellow bullhead (*Ameiurus natalis*). However, given the results of the electrofishing survey and the year long study by Wieg, it is unlikely that these species are present. The isolated location of the pond whereby no connection is present for natural migration of other species limits the addition of new species. These conditions result in poor species richness with no potential for connectivity to existing waterways.

In the larger streams, high species richness was evident in all bodies of water, especially Paint Creek with the highest number of species, 62, followed by the North Fork of Paint Creek with 60 species, and finally the Scioto River with 54.

Discussion

Expected Species

Based on the results of this and other surveys, the overall number of species sampled was 81 out of 88 expected species (92%). The high outcome is a product of a variety of factors- different stream types and sizes, various habitat availability, good water quality, use of electroshocking, and long-term monitoring. Watershed sizes range from the Scioto River draining 6,517.0 mi^2, Paint Creek draining 1,144.0 mi^2, and the North Fork of Paint Creek draining 234.5 mi^2. Based on the continuous and extensive monitoring done by the Ohio EPA, they have concluded that "The lower portion of Paint Creek (flows by Seip Earthworks) is one of the highest quality large rivers in the state of Ohio. Exceptional biological diversity is present within this segment of the river" (ODSW 2002).

Species included on the expected list but not observed through all the studies include the following: bigmouth buffalo, grass carp, golden shiner (*Notemigonus crysoleucas*), grass pickerel, pumpkinseed, black bullhead, and tadpole madtom.

Typical habitat for bigmouth buffalo is in large river bodies such as the Ohio River, Scioto River, and the lower Muskingum River. Due to the small section of the Scioto River that borders park property, this species may be sampled further upstream or downstream from these sites, therefore should probably be assumed to use areas bordering the park.

Grass carp are non-native fish that feed primarily on vegetation and occur in flowing water, although they can survive in reservoirs. Once again, the small section rivers that flow by the park units may not have resulted with sampling this species, but due to their ability to exist in low-oxygen water and a range of conditions, they are likely present.

The golden shiner is generally found in slow-moving large streams that contain relatively clear water with sandy bottoms (Trautman 1981). Based on these requirements, the shiner should be present in Paint Creek; however the limited area sampled may have restricted the sampling of this species.

Habitat for grass pickerel is lacking along the stretches of river that borders park property. This species prefers low-gradient streams with dense vegetation and organic bottoms (Trautman 1981). No records for this fish in found in this area, however, this species has been captured further upstream and downstream in the Scioto River.

The Ohio River drainage contains scattered populations of pumpkinseed, with introductions being highly successful. This species prefers clear, still water, therefore would not typically be found in streams. Its presence may be highly questionable, but it does occur in the Scioto River watershed.

The black bullhead is tolerant of many poor water quality conditions including industrial pollutants. They prefer muddy, silt-laden bottoms of small to medium-sized rivers.

Unfortunately, some areas bordering all the streams provide continuous sources of silt, with potential industrial pollutants flowing into the Scioto River. Once again, limited sampling area may have limited the capture of this species in the surveys conducted.

Over time, populations of tadpole madtom have slowly decreased as habitat degradation increased. This fish prefers clear, slow-moving water, and is highly intolerant of turbidity. Historically, specimens have been captured in the Scioto River watershed, however due to their low and declining numbers, the difficulty of documenting this fish rises.

Conclusion

Sedimentation and habitat alteration are the leading causes of impairment in headwater streams (Ohio EPA 2003). In order to sustain a healthy warmwater habitat fish community in Dry Run, it is recommended that the wooded riparian area be maintained and undisturbed. The wooded riparian corridor adjacent to Dry Run provides many benefits including shading, bank stabilization, leaf litter (which provides food for the macroinvertebrates), flood control and sediment control. If there are any construction or development activities within this small watershed, proper storm water management is needed to prevent damage to the natural hydrology of the stream and to maintain good water quality. In order to protect the pond at the Hopewell Mound Group, it is also recommended that the mature woody vegetation around the pond be maintained for the purpose of shade, habitat, and to protect the water quality within the pond.

Most of the water resources lay along property boundaries, with land management decisions having significant impact on water quality, habitat availability, and species diversity. Issues such as erosion due to land development and agricultural activities, non-point and point source pollution, construction on floodplains, competition from invasive exotic species, and alteration to the river channel all contribute to the degradation of streams.

Within the last ten years, the US Census Bureau recorded an increase in the human population of Ross County at 5.8% (U.S. Census Bureau 2003). This increase is a percentage point higher than the state average, indicating development may also increase. Areas targeted for housing are generally agriculture fields, which results in an increase in non-permeable surfaces and potential increase in nutrient load to waterways.

Management options

This park was established to preserve, protect, and interpret the remnants of the Hopewell, thereby increasing understanding of their culture. All management options should take into consideration the potential impact to cultural resources at this park. Stabilization of waterways will coincide with cultural preservation as the less land lost to erosion results in less cultural resources being swept away.

Due to the noncontiguous nature of this park, a larger ecosystem-wide vision should be used when considering management on and off park land. Partnerships and networking with local, state and Federal agencies and organizations may help broaden the ecosystem view of the health of our landscape, and in turn create an awareness of maintaining and identifying important habitat and wildlife areas. In addition, these surface waters function as a connection between all the park units, therefore management decisions should keep in mind potential impacts both upstream and downstream.

Riparian areas play an important role in controlling erosion, providing habitat and nutrients for the aquatic species throughout the watershed, and functioning as a buffer between terrestrial and aquatic resources. Whenever possible, forested riparian areas should be protected and enhanced

to expand the corridor. Along with fish, other wildlife depend on intact riparian corridors as valuable habitat for nesting, feeding, and as essential stopping points along migratory pathways. This is true especially in the case of migratory birds as the riparian areas in Mound City Group and High Bank Works has been designated as Important Bird Areas by the Ohio Audobon Society.

To ensure high quality riparian corridors, invasive plant control is essential. Maintaining a healthy forest requires a diverse mix of native trees, which can sometimes be altered by the presence of highly aggressive plants such as shrub honeysuckle (*Lonicera tatarica, L. maackii*), tree of heaven (*Ailanthus altissima*), Russian olive (*Elaeagnus angustifolia*), and multiflora rose (*Rosa multiflora*). In addition, monitoring programs for invasive and highly destructive animals, such as gypsy moth (*Lymantria dispar*), emerald ash borer (*Agrilus planipennis*), and other pests should be in place, along with action plans to deal with the pests should they manifest themselves.

Standard widths of healthy functioning riparian corridors can be estimated based on 2.5 times bankfull width or 50 feet, whichever is less (Mecklenburg 2004). Riparian areas do vary in size, however this generic width can be used to establish a baseline width to which corridors can be maintained or re-established.

In order for riparian systems to function correctly, work with neighboring landowners is essential. The Paint Creek watershed has a headstart as there is currently a watershed coordinator specifically designated to work in that drainage system. The park should develop working relationships with private and government landowners to ensure extensive protection of riparian areas. Some partners include the US Army Corps of Engineers, Ohio Environmental Protection Agency, Natural Resource Conservation Service, Ohio Historical Society, Highlands Sanctuary, businesses, and private citizens.

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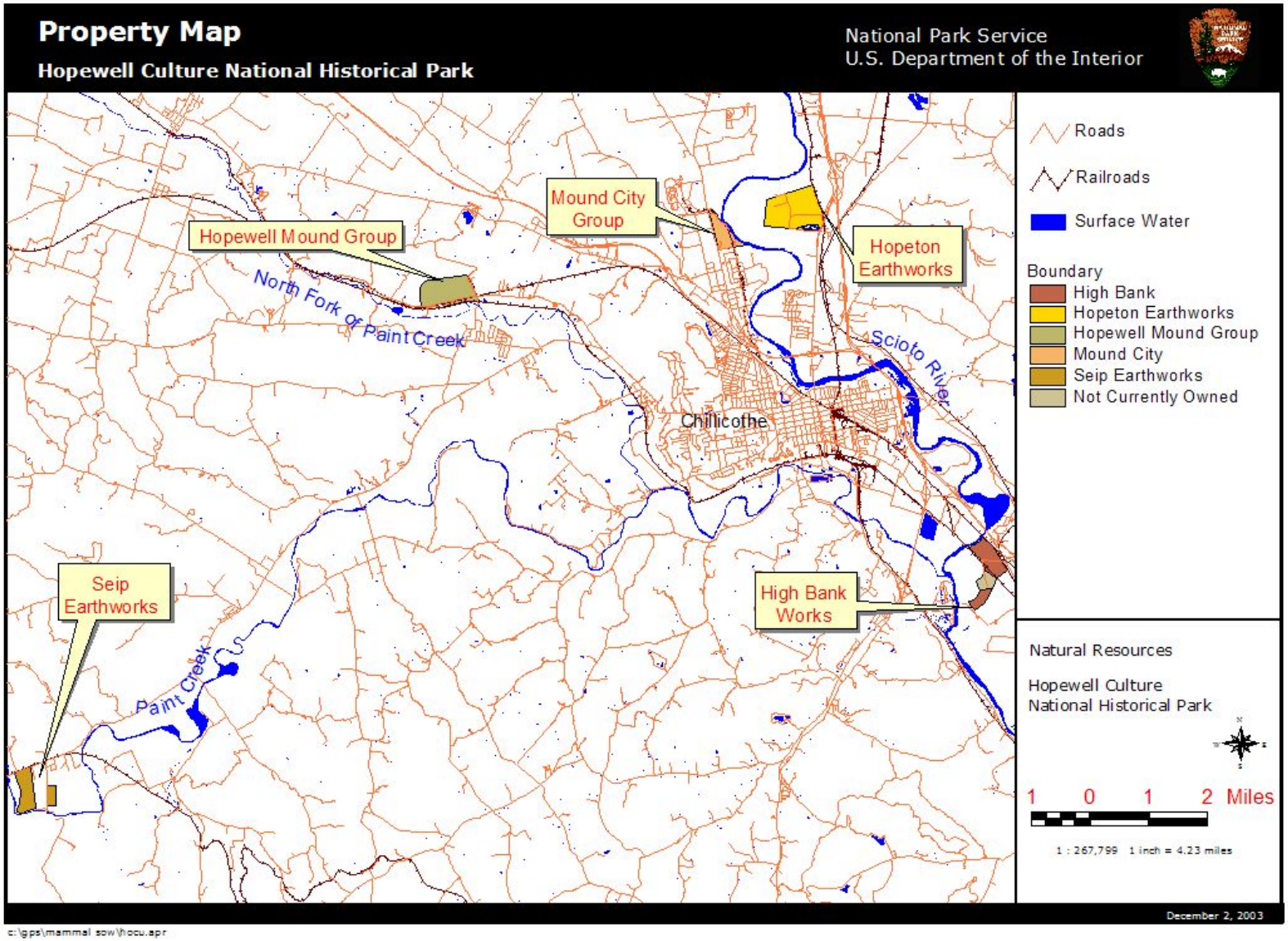

Figure 1. Map of Hopewell Culture National Historical Park, Chillicothe, Ross County, Ohio.

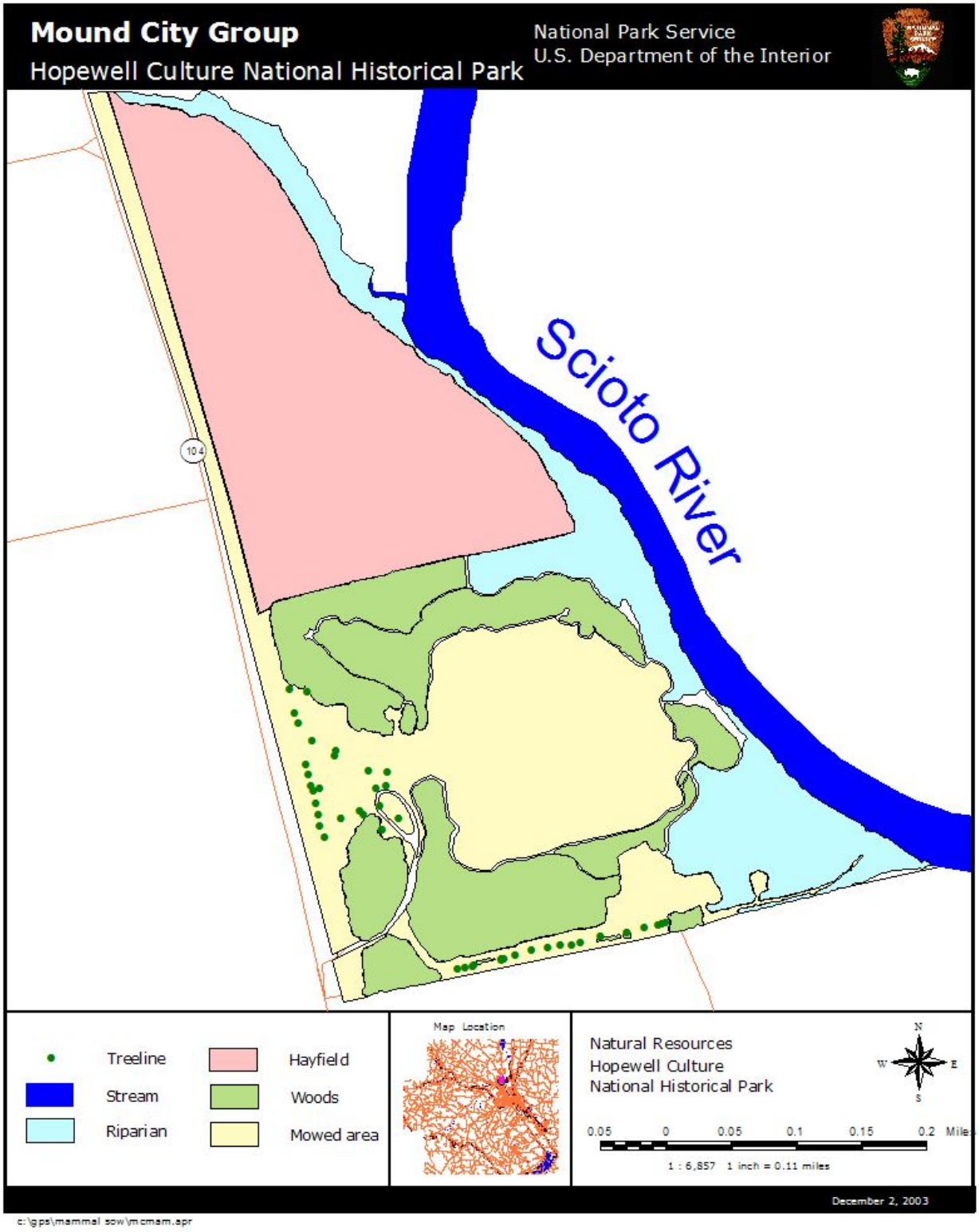

Figure 2. Map of Mound City Group.

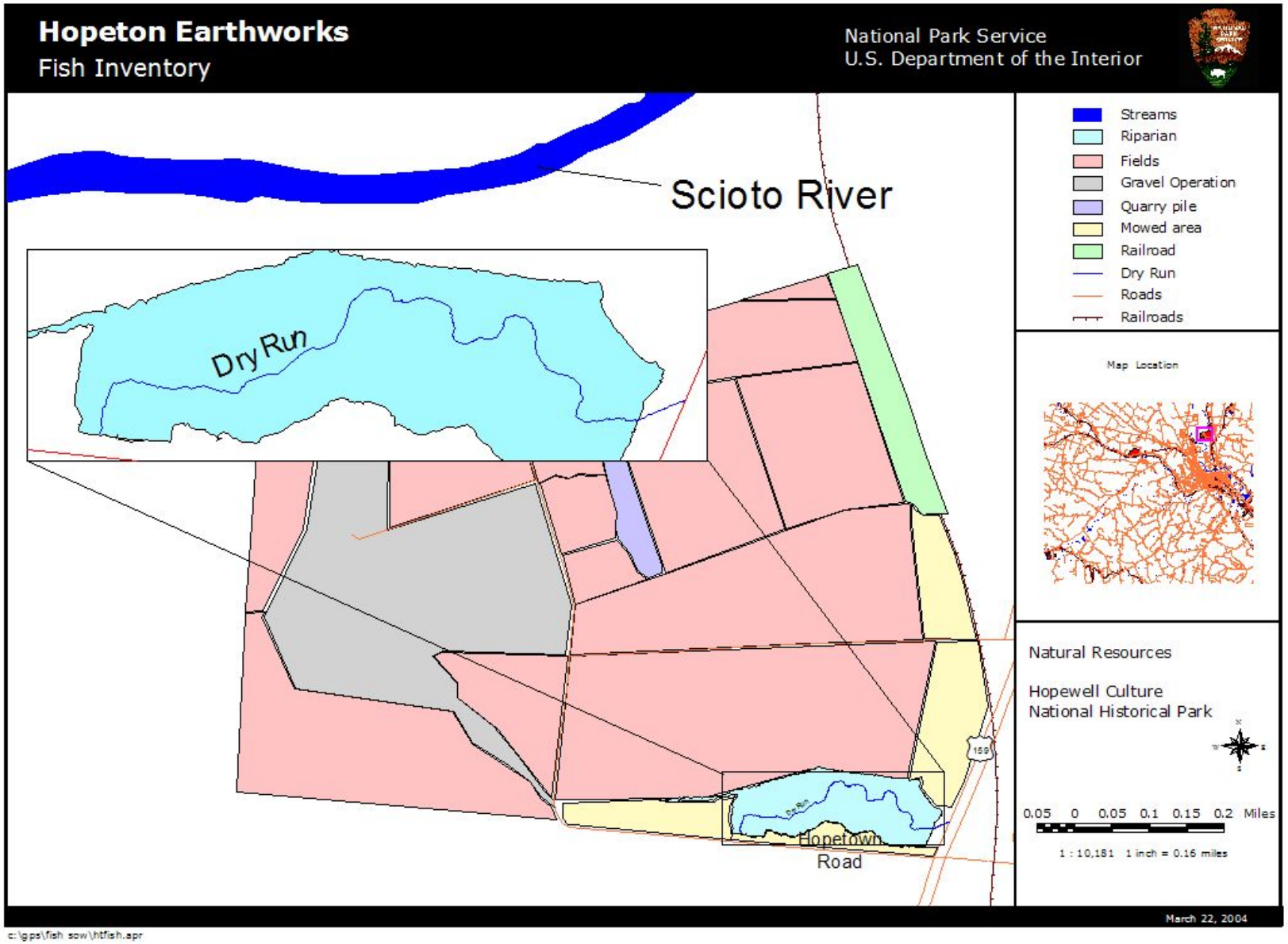

Figure 3. Map of Hopeton Earthworks.

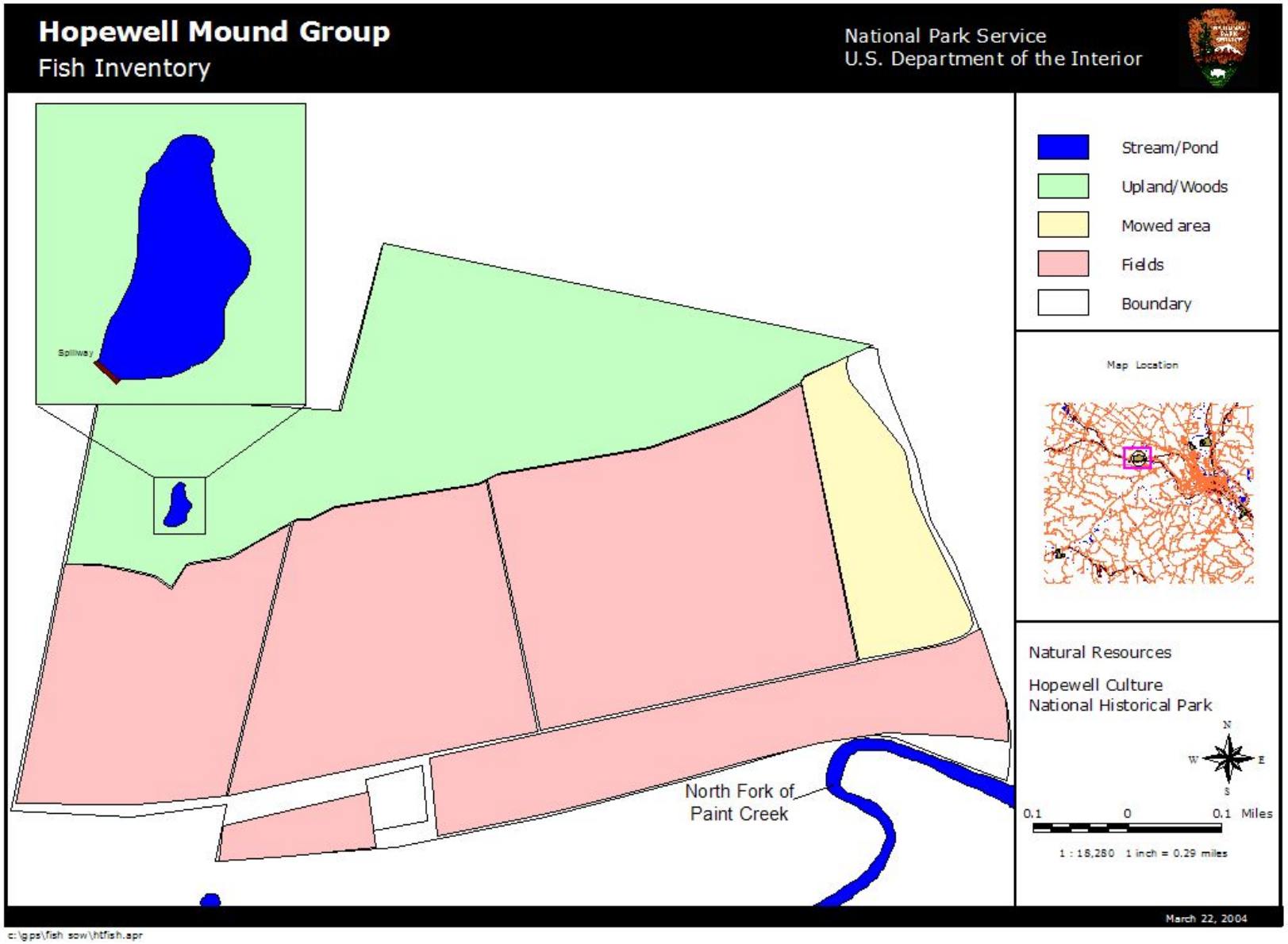

Figure 4. Map of Hopewell Mound Group.

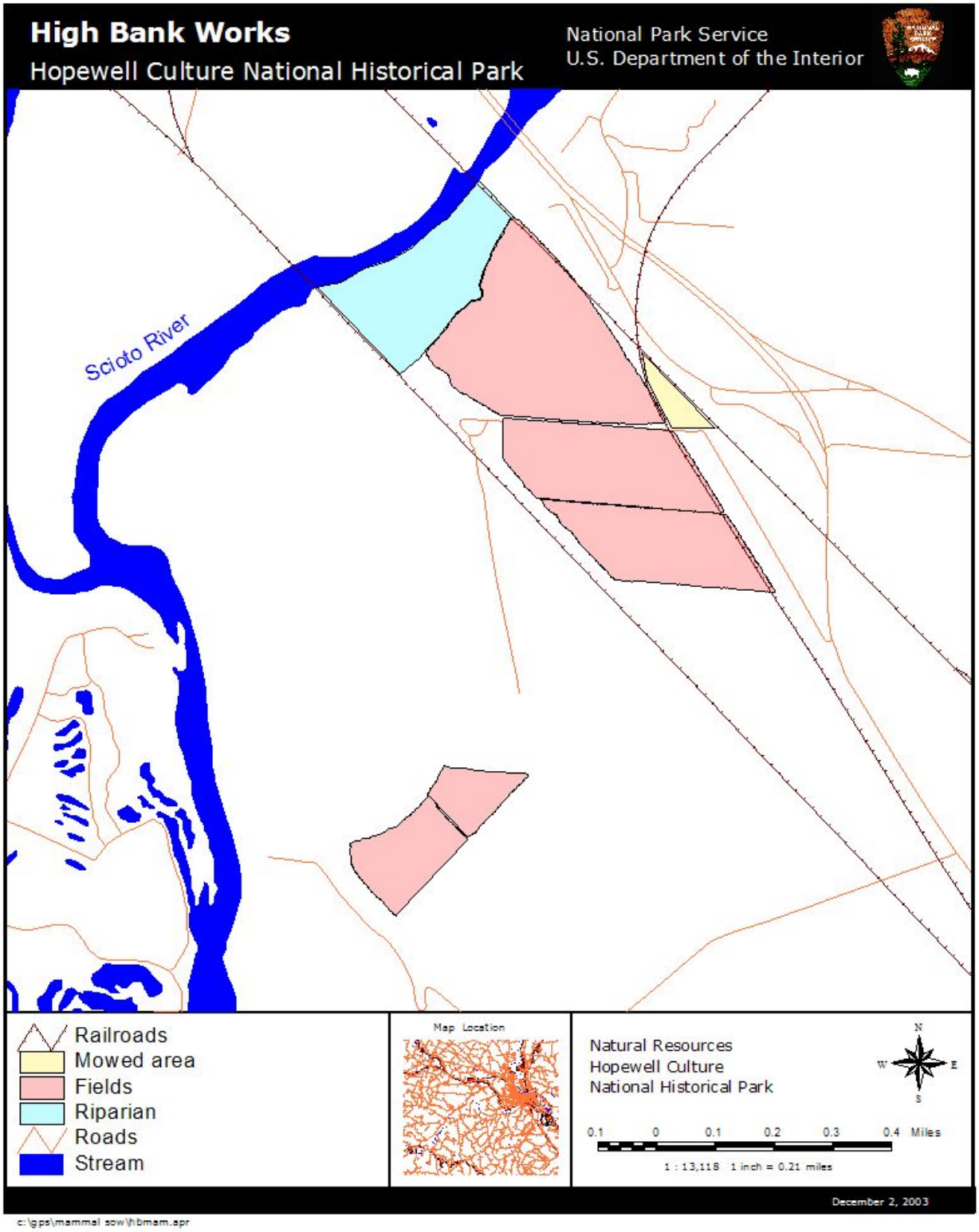

Figure 5. Map of High Bank Earthworks.

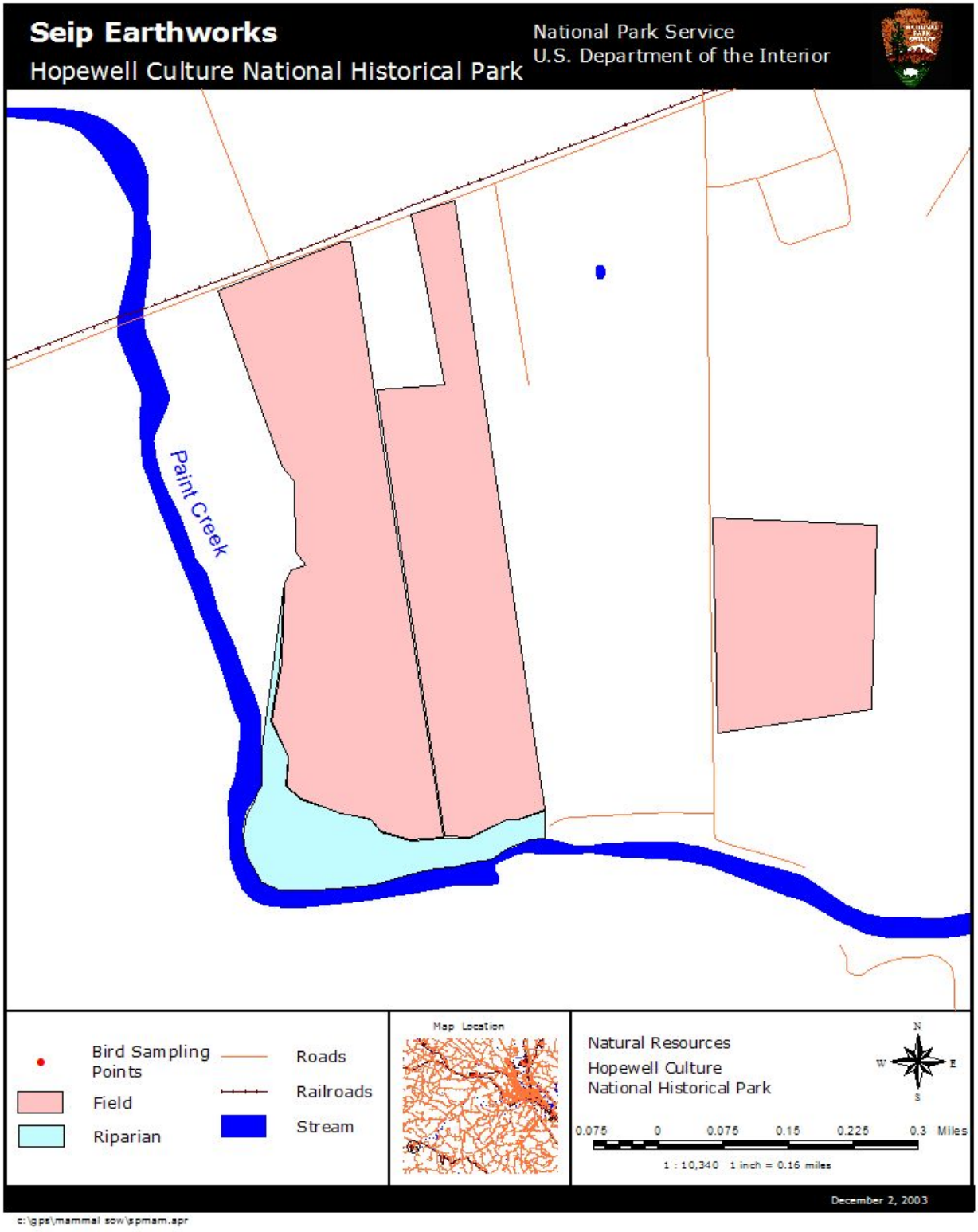

Figure 6. Map of Seip Earthworks.

Table 1. Habitat and acreage for each unit at Hopewell Culture NHP.

Unit/Strata	**WOODS/ UPLAND**	**RIPARIAN**	**AG/OLD FIELD**	**MOWED/ DEVELOPED AREAS**	**TOTAL**
Mound City	9.5 ha	7.4 ha	15.8 ha	15.8	**48.5 ha**
High Bank		11.7 ha	48.2 ha	7.6	**67.5 ha**
Hopeton		5.5 ha	96.1 ha	50.3	**151.9 ha**
Hopewell	33.6 ha		73.0 ha	19.0	**125.6 ha**
Seip		5.9 ha	58.2 ha	2.9	**67.0 ha**
TOTAL	**43.1 ha**	**30.6 ha**	**291.3 ha**	**95.6 ha**	**460.5 ha**

Table 2. Surface water in and around Hopewell Culture National Historical Park.

Water body within park boundary	**Park unit**	**Area/length**
Dry Run	Hopeton Earthworks	0.655 km
Hopewell Pond	Hopewell Mound Group	0.20 ha
Water body bordering park boundary	**Park unit**	**Length**
Scioto River	Mound City Group	0.90 km
	High Bank Works	0.45 km
Paint Creek	Seip Earthworks	0.84 km
North Fork of Paint Creek	Hopewell Mound Group	0.35 km

Table 3. Status and abundance of expected fish species at Hopewell Culture NHP.

	Order: Family	**Scientific Name**	**Common Name**	**Ohio**	**Ross County**	**HOCU**	**Old**	**New**	**Voucher**
1.	Atheriniformes: Atherinidae	*Labidesthes sicculus*	Brook silverside	U	U	na	1	0	No
2.	Clupeiformes: Clupeidae	*Alosa chrysochloris*	Skipjack herring	U	C	na	1	0	No
3.		*Dorosoma cepedianum*	Gizzard shad	C	C	na	1	0	No
4.		*Carpiodes carpio*	River carpsucker	U	C	na	1	0	No
5.		*Carpiodes cyprinus*	Quillback	C	U	na	1	0	No
6.		*Carpiodes velifer*	Highfin carpsucker	U	C	na	1	0	No
7.		*Catostomus commersoni*	White sucker	C	C	U	1	2	Yes
8.		*Erimyzon oblongus*	Creek chubsucker	U	U	na	1	0	No
9.		*Hypentelium nigricans*	Northern hog sucker	C	C	na	1	0	No
10.		*Ictiobus bubalus*	Smallmouth buffalo	U	U	na	1	0	No
11.		*Ictiobus cyprinellus*	Bigmouth buffalo	U	U	na	1	0	No
12.		*Ictiobus niger*	Black buffalo	U	C	na	1	0	No
13.		*Minytrema melanops*	Spotted sucker	U	U	na	1	0	No
14.		*Moxostoma anisurum*	Silver redhorse	C	C	na	1	0	No
15.		***Moxostoma carinatum* (SOC)**	River redhorse	U	U	na	1	0	No
16.		*Moxostoma duquesnei*	Black redhorse	C	C	na	1	0	No
17.		*Moxostoma erythrurum*	Golden redhorse	C	C	na	1	0	No

	Order: Family	Scientific Name	Common Name	Ohio	Ross County	HOCU	Old	New	Voucher
18.		*Moxostoma macrolepidotum*	Shorthead redhorse	U	N	na	1	0	No
19.	Cyprinidae	*Campostoma anomalum*	Central stoneroller	C	C	C	1	2	Yes
20.		*Ctenopharyngodon idella*	Grass carp	C	U	na	1	0	No
21.		*Cyprinella spiloptera* (syn. *Notropis spilopterus*)	Spotfin shiner	C	C	U	1	2	Yes
22.		*Cyprinella whipplei* (syn. *Notropis whipplei*)	Steelcolor shiner	U	C	na	1	0	No
23.		*Cyprinus carpio*	Common carp	C	C	na	1	0	No
24.		*Erimystax dissimilis* (syn. *Hybopsis dissimilis*)	Streamline chub	U	U	na	1	0	No
25.		*Erimystax x-punctata* (syn. *Hybopsis* x-*punctata*)	Gravel chub	U	U	na	1	0	No
26.		*Luxilus chrysocephalus*	Striped shiner	C	C	U	1	2	Yes
27.		*Lythrurus ardens*	Rosefin shiner	U	C	na	1	0	No
28.		*Notemigonus crysoleucas*	Golden shiner	C	C	na	1	0	No
29.		*Notropis atherinoides*	Emerald shiner	U	C	na	1	0	No
30.		*Notropis photogenis*	Silver shiner	C	C	na	1	0	No
31.		*Notropis rubellus*	Rosyface shiner	U	U	na	1	0	No

	Order: Family	Scientific Name	Common Name	Ohio	Ross County	HOCU	Old	New	Voucher
32.		*Notropis stramineus*	Sand shiner	C	C	U	1	2	Yes
33.		*Notropis volucellus*	Mimic shiner	C	C	na	1	0	No
34.		*Notropis buccatus*	Silverjaw minnow	C	C	C	1	2	Yes
35.		*Phenacobius mirabilis*	Suckermouth minnow	U	C	C	1	2	Yes
36.		*Phoxinus erythrogaster*	Southern Redbelly Dace	?	?	C	-	2	Yes
37.		*Pimephales notatus*	Bluntnose minnow	C	C	C	1	2	Yes
38.		*Pimephales vigilax*	Bullhead minnow	U	U	na	1	0	No
39.		*Rhinichthys atratulus*	Blacknose dace	C	C	C	1	2	Yes
40.		*Semotilus atromaculatus*	Creek chub	C	C	C	1	2	Yes
41.	Cyprinodontiformes: Fundulidae	*Fundulus notatus*	Blackstripe topminnow	U	C	na	1	0	No
42.	Esociformes: Esocidae	*Esox americanus*	Grass pickerel	U	U	na	1	0	No
43.		*Esox masquinongy*	Muskellunge	C	C	na	1	0	No
44.	Osteoglossiformes: Hiodontidae	***Hiodon alosoides* (E)**	Goldeye*	U	U	na	-	0	No
45.		*Hiodon tergisus*	Mooneye	U	U	na	1	0	No
46.	Perciformes: Centrarchidae	*Amblopites rupestris*	Rock bass	C	C	na	1	0	No
47.		*Lepomis cyanellus*	Green sunfish	C	C	U	1	2	Yes
48.		*Lepomis gibbosus*	Pumpkinseed	U	U	na	1	0	No
49.		*Lepomis gulosus*	Warmouth	U	C	na	1	0	No
50.		*Lepomis humilis*	Orangespotted sunfish	U	C	na	1	0	No
51.		*Lepomis macrochirus*	Bluegill	C	C	C	1	2	Yes
52.		*Lepomis megalotis*	Longear sunfish	C	C	na	1	0	No

	Order: Family	Scientific Name	Common Name	Ohio	Ross County	HOCU	Old	New	Voucher
53.		*Micropterus dolomieu*	Smallmouth bass	C	C	na	1	0	No
54.		*Micropterus punctulatus*	Spotted bass	U	U	na	1	0	No
55.		*Micropterus salmoides*	Largemouth bass	C	C	na	1	0	No
56.		*Pomoxis annularis*	White crappie	C	C	na	1	0	No
57.		*Pomoxis nigromaculatus*	Black crappie	C	C	na	1	0	No
58.	Moronidae	*Morone chrysops*	White bass	U	U	na	1	0	No
59.	Percidae	*Etheostoma blennioides*	Greenside darter	C	C	na	1	0	No
60.		*Etheostoma caeruleum*	Rainbow darter	C	C	C	1	2	Yes
61.		***Etheostoma camurum* (T)**	Bluebreast darter	U	U	na	1	0	No
62.		*Etheostoma flabellare*	Fantail darter	C	C	na	1	0	No
63.		***Etheostoma microperca* (SOC)**	Least darter	U	U	na	-	0	No
64.		*Etheostoma nigrum*	Johnny darter	C	C	na	1	0	No
65.		***Etheostoma pellucidum* (SOC)**	Eastern sand darter	U	U	na	1	0	No
66.		*Etheostoma spectabile*	Orangethroat darter	U	U	U	1	2	Yes
67.		***Etheostoma tippecanoe* (T)**	Tippecanoe darter	U	U	na	1	0	No
68.		*Etheostoma variatum*	Variegate darter	U	U	na	1	0	No
69.		*Etheostoma zonale*	Banded darter	U	C	na	1	0	No

	Order: Family	Scientific Name	Common Name	Ohio	Ross County	HOCU	Old	New	Voucher
70.		*Perca flavescens*	Yellow perch	U	U	na	1	0	No
71.		*Percina caprodes*	Logperch	C	C	na	1	0	No
72.		*Percina maculata*	Blackside darter	C	U	na	1	0	No
73.		*Percina phoxocephala*	Slenderhead darter	U	U	na	1	0	No
74.		*Percina sciera*	Dusky darter	U	C	na	1	0	No
75.		*Stizostedion canadense*	Sauger	U	U	na	1	0	No
76.		*Stizostedion vitreum*	Walleye	U	U	na	-	0	No
77.	Sciaenidae	*Aplodinotus grunniens*	Freshwater drum	U	U	na	1	0	No
78.	Petromyzontiformes: Petromyzontidae	*Ichthyomyzon unicuspis*	Silver lamprey	U	U	na	1	0	No
79.		*Lampetra aepyptera* (syn. *Ichthyomyzon aepyptera*)	Least brook lamprey	U	U	na	1	0	No
80.	Scorpaeniformes: Cottidae	*Cottus bairdi*	Mottled sculpin	U	U	na	1	0	No
81.	Semionotiformes: Lepisosteidae	*Lepisosteus osseus*	Longnose gar	U	U	na	1	0	No
82.	Siluriformes: Ictaluridae	*Ameiurus melas* (syn. *Ictalurus melas*)	Black bullhead	C	C	na	1	0	No
83.		*Ameiurus natalis* (syn. *Ictalurus natalis*)	Yellow bullhead	U	U	na	1	0	No
84.		*Ictalurus punctatus*	Channel catfish	C	C	na	1	0	No
85.		*Noturus flavus*	Stonecat	U	C	na	1	0	No
86.		*Noturus gyrinus*	Tadpole madtom	U	N	na	1	0	No

	Order: Family	Scientific Name	Common Name	Ohio	Ross County	HOCU	Old	New	Voucher
87.		*Noturus miurus*	Brindled madtom	U	U	na	1	0	No
88.		*Pylodictis olivaris*	Flathead catfish	U	U	na	1	0	No
89.		*Stizostedion canadense* X *vitreum*	Sauger X Walleye	?	?	na	-	0	No
90.		*Lepomis megalotis* X *macrochirus*	Longear Sf X Bluegill Sf	?	?	na	-	0	No
91.		*Lepomis macrochirus* X *cyanellus*	Bluegill X green sunfish	?	?	na	-	0	No
92.			Hybrid X Minnow	?	?	na	-	0	No

C= Common, U= Uncommon, N= Not likely, na= not applicable, ?=unknown; *SOC=Species of Concern, E=state endangered, T=state threatened. "Old" indicates the status prior the inventory, "New" the status after the inventory, and "Author" indicates whether the author vouchered the species. Values for Old and New follow Boetsch et al (2000): a "1" is used to indicate that a given species is expected, "2" indicates that the species was observed (documented within the park), "3" indicates species that were not on the expected species list but were observed, and "4" indicates an extinct or regionally extirpated species.

Abundance was determined based on "The fishes of Ohio with illustrated keys" by MB Trautman, 1981.

Table 4. Fish species collected from Dry Run, Hopewell Mound Group Pond, Scioto River, Paint Creek, and the North Fork of Paint Creek.

	Order: Family	**Scientific Name**	**Common Name**	**Dry Run**	**HW Pond**	**Paint Crk MAIN**	**NF Paint Crk**	**Scioto River**	**TOTAL**
1.	Atheriniformes: Atherinidae	*Labidesthes sicculus*	Brook silverside	0	0	1	1	0	2
2.	Clupeiformes: Clupeidae	*Alosa chrysochloris*	Skipjack herring	0	0	0	0	1	1
3.		*Dorosoma cepedianum*	Gizzard shad	0	0	7	1	6	14
4.	Clupeiformes: Catostomidae	*Carpiodes carpio*	River carpsucker	0	0	6	0	6	12
5.		*Carpiodes cyprinus*	Quillback	0	0	6	3	4	13
6.		*Carpiodes velifer*	Highfin carpsucker	0	0	4	2	4	10
7.		*Catostomus commersoni*	White sucker	0	0	0	1	0	1
8.		*Erimyzon oblongus*	Creek chubsucker	0	0	0	1	0	1
9.		*Hypentelium nigricans*	Northern hog sucker	0	0	6	4	4	14
10.		*Ictiobus bubalus*	Smallmouth buffalo	0	0	5	0	6	11
11.		*Ictiobus niger*	Black buffalo	0	0	2	0	2	4
12.		*Minytrema melanops*	Spotted sucker	0	0	0	1	0	1
13.		*Moxostoma anisurum*	Silver redhorse	0	0	6	3	4	13
14.		*Moxostoma carinatum*	River redhorse	0	0	5	0	3	8
15.		*Moxostoma duquesnei*	Black redhorse	0	0	6	4	2	12
16.		*Moxostoma erythrurum*	Golden redhorse	0	0	6	4	5	15
17.		*Moxostoma macrolepidotum*	Shorthead redhorse	0	0	6	2	5	13
18.	Clupeiformes: Cyprinidae	*Campostoma anomalum*	Central stoneroller	75	0	7	1	5	88
19.		*Cyprinella spiloptera*	Spotfin shiner	17	0	9	4	6	36
20.		*Cyprinella whipplei*	Steelcolor shiner	0	0	8	2	6	16
21.		*Cyprinus carpio*	Common carp	0	0	6	4	6	16

	Order: Family	Scientific Name	Common Name	Dry Run	HW Pond	Paint Crk MAIN	NF Paint Crk	Scioto River	TOTAL
22.		*Erimystax dissimilis*	Streamline chub	6	0	3	2	0	11
23.		*Erimystax x-punctata*	Gravel chub	0	0	6	2	2	10
24.		*Lythrurus ardens*	Rosefin shiner	1	0	0	2	0	3
25.		*Luxilus chrysocephalus*	Striped shiner	5	0	0	4	1	10
26.		*Notropis atherinoides*	Emerald shiner	0	0	5	0	4	9
27.		*Notropis buccatus*	Silverjaw minnow	7	0	0	2	0	9
28.		*Notropis photogenis*	Silver shiner	0	0	4	4	1	9
29.		*Notropis rubellus*	Rosyface shiner	0	0	3	4	0	7
30.		*Notropis stramineus*	Sand shiner	20	0	7	4	3	34
31.		*Notropis volucellus*	Mimic shiner	0	0	2	3	0	5
32.		*Phenacobius mirabilis*	Suckermouth minnow	15	0	0	2	6	23
33.		*Phoxinus erythrogaster*	Southern Redbelly Dace	40	0	0	0	6	40
34.		*Pimephales notatus*	Bluntnose minnow	41	0	9	4	6	60
35.		*Pimephales vigilax*	Bullhead minnow	0	0	6	0	3	9
36.		*Rhinichthys atratulus*	Blacknose dace	209	0	0	1	1	211
37.		*Semotilus atromaculatus*	Creek chub	159	0	1	3	0	163
38.	Cyprinodontiformes: Fundulidae	*Fundulus notatus*	Blackstripe topminnow	0	0	0	1	0	1
39.	Esociformes: Esocidae	*Esox masquinongy*	Muskellunge	0	0	0	3	0	3
40.	Osteoglossiformes: Hiodontidae	*Hiodon alosoides**	Goldeye*	0	0	0	0	1	1
41.		*Hiodon tergisus*	Mooneye	0	0	1	0	2	3
42.	Perciformes: Centrarchidae	*Amblopites rupestris*	Rock bass	0	0	8	4	2	14
43.		*Lepomis cyanellus*	Green sunfish	0	0	2	1	2	5
44.		*Lepomis gulosus*	Warmouth	0	0	0	1	0	1

	Order: Family	Scientific Name	Common Name	Dry Run	HW Pond	Paint Crk MAIN	NF Paint Crk	Scioto River	TOTAL
45.		*Lepomis humilis*	Orangespotted sunfish	0	0	1	0	3	4
46.		*Lepomis macrochirus*	Bluegill	0	32	6	2	5	45
47.		*Lepomis megalotis*	Longear sunfish	0	0	9	4	3	16
48.		*Micropterus dolomieu*	Smallmouth bass	0	0	7	4	6	17
49.		*Micropterus punctulatus*	Spotted bass	0	0	8	3	4	15
50.		*Micropterus salmoides*	Largemouth bass	0	0	2	1	0	3
51.		*Pomoxis annularis*	White crappie	0	0	6	1	1	8
52.		*Pomoxis nigromaculatus*	Black crappie	0	0	8	1	1	10
53.	Perciformes: Moronidae	*Morone chrysops*	White bass	0	0	2	1	4	7
54.	Perciformes: Percidae	*Etheostoma blennioides*	Greenside darter	0	0	1	4	5	10
55.		*Etheostoma caeruleum*	Rainbow darter	1	0	5	4	3	13
56.		*Etheostoma camurum*	Bluebreast darter	0	0	1	1	0	2
57.		*Etheostoma flabellare*	Fantail darter	0	0	1	2	1	4
58.		*Etheostoma microperca*	Least darter	0	0	0	1	0	1
59.		*Etheostoma nigrum*	Johnny darter	0	0	4	2	0	6
60.		*Etheostoma pellucidum*	Eastern sand darter	0	0	5	0	0	5
61.		*Etheostoma spectabile*	Orangethroat darter	10	0	2	2	0	14
62.		*Etheostoma tippecanoe*	Tippecanoe darter	0	0	0	0	1	1
63.		*Etheostoma variatum*	Variegate darter	0	0	1	4	1	6
64.		*Etheostoma zonale*	Banded darter	0	0	3	4	2	9
65.		*Perca flavescens*	Yellow perch	0	0	1	0	0	1
66.		*Percina caprodes*	Logperch	0	0	5	4	1	10
67.		*Percina maculata*	Blackside darter	0	0	3	1	0	4
68.		*Percina phoxocephala*	Slenderhead darter	0	0	0	0	2	2

	Order: Family	Scientific Name	Common Name	Dry Run	HW Pond	Paint Crk MAIN	NF Paint Crk	Scioto River	TOTAL
69.		*Percina sciera*	Dusky darter	0	0	6	2	1	9
70.		*Stizostedion canadense*	Sauger	0	0	3	0	6	9
71.		*Stizostedion vitreum*	Walleye	0	0	0	0	1	1
72.	Perciformes: Sciaenidae	*Aplodinotus grunniens*	Freshwater drum	0	0	5	2	4	11
73.	Petromyzontiformes: Petromyzontidae	*Ichthyomyzon unicuspis*	Silver lamprey	0	0	1	0	0	1
74.		*Lampetra aepyptera*	Least brook lamprey	0	0	1	0	0	1
75.	Scorpaeniformes: Cottidae	*Cottus bairdi*	Mottled sculpin	0	0	3	0	0	3
76.	Semionotiformes: Lepisosteidae	*Lepisosteus osseus*	Longnose gar	0	0	3	1	4	8
77.	Siluriformes: Ictaluridae	*Ameiurus natalis*	Yellow bullhead	0	0	0	2	0	2
78.		*Ictalurus punctatus*	Channel catfish	0	0	6	3	5	14
79.		*Noturus flavus*	Stonecat	0	0	5	4	3	12
80.		*Noturus miurus*	Brindled madtom	0	0	2	1	0	3
81.		*Pylodictis olivaris*	Flathead catfish	0	0	4	0	2	6
		Stizostedion canadense X *vitreum*	Sauger X Walleye	0	0	5	1	1	7
		Lepomis megalotis X *macrochirus*	Longear Sf X Bluegill Sf	0	0	1	0	0	1
		Lepomis macrochirus X *cyanellus*	Bluegill X green sunfish	0	0	1	0	0	1
			Hybrid X Minnow	0	0	0	1	0	1
			TOTAL	**14**	**1**	**62**	**60**	**55**	**81**