**Species Assessment and Listing Priority Assignment Form**

**SCIENTIFIC NAME:** *Notropis ariommus*

**COMMON NAME:** Popeye Shiner

**LEAD REGION:** Region 4 (Southeast Region)

**LEAD REGION CONTACT:**

**LEAD FIELD OFFICE CONTACT:**

**INFORMATION CURRENT AS OF:** 1/15/2018

**STATUS/ACTION**

\_\_\_ Funding provided for a proposed rule. Assessment not updated.

\_\_\_ Species Assessment - determined species did not meet the definition of the endangered or threatened under the Act and, therefore, was not elevated to the Candidate status.

\_\_\_ New Candidate

\_\_\_ Continuing Candidate

\_\_\_ Candidate Removal

\_\_\_ Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status

\_\_\_ Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species

\_\_\_ Range is no longer a U.S. territory

\_\_\_ Insufficient information exists on biological vulnerability and threats to support listing

\_\_\_ Taxon mistakenly included in past notice of review

\_\_\_ Taxon does not meet the definition of "species"

\_\_\_ Taxon believed to be extinct

\_\_\_ Conservation efforts have removed or reduced threats

\_\_\_ More abundant than believed, diminished threats, or threats eliminated.

**PETITION INFORMATION**

\_\_ Non-Petitioned

\_x\_ Petitioned

90-Day Positive:

12-Month Positive:

Did the Petition request a reclassification?

**For Petitioned Candidate Species:**

Is the listing warranted? If yes, see summary threats below.

To Date, has publication of the proposal to list been precluded by other higher priority listing?

Explanation of why precluded:

Table of Contents

[EXTENT OF OCCURRENCE/AREA OF OCCUPANCY 1](#_Toc505240912)

[Historical and Current States/Territories/Counties of Occurrence: 1](#_Toc505240913)

[Land Ownership: 3](#_Toc505240914)

[BIOLOGICAL INFORMATION 3](#_Toc505240915)

[Species Description: 3](#_Toc505240916)

[Taxonomy: 4](#_Toc505240917)

[Habitat / Life History: 4](#_Toc505240918)

[Historical and Current Range / Distribution: 6](#_Toc505240919)

[Population Estimates / Status: 7](#_Toc505240920)

[Distinct Population Segment (DPS): 11](#_Toc505240921)

[THREATS 12](#_Toc505240922)

[A. The Present or Threatened Destruction, Modification, or Curtailment of its Habitat Range: 12](#_Toc505240923)

[B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes: 13](#_Toc505240924)

[C. Disease or Predation: 13](#_Toc505240925)

[D. The Inadequacy of Existing Regulatory Mechanisms: 13](#_Toc505240926)

[E. Other Natural or Manmade Factors Affecting its Continued Existence: 15](#_Toc505240927)

[Summary of Threats: 15](#_Toc505240928)

[CONSERVATION MEASURES IMPLEMENTED, PLANNED, AND RECOMMENDED 16](#_Toc505240929)

[FOR SPECIES THAT ARE BEING REMOVED FROM CANDIDATE STATUS 23](#_Toc505240930)

[DESCRIPTION OF MONITORING 23](#_Toc505240931)

[LITERATURE CITED 24](#_Toc505240932)

[SPECIES ASSESSMENT/LISTING PRIORITY ASSIGNMENT FORM – DEVELOPMENT 29](#_Toc505240933)

# EXTENT OF OCCURRENCE/AREA OF OCCUPANCY

## Historical and Current States/Territories/Counties of Occurrence:

**Countries:** United States

**Historical States:** Alabama, Georgia, Indiana, Kentucky, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia

**Historical Counties:** See Table 1

**Current States:** Kentucky, Indiana, Ohio, Pennsylvania\*\*, Tennessee, Virginia, West Virginia

**Current Counties:** See Table 1

**Sources of Occurrence Information:** Gilbert 1891; Kuhne 1939; Martin and Campbell 1953; Gilbert 1969; Masnik 1974; McReynolds and Janisch 1977; Lee et al. 1980; Mickey 1984; Kitchel 1985; Neves and Widlak 1988; Page and Burr 1991; Terwilliger 1991; USGS 1996; Margat and Knight 2001; Simon 2006; Shelton-Nix 2013; NatureServe-IUCN 2015; Frimpong et al. 2015; Simon et al. 2015; Thomas and Brandt 2016; Froese and Pauly 2017; NatureServe 2017; Shelton-Nix 2017; GBIF; NMNH; VaFWIS)

Table 1. Current (2000–2017, **bold text**) and historical (pre-2000) occurrences of Popeye Shiner *(Notropis ariommus)* by state and county.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| State | County |  | State | County |  | State | County |  | State | County |
| Alabama | Colbert |  | **Kentucky** | Adair |  | North Carolina | Avery |  | **Tennessee** | **Bedford** |
|  | Franklin |  |  | Allen |  |  | Cherokee |  |  | Campbell |
|  | Lauderdale |  |  | Barren |  |  | Clay |  |  | Carter |
|  | Lawrence |  |  | **Bath** |  |  | Transylvania |  |  | Cheatham |
|  |  |  |  | Bell |  |  |  |  |  | Claiborne |
| Georgia | Catoosa |  |  | Boyle |  | **Ohio** | Paulding |  |  | Coffee |
|  | Towns |  |  | Breathitt |  |  | **Pike\*** |  |  | Cumberland |
|  | Union |  |  | Breckinridge |  |  | **Scioto** |  |  | Davidson |
|  | Walker |  |  | Casey |  |  |  |  |  | DeKalb |
|  |  |  |  | Clay |  | **Pennsylvania** | Armstrong |  |  | Fentress |
| **Indiana** | Allen |  |  | **Edmonson** |  |  | Butler |  |  | Greene |
|  | Bartholomew |  |  | Estill |  |  | Clarion |  |  | Hamilton |
|  | Benton |  |  | Green |  |  | **Fayette\*\*** |  |  | **Hancock** |
|  | Crawford |  |  | Harlan |  |  | Indiana |  |  | Hawkins |
|  | Decatur |  |  | Hart |  |  | Jefferson |  |  | Hickman |
|  | Fayette |  |  | Larue |  |  |  |  |  | Humphreys |
|  | Fountain |  |  | Laurel |  | **Virginia** | Giles |  |  | Jackson |
|  | Franklin |  |  | Lee |  |  | **Lee** |  |  | Lawrence |
|  | Fulton |  |  | Leslie |  |  | Norton |  |  | Lewis |
|  | Hancock |  |  | Lewis |  |  | **Russell** |  |  | Lincoln |
|  | Hendricks |  |  | Lincoln |  |  | **Scott** |  |  | Macon |
|  | Henry |  |  | Marion |  |  | **Smyth** |  |  | Marshall |
|  | Jackson |  |  | McCreary |  |  | Tazewell |  |  | **Maury** |
|  | **Jefferson\*** |  |  | **Metcalfe** |  |  | **Washington** |  |  | Montgomery |
|  | **Jennings\*** |  |  | Monroe |  |  | Wise |  |  | Moore |
|  | Johnson |  |  | Nelson |  |  |  |  |  | Overton |
|  | Lake |  |  | Owsley |  | **West Virginia** | Boone |  |  | **Perry** |
|  | Marion |  |  | Perry |  |  | **Braxton** |  |  | Pickett |
|  | Marshall |  |  | Pulaski |  |  | **Clay** |  |  | Putnam |
|  | Parke |  |  | Rockcastle |  |  | Fayette |  |  | Rhea |
|  | Porter |  |  | Simpson |  |  | **Kanawha** |  |  | Rutherford |
|  | Pulaski |  |  | Taylor |  |  | Mercer |  |  | **Scott** |
|  | **Ripley\*** |  |  | Warren |  |  | **Preston** |  |  | Sevier |
|  | Shelby |  |  | Wayne |  |  | Raleigh |  |  | Sullivan |
|  | Starke |  |  |  |  |  | Summers |  |  | Unicoi |
|  | Tippecanoe |  |  |  |  |  | Tucker |  |  | Union |
|  | Union |  |  |  |  |  |  |  |  | Van Buren |
|  | Vermillion |  |  |  |  |  |  |  |  | Warren |
|  | Warren |  |  |  |  |  |  |  |  | Washington |
|  | Washington |  |  |  |  |  |  |  |  | Wayne |
|  | Wayne |  |  |  |  |  |  |  |  | White |
|  |  |  |  |  |  |  |  |  |  | Wilson |

\*Denotes new county occurrence; not occupied prior to 2000.

\*\*Not believe to be an extant, viable population. Encounter consists of one individual.

## Land Ownership:

Popeye Shiners occur in large streams to smaller rivers that flow through both privately and publicly owned lands. This includes, but is not limited to, conservation easements owned by private organizations and public agencies, and National and State Parks.

# BIOLOGICAL INFORMATION

## Species Description:

The Popeye Shiner is distinguished from other similar species of shiners (genus *Notropis*) by its very large eye (proportionally the largest eye compared to other species of *Notropis*), which diameter is usually >1.5 times its snout length. Adult Popeye Shiners range from 55–80 mm in standard length (tip of snout to caudal fin base). The body is characterized as laterally compressed and moderately to somewhat elongate (i.e., slender), with a moderate head, round to slightly pointed snout, and a large, terminal mouth. Dorsal fin origin is above or slightly posterior to pelvic fin base. It has a complete lateral line that distinctly (shallowly) slopes from just posterior to head. Pharyngeal teeth are usually 2,4-4,2. Dorsum is dusky (scales distinctly outlined by melanophores) and pale olive to olive-green, fading ventrally to white; lower two-thirds of body silvery. Lateral stripe present and diffuses anteriorly. Breeding males have small, densely spaced, tubercles on head, body (except along breast or urosome), and pectoral fins. Breeding females may have tiny tubercles on snout. Popeye Shiners closely resemble, and can occur sympatrically with, Telescope Shiners (*Notropis telescopus*). These species can be distinguished by typical anal ray counts of 9 in *N. ariommus* (versus 10 in *N. telescopus*), and the distinctly irregular shaped and sized anterdorsolateral scales with dark margins that appear as a zig-zag pattern, and black pre-dorsal stripe, that characterize *N. telescopus* and are absent in *N. ariommus* (Gilbert et al. 1969; Terwilligner 1991; Etnier and Starnes 1993; Jenkins and Burkehead 1993; Stauffer et al. 1995).

## Taxonomy:

Table 2. Taxonomic hierarchy for Popeye Shiner (*Notropis ariommus*).

|  |  |
| --- | --- |
| Scientific Classification | |
| Kingdom | Animalia |
| Subkingdom | Bilateria |
| Infrakingdom | Deuterostomia |
| Phylum | Chordata |
| Subphylum | Vertebrata |
| Infraphylum | Gnathostomata |
| Superclass | Actinopterygii |
| Class | Teleostei |
| Superorder | Ostariophysi |
| Order | Cypriniformes |
| Superfamily | Cyprinoidea |
| Family | Cyprinidae |
| Genus | Notropis |
| Species | *Notropis ariommus* (Cope, 1867) |
| Common Name | Popeye Shiner |

Popeye Shiners (*Notropis ariommus*) belong to the carp and minnow family, Cyprinidae. Popeye Shiners and Telescope Shiners were first described by Cope (1867, 1868) as two distinct species (IT IS; Table 2). Later, and without rationale, Kuhne (1939, as cited by Gilbert 1969) listed *N. telescopus* as a subspecies of *N. ariommus*. This led to the notion that *N. ariommus* was composed of 2–3 subspecies based on geographically distinct distributions found in the Ohio (as *N. ariommus ariommus*), Cumberland and Tennessee (as *N. ariommus telescopus*), and (possibly) White River (as *N. ariommus arcansanus*) systems. It is believed that this idea erroneously developed in response to the lack of *N. ariommus* collections since 1893, and the little collections from the Cumberland and Tennessee pre-1900s. However, Gilbert (1969) suggest that this absence of occurrence data “can be attributed to failure of ichthyologists to collect at localities [during the 1894–1948 period] where the fish [had historically] occurred.” Gilbert’s (1969) comprehensive assessment of the systematics and distributions of *N. ariommus* and *N. telescopus* disputed those assertions and concluded these are two distinct species; which are the taxonomic distinctions recognized today. In addition to their different morphometric and meristic characteristics, *N. ariommus* and *N. telescopus* generally have different habitat preferences. *Notropis telescopus* can occur across a variety of sized systems, from headwaters to smaller streams, and sometimes larger rivers, whereas *N. ariommus* prefers to occupy larger creeks to small rivers. (Gilbert et al. 1969; Terwilligner 1991; Etnier and Starnes 1993; Jenkins and Burkehead 1993; Stauffer et al. 1995).

## Habitat / Life History:

Popeye Shiners prefer clear, warm, moderate-gradient habitats in larger streams and small rivers composed of clean-swept gravel and smaller substrates. The Popeye Shiner utilizes areas of flowing water, typically in runs or heads of pools, and sometimes in backwaters near a decent current, but rarely in riffles (Gilbert et al. 1969; Masnik 1974; Terwilligner 1991; Etnier and Starnes 1993; Jenkins and Burkehead 1993; Stauffer et al. 1995). Stauffer et al. (1995) reported that Popeye Shiners are typically encountered “in shallow pools with some flow” and along stream edges with vegetation over gravel. In the 1970s, Masnik (1974) collected Popeye Shiner in the Clinch and Powell River systems and reported that occurrences were associated with elevations <488 m, gradients 0–9.5 m/km, and 3rd–7th ordered streams. The Virginia State Wildlife Action Plan (2015) identifies a need for better understanding of the habitat requirements of this species.

Popeye Shiners are insectivores with a diet consisting of a diversity of taxa and sizes, such as large adult Coleoptera and Trichoptera, midges, and mayfly (genus *Potamanthus*) nymphs (Etnier and Starnes 1993). In “The Fishes of Tennessee” (Etnier and Starnes 1993), the species account for Popeye Shiner notes a collection of a prenuptial female with roughly 275 eggs and observations of breeding males (presence of nuptial tubercles) from early April–late July. Overall, little is known about the life-history and local dispersal range of this species (Stauffer et al. 1995).

## Historical and Current Range / Distribution:

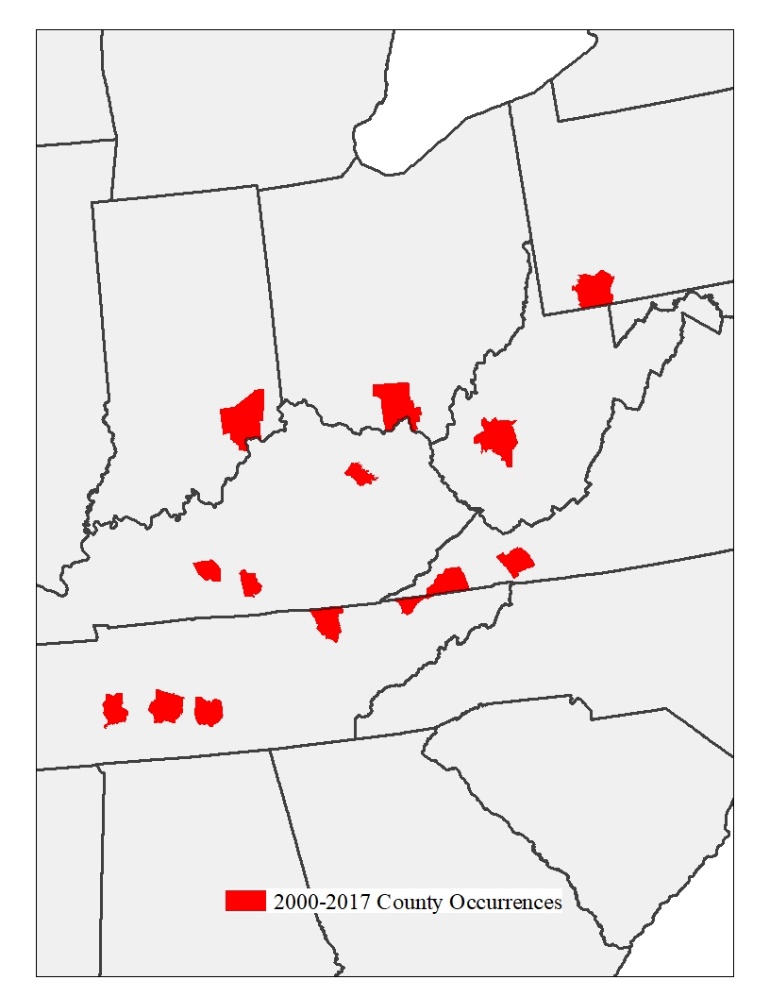
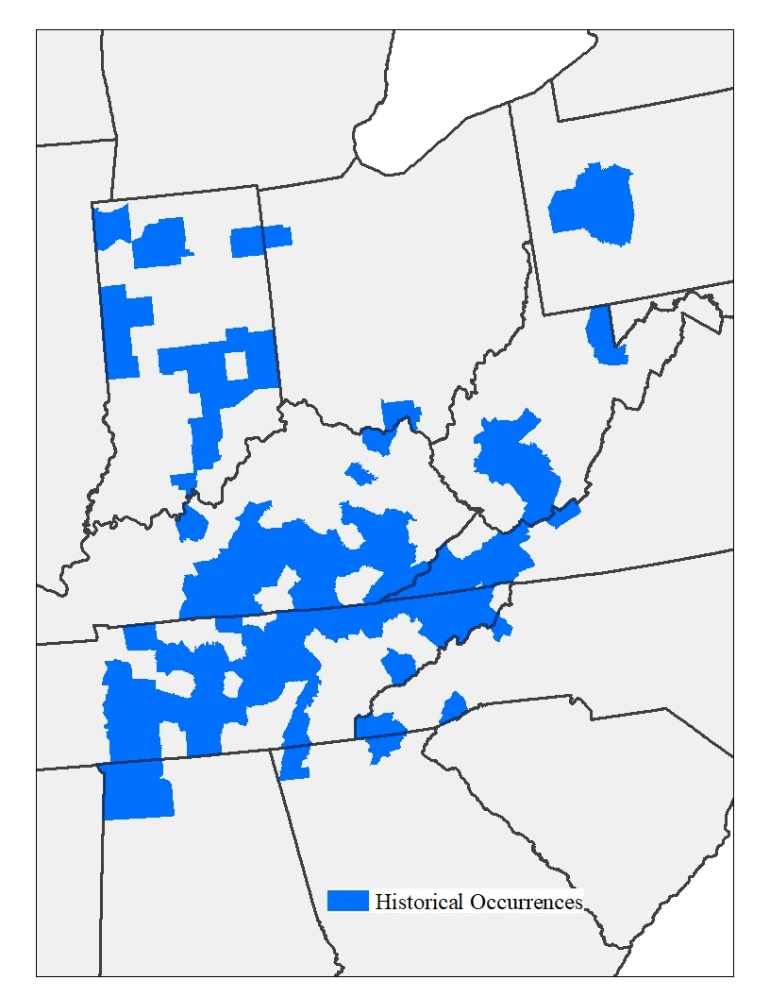


Figure 1. Historical (1867–1999; left image in blue) and extant (known based on collections post-2000; right image in red) distribution range of Popeye Shiners. Occurrences are shown by county. Note that lack of current occurrences in historically occupied counties (in this figure) does not necessarily signify true absence and could be due to a lack of recent survey data (i.e., not recently reassessed), or insufficient sampling efforts.

Popeye Shiner populations were distributed widely, but are spotty, across the Tennessee, Cumberland, and Ohio river drainages, and have experienced fluctuating locality occurrences and abundances from the 1860s to 1970s. As described by Page and Burr (2011), Popeye Shiners tend to be rare and highly localized. Historically, most of the occupied localities were centralized in and around Tennessee, Kentucky, West Virginia, and Virginia; extended outwards into adjacent the states of Alabama, Georgia, Indiana, North Carolina, Ohio, and Pennsylvania (Figure 1).

Today, Popeye Shiners occur in spotty distributions across the Ohio, Tennessee, and Cumberland River drainages, with most of its occupied localities continuing to be centralized within Tennessee, Kentucky, West Virginia, and Virginia (Figure 1). Popeye Shiners are now believed to be extirpated from Alabama, Pennsylvania, and Indiana; although a 2006 Indiana survey reported collections in at least one locality (Simon 2006; Simon et al. 2015). The one recent occurrence from Pennsylvania (Figure 1) results from the collection of one individual believed to have washed downstream from an upper West Virginia extant population. Popeye Shiners still occur in the Sciota River drainage of Ohio (GBIF, 2011 collection by Ohio State University) and were last collected in Georgia in the South Chickamauga Creek in 1993 (GADNR 2009). It is unclear if this species still occurs in North Carolina.

There are several questionable, historical records of Popeye Shiner occurrences in Arkansas and Missouri. Gilbert (1969) addressed the first known record from 1889 in the Meramec River drainage of Phelps County, Missouri, by examining two voucher specimens that were housed at the University of Michigan, Museum of Zoology. Based on the morphological and pharyngeal teeth count similarities to other species, Gilbert (1969) concluded that it is possible that the specimens were Popeye Shiners, but that the record should be “regarded with suspicion” based on the lack of records west of the Mississippi. Our review revealed additional collections of Popeye Shiner from the Black River, Missouri from 1947–1950 (Martin and Cambell 1953) and several records in Missouri and Arkansas (1947–1971) from the University of Kansas Biodiversity Institute (KUBI) Ichthyology Collection that were downloaded from FishBase and the Global Biodiversity Information Facility (GBIF). We believe these records are also questionable and likely misidentifications based on 1) there are only 3 independent sources of historical records or mentions in literature (including the 1889 specimen), 2) the lack of occurrence data after the 1970s, and 3) its absence from literature, databases, or state identification guides. These records were all made before or around the time Gilbert (1969) was first describing the differences in systematics and distributions between the Popeye Shiner and Telescope Shiner (and other species it closely resembled) and providing ichthyologists with knowledge to reduce misidentifications, which may explain why collection records from Missouri and Arkansas ceased shortly following its publication. Conversely, if these were in fact Popeye Shiner occurrences, then the absence of collections post-1970s suggests the species has been extirpated from both states.

## Population Estimates / Status:

*Population Estimates:*

The current population size of Popeye Shiners is unknown (NatureServe-IUCN 2014). While local population estimates for Popeye Shiners are unavailable, fish sampling data, personal communications, and Gilbert’s (1969) species assessment provide insight into trends in relative abundances over time. From 1866–1892, Popeye Shiner was reported to be abundant in two localities: White River, at Indianapolis, Indiana (Academy of Natural Sciences of Philadelphia [ANSP] 16488, as cited in Gilbert 1969), and Cypress Creek, near Florence, Alabama (Gilbert 1891; Gilbert 1969). Although it was distributed widely across several localities in the Ohio, Tennessee, and Cumberland drainages, very few individuals were encountered in other locations (i.e., uncommon). From 1890s–1940s, very few individuals were encountered at location; however, historically occupied sites were not reassessed during this period and thus population abundances over this time frame cannot be inferred. When several historically occupied sites in Kentucky were resurveyed in the 1940s, Popeye Shiner was found to occur at the same relative abundances as previous surveys.

In the 1960s, Popeye Shiner was very common in the Powell and Rockcastle rivers; where it had not been observed across surveys the 1920s–1950s. This suggests that Popeye Shiners may have occurred at undetectable levels in these rivers the 1920s–1950s and that populations were increasing in the 1960s. Masnik (1974) reported increasing abundance in the Powell and Clinch rivers since the Popeye Shiner’s first detection in 1963. While Popeye Shiners still occur in the Powell, Clinch, and North Fork Holston rivers of Virginia, they are now a rarely encountered species (VaFWIS; M. Pinder, Virginia Department of Game and Inland Fisheries [VDGIF], personal communication).

The “Atlas of North American Freshwater Fishes” (Lee et al. 1980) noted that Popeye Shiners are “seldom very common” when encountered. Page and Burr (2011) described populations of Popeye Shiner to be “rare and highly localized”. As defined by the NatureServe-IUCN (2014), there are likely 21–100 Popeye Shiner (sub)populations (i.e., occurrences) remaining today, most of which are occur in Kentucky and Tennessee.

Table 1. Popeye Shiner listing status by state.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| State | State Status | S Rank\* | Mentioned in SWAP | SGCN\*\* | SGCN Rank | Source | Notes |
| Alabama | EX | SX | Yes | Yes | EX | ADCNR 2015 |  |
| Georgia | E | S1 | Yes | Yes |  | GADNR 2009 | Rare; last collected in 1993 in South Chickamauga Creek. |
| Indiana | EX | SX | No | No |  | GBIF; Simon et al. 2015 | Recently encountered in Otter, Big Graham, and Big creeks in 2006 (Big Oak National Wildlife Refuge) |
| Kentucky | NA | S3 | No | No |  | KYDFWR2013; Thomas and Brandt 2016 |  |
| North Carolina | NA | NA | No | No |  |  | Not described from the state except for Mickey 1984 |
| Ohio | E | S1 | Yes | Yes |  | OHDW 2015 | 3rd top priority species of 63 SGCN fishes |
| Pennsylvania | EX | SX | No | No |  | PAFBC |  |
| Tennessee | None | S3 | No | No |  | TN-SWAPT 2015 |  |
| Virginia | None | S2S3 | Yes | Yes | Tier 2c | VDGIF 2015 |  |
| West Virginia | NA | S2 | Yes | Yes | Priority 1 | WVDNR 2015 | Post-1980s, populations have rebounded in the Elk, lower Kanawha, and Cheat rivers. |

|  |  |
| --- | --- |
| State Species Protection Status | S Rank\* = NatureServe Subnational (state) Conservation Status Rank |
| E = State Endangered | SX = Presumed Extirpated |
| T = State Threatened | S1 = Critically Imperiled (≤ 5 occurrences) |
| EX = State Extirpated | S2 = Imperiled (≤ 20 occurrences) |
|  | S3 = Vulnerable (≤ 80 occurrences) |
| \*\*SGCN = Species of Greatest Conservation Need (identified by the states) | S4 = Apparently Secure (uncommon but not rare) |
|  | S5 = Secure (Common, widespread, abundant) |
|  | Popeye Shiner NatureServe Global Level Conservation Status Rank = G3 = Vulnerable |
|  | (detailed definitions available at http://explorer.natureserve.org/nsranks.htm) |

*Listing Status in Alabama.—*Species presumed to be extirpated. May be rediscovered in the state in the future. Can be reintroduced to state from outside populations. “Last collected […] during the 1880s from Cypress Creek near Florence. Recently collected in the Elk River system north of the Alabama-Tennessee state line” (Shelton-nix 2017).

*Listing Status in Georgia.—*Very rare species listed as State Endangered. Considered a high priority species and species of special concern. Occurrences restricted to the upper northwest corner of the state in Lookout Creek and South and West Chickamauga Creek drainages of the Tennessee River system.

*Listing Status in Indiana.—*Considered extirpated. In a review of fishes of the Wabash River drainage, Simon (2006) reported that the Popeye Shiner was last collected in the White River (near Indianapolis) around the time it was first described from the system (1860s–1870s). However, Simon et al. (2015) reported new collections made in 2006—the first since the late 1800s— within the Big Oaks National Wildlife Refuge in Otter, Big Graham, and Big creeks (tributaries to the Wabash River).

*Listing Status in Kentucky**.*—State conservation status S3 (NatureServe-IUCN 2014; NatureServe 2017), designating this species as vulnerable with <80 documented occurrences within the state. Not listed or mentioned in 2005 or 2013 Kentucky Wildlife Action Plans (KYDFWR 2013). Thomas and Brandt (2016) report occurrences during 2012–2015 surveys in the Green River, Edmonson County, within Mammoth Cave National Park.

*Listing Status in North Carolina.*—Not protected by the state or mentioned in 2015 SWAP documents. NatureServe and other databases do not report Popeye Shiner to occur in North Carolina. However, a 1984 symposium paper lists it as occurring in upper New River drainage in North Carolina, based on a literature review (Mickey 1984).

*Listing Status in Ohio.*—Listed as State Endangered. The state conservation status, S1, classifies it as having 5 or few documented occurrences and critically imperiled within the state. It is a high priority Species of Greatest Conservation Need (SGCN; OHDW 2015). Thought to have been extirpated until rediscovered in 1980s.

*Listing Status in Pennsylvania.*—Considered extirpated. One recent occurrence in the Cheat River near the southern Pennsylvania-West Virginia border is believed to be an individual that was displaced downstream from a West Virginia population; hence, not a viable population within the state. It is believed that historically occupied habitats may have improved in condition and could be considered for reintroduction.

*Listing Status in Tennessee.—*Not state protected and categorized as S3 conservation status (vulnerable, <80 documented occurrences).

*Listing Status in Virginia.*—Not state protected but designated as a SGCN with a conservation status of S2,S3 (Imperiled–Vulnerable). It is listed under a Tier 2c SGCN rank, defined as a species of very high conservation need and high risk of extinction or extirpation. Tier II species occur at very low levels, face real threats, or occur within a very limited distribution and require immediate for population protection and restoration. In addition, “baseline information is required to better understand this species’ habitat requirements” (VDGIF 2015). Although rare, the species still persists in historically occupied localities within the Tennessee River drainage. State non-game biologist (M. Pinder, VDGIF, personal communication) does not believe this species warrants federal listing at this time.

*Listing Status in West Virginia.*—Not state protected with a S2 conservation status rank (Imperiled, <20 documented occurrences). Rarely encountered before 1980s. Margraf and Knight (2002) reported it during 1988-89 surveys near the London Locks dam on the Kanawha River. More recently, populations are believed to have significantly rebounded in the Elk River, a large tributary to the Kanawha River, and is considered common there. Also, there has been an observed increase in relative abundance in the Cheat River.

In a 2012 biological review, Popeye Shiners were listed as a species of Least Concern under IUCN definitions. This assessment found Popeye Shiners, although rare and localized, to be widely distributed and concluded that the species was not declining at a rate to meet IUCN Criterion A (population size reduction) under any of the threatened categories. Additional conservation research and efforts were recommended for the species (NatureServe-IUCN 2014).

## Distinct Population Segment (DPS):

Not applicable

# THREATS

## A. The Present or Threatened Destruction, Modification, or Curtailment of its Habitat Range:

Popeye Shiners prefer clear, clean free-flowing rivers and are particularly sensitive to siltation and pollution and intolerant of turbid and lentic habitats (Gilbert 1969; Masnik 1974; USGS 1996; NatureServe-IUCN 2014; GADNR 2009). Because of this, this species has experienced fluctuating population abundances and declines in its overall range since the early 1900s (Gilbert 1969; Masnik 1974; NatureServe-IUCN 2014).

Habitat degradation, fragmentation, and loss are the most significant threats to Popeye Shiners. Over the last 150 years, stream habitat and water quality have been heavily influenced by expanding urbanization, increased agriculture, poor land-use practices, poor forestry practices, coal mining operations, toxic spills, and dams. These anthropogenic factors have driven habitat loss and degradation by increasing siltation, nutrient loading, pollution, and water temperatures—consequently impacting aquatic community assemblages and their ecological services and functions. Over the past century, increased conversion of forest to agriculture and urban land uses have increased nutrient loading through soil erosion and nutrient run-off, and have increased exposure and concentrations of contaminants in the water such as pesticides, herbicides, and synthetic estrogens. In addition, dams alter water quality and habitat suitability through modifications to natural river hydrological and geomorphological processes. These impacts include alteration to natural thermal and hydrological regimes which can limit individual growth, create hypoxic (low dissolved oxygen levels) conditions, contribute to (potentially toxic) algae blooms, prevent or destroy essential nursery, foraging, protection habitats once provided by aquatic vegetation, and disrupt reproduction and limit recruitment success across aquatic communities—consequently altering food-web, predator-prey, and competition dynamics (Ligon et al. 1995; Poff et al. 1997; Wood and Armitage 1997; Lessard and Hayes 2003; McDonald et al. 2013; Ahlstedt et al. 2016; Ankley et al. 2017).

Habitat in the Clinch and Powell Rivers have been significantly impacted by coal-mining operations, poorly-treated wastewater effluent, and several toxic spills. Popeye Shiners were once commonly encountered in these drainages of Virginia; however, populations have been slow to recover after several major toxic spills (e.g., fly-ash, black-water releases, sulfuric acid, rubber accelerant) and logging and surface mining operations through the 20th century (NatureServe-IUCN 2014; Ahlstedt et al. 2016). Identified threats to Popeye Shiners in Georgia, where distributions are restricted to the Tennessee River system in the upper northwest corner of the state, include increased pollution run-off and sedimentation from upstream-urbanized areas of Tennessee, population isolation by dams, and agriculture pollution (GADNR 2009). Extirpations from the White River Basin in Indiana have been attributed to increased soil erosion and declining water clarity resulting from forest-to-cropland conversions (USGS 1996). Improved habitat conditions in the Elk River, West Virginia have resulted in rebounding Popeye Shiner populations.

“As is the case with extinct and extirpated species, most of the endangered fish species are suffering from habitat loss/degradation and degraded water quality as development, dams, and agriculture have changed the landscape of Ohio. As expected, endangered fishes are typically lesser tolerant species requiring clean, clear, often vegetated waters. Many of these now [, such as the Popeye Shiner,] only occur in isolated locations around Ohio (OHDW 2015).”

Compounded by the many existing anthropogenic stressors to Popeye Shiners and other aquatic biota, impending changes in climate are predicted to exacerbate habitat and water quality issues throughout the southeast region. For example, predicted climate-change-induced increases in precipitation related run-off in the region would negatively impact extant Popeye Shiner populations due to their high sensitivity to turbid and polluted waters.

## B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes:

Overutilization of Popeye Shiners for commercial, recreational, scientific, or educational purposes has not been reported and are not believed to be a significant threat to the species. It is possible that some Popeye Shiners may be taken incidentally during angler bait-bucket collections, but, there is no evidence to suggest this is a threat to this particular species. Also, while there is a growing aquarium trade for native freshwater fishes and potential illegal take, Popeye Shiners have not been reported as a targeted species.

## C. Disease or Predation:

Disease and predation pressures have not been reported as specific threats to the persistance of Popeye Shiner populations. There is a growing potential for disease and predation to become signifcant threats to native aquatic species under the added stress of climate change. Rahel and Olden (2008) found that climate change will increase the occurrence of non-native invasions and their subsequent likelihood of successful establishment. This may alter the impacts non-native have on natives by magnifying predation pressures, and could increase the severity of introduced diseases.

Jackson and Mandrak (2002) reported that warming temperatures under climate change will reduce overwintering mortality in predatory species, thereby intensifying predation pressures and leading to a greater number of cyprinid population extirpations. To put the significance of this impact into perspective, Jackson and Mandrak’s (2002) research conservatively estimated the loss of over 25,000 local populations of cyprinds (across four species) under climate change scenarios that predicted an increased number of Smallmouth Bass (*Micropterus dolomieu*) invasions in Ontario.

## D. The Inadequacy of Existing Regulatory Mechanisms:

*States with Protections and/or State Ranking for Popeye Shiner*

Popeye Shiners are not a federally listed or of concern. They are listed as State Endangered in Georgia and Ohio, and as a SGCN in Alabama, Georgia, Ohio, Virginia, and West Virginia’s most recent State Wildlife Action Plans. When State Legislation does not explicitly provide protections for Popeye Shiners, the species may receive cascading benefits from conservation actions applied in the drainage that protect and restore habitat and water quality.

*Alabama State Statutes and Regulations-*

Popeye Shiner is believed to be extirpated (State Rank) from the Alabama (ADCNR 2015). The Alabama Department of Conservation and Natural Resources (ADCNR) is responsible for assessing species status and distributions with the state and assigning State Ranks under the SWAP. While Alabama State Legislation for Threatened and Endangered species does not explicitly mandate regulatory protections for Popeye Shiner, this species (if present) would benefit from habitat restoration activities occurring in the drainage.

*Georgia State Statutes and Regulations-*

The Popeye Shiner met criteria (Rule 391-4-10[.03], Rules and Regulations of the State of Georgia; GSOS) to be listed as State Endangered per The Endangered Wildlife Act 1973, Georgia Code Annotated § 27-3-130 to 133. Georgia protections prohibit 1) activities intended to harm, harass, wound, capture, kill, or otherwise directly cause death to a protected species, 2) the purchase, sale, or possession of a protected species (or parts) except as authorized by the Department of Natural Resources, and the 3) destruction of protected species’ habitat on public lands. In addition, this rule nullifies the take of nongame species authorized in Ga. Code Ann. § 27-1-28 if the species is protected. Exceptions include Department of Natural Resources issued permits which allow for the collection, possession, and transportation of protected species (Rule 391-4-10[.07]; GSOS).

*Ohio State Statutes and Regulations-*

The Popeye Shiner is listed as State Endangered in Ohio per Ohio Revised Code 1531.25 that grants the Chief of the Division of Wildlife to update the list of endangered species and the authority to adopt rules prohibiting the collection, possession, or take of species believed to be state imperiled. Criteria to be considered State Endangered is defined as a native (sub)species threatened with statewide extirpation. Applicants wishing to collect and possess a protected species for the purposes of outreach and education, rehabilitation, or research may apply to the Chief of the Division of Wildlife on an annual basis for a permit (1553.08; LAWriter, LLC 2018).

*Virginia State Statutes and Regulations-*

Popeye Shiners are not listed as a State Threatened or Endangered Species in Virginia. Compiled by the VDGIF, the recent Virginia SWAP’s (VDGIF 2015) assessment of the Popeye Shiner was assigned two State Ranks (S2, S3) and a Tier (II) and Conservation Opportunity Ranking (c). These rankings assist the state in planning and prioritizing conservation actions. While Popeye Shiners do not have a legal protection in Virginia, their listing in the SWAP indicates it a species that warrants conservation action and monitoring.

Virginia freshwater fishing regulations­ categorize bait species and set possession limits. For bait type 1 (minnows, chubs, hellgrammites, crayfish, madtoms, salamanders) in possession, one is limited to the possession of 50 total for all species combined. Therefore, because Popeye Shiners are a native, naturalized, and non-game species of Virginia, and are not state or federally protected, one may possess—for personal use and not for sale—up to 20 individuals.

*West Virginia State Statutes and Regulations-*

West Virginia does not have State Threatened or Endangered species legislation. Rather, the state adheres and provides protection to federally listed species under the Endangered Species Act. Since the Popeye Shiner is not federally protected, it is not afforded protections (that would otherwise be granted to federally listed species) under West Virginia law. The West Virginia Natural Heritage Program assigns State Ranks to species based on their status and distributions, and threats to their existence, within the state. The West Virginia Natural Heritage Program and Wildlife Division Program (WDP) are responsible for protecting federally listed species and their habitats, and for monitoring State Ranked species such as the Popeye Shiner (rank S2).

## E. Other Natural or Manmade Factors Affecting its Continued Existence:

*Human-related Factors*-

Not only do dams alter water quality and habitat conditions through modifications to natural river hydrological and geomorphological processes, but they fragment habitat and act as barriers to upstream fish dispersal. The resulting fragmentation of habitat causes loss of riverine connectivity between subpopulations; disrupting gene flow and creating isolated populations that are vulnerable to genetic drift and extirpation. Isolated populations are also susceptible to stochastic events and anthropogenic stressors. All SWAP’s reviewed in this assessment have identified the interrupted connectivity of free-flowing river systems as a significant threat to aquatic biodiversity. It is likely that dams have contributed to the extirpation, and continued absence, of Popeye Shiners from several historically occupied localities.

Bait-bucket introductions of non-natives by anglers is one pathway of establishing invasive species populations that can have detrimental ecological impacts on native fauna, such as through increased competition or predation, or hybridization with natives.

*Natural Factors-*

As mentioned earlier, climate change is anticipated to increase species invasions and influence the ecological impacts of non-native species on native species. In addition to climate-change-induced changes in predation pressures through increased survival of existing and newly introduced non-native predatory species, climate change can increase competition between natives and non-natives. Non- native species may outcompete natives for resources and be more resilient to changing environmental conditions.

## Summary of Threats:

Of the five listing factors—under section 4 of the Endangered Species Act—considered by the U.S Fish and Wildlife Service to determine whether a proposal for listing is warranted for a species, two pose threats to the continued existence of Popeye Shiner populations: (A) the present or threatened destruction, modification, or curtailment of the species’ habitat or range, and (E) other natural or manmade factors affecting the species’ continued existence. The most significant threat to Popeye Shiner populations is the loss, degradation, and fragmentation of suitable habitat resulting from increased urbanization and agriculture, pollution (e.g., non-point source, contaminant spills, wastewater treatment plant effluent), coal mining, channel modification, dams, and climate change.

Listing factors (A) and (E) are connected by the impacts of dams, which modify suitable habitat (A) and serve as physical barriers to fish movement (E), and climate change impacts, which alter habitat conditions (A) and can increase competition pressures between natives and non-natives (E).

# **CONSERVATION MEASURES IMPLEMENTED, PLANNED, AND RECOMMENDED**

|  |  |
| --- | --- |
| *Alabama.—* | Believe the Elk River has the most potential for supporting Popeye Shiners in the state as they occur further upstream in Tennessee. This river has been classified by the state as a Strategic Habitat Unit for recovery of imperiled species. Subsequently, restoration activities in the watershed could have a positive impact on Popeye Shiners through improved habitat. Flows have been improved below Tim’s Ford Dam resulting in warmer temperatures that could benefit and support a viable Popeye Shiner population (Shelton-Nix 2017).  Management recommendations include reducing sedimentation and erosion to improve and provide suitable habitat for silt-intolerant species, such as Popeye Shiners (Shelton-Nix 2017). |
| *Georgia.—* | High Priority Watersheds (HPW) and High Priority Aquatic Species were identified in Georgia’s SWAP (GADNR 2015). These will be used to guide conservation efforts and research over the next 10 years.  Several planned conservation strategies to mitigate impacts from urbanization and other activities on wildlife and habitat, as listed in Georgia’s SWAP (2015), include:   1. “Implement targeted dam and culvert removal/replacement projects and mitigation projects to restore and conserve stream banks and channels. 2. Provide technical assistance to farmers to protect streams in high priority watersheds 3. Facilitate training for and compliance with Best Management Practices for erosion and sedimentation control, stormwater runoff, and stream buffer protection.”   For restoring and conserving Georgia’s aquatic biodiversity, the SWAP (2015) identified the following as high priority conservation actions and conservation needs:   1. Protecting riverine connectivity in free-flowing systems 2. Development of recommended environmental flows 3. Acquisition of land and easements in high priority watersheds (HPW) 4. Providing technical assistance to local governments in support of stream protection in HPW 5. Outreach and regulation on invasive species 6. Providing technical assistance to farmers in support of stream protection in HWP 7. Protection of species and habitats through the Statewide Water Planning Process 8. Expansion of Georgia’s Nongame Conservation Section, Aquatic Program 9. Implement dam and culvert removal and improvement projects 10. Restoration of riparian forests 11. Coordinating aquatic conservation planning meetings 12. Assessing the status and distribution of high priority snail species 13. Conducting Shoal Creek Watershed Project 14. Conducting water quality and contaminants study in the Conasauga River 15. Distributional surveys and monitoring 16. Research and conservation planning that will improve the effectiveness of conservation efforts 17. On the ground conservation actions 18. Environmental education and outreach |
| *Indiana.—* | Considered extirpated from the state. No direct conservation measures implemented or planned. Indiana’s SWAP (IDNR-DFW 2015) lists species monitoring and assessments as essential to conserving species and preventing listings and extirpation. This includes monitoring of at-risk species, species in decline, species in at-risk habitats, SGCNs, and game, commercial, and common species for early detection of threats or declines. Indiana has established standardized fish sampling and analysis protocols relative to water and environmental quality monitoring that have contributed to a better understanding of species abundance and distribution.  Monitoring aquatic habitats and understanding species-habitat associations:  “In aquatic systems, collection of corresponding habitat data has been an important component of sampling protocols aimed at aquatic community assessment such as the Index of Biotic Integrity (IBI), which classifies species in part by their habitat requirements, and the Qualitative Habitat Evaluation Index (QHEI) which directly describes habitat characteristics. More recently, bathymetric, vegetation, and bottom hardness mapping has been incorporated as a habitat component of the DNR’s Glacial Lakes Status and Trends Monitoring. However, most of these efforts collect data on a limited number of indicator parameters, in selected portions of streams, lakes, or reservoirs. Even the systematic efforts of the EPA and USGS in Indiana fail to provide a complete picture of aquatic system habitat in Indiana.”  Indiana’s SWAP (2015) identified habitat survey and monitoring needs to fill gaps in knowledge of species-habitat associations and gain a better understanding of the factors driving habitat change. The following areas in habitat monitoring components were recommended to be included in evaluations of habitats and species distributions:   1. Invasive species 2. Quantitative or indices of habitats 3. Soil mapping 4. Land cover/land use assessments 5. Agriculture statistics 6. Stream substrate composition and contour 7. Environmental contaminants 8. Barren lands/ rock outcrops 9. Forest statistics 10. Karst features 11. Restored wetlands |
| *Kentucky.—* | In 2017, the Army Corps of Engineers Green River Lock and Dam No. 6 was removed following an uncontrolled breach in 2016 (Labashosky). Thomas and Brandt (2016) reported the last known (based on available data) collection of Popeye Shiner in Kentucky just upstream of this dam in their 2006 sampling efforts. They recommended that the removal of this dam would help restore natural flows to roughly 6 river miles, and contribute to ongoing flow and temperature regime restoration efforts associated with the Sustainable Rivers Project (Konrad 2010, as cited by Thomas and Brandt 2016)  Thomas and Brandt (2016) recommended continued long-term biological monitoring in the Green River in support of imperiled fish conservation.  The following are several conservation actions in need identified by Kentucky’s Comprehensive Wildlife Conservation Strategy (KYDFWR 2013):   1. Protect riparian habitat and critical aquatic habitats through acquisition or conservation easements 2. Promoting the use of, and helping develop, Best Management Practices for implementation 3. Coordinate with hydroelectric (and other) dams to balance operational needs with environmental needs 4. Develop aquatic education programs for the public 5. Develop an aquatic nuisance species plan |
| *North Carolina.—* | Propagation of at-risk aquatic species in captivity has been an ongoing research and conservation tool used to protect species from declining further towards extirpation and enhancing populations through augmentations (NCWRC 2015).  North Carolina has several land trusts, private conservation organizations, and local and municipal programs that share an interest in protecting, conserving, and restoring native species and habitats. Several groups include the North Carolina Wildlife Federation, the Conservation Trust for North Carolina, The Nature Conservancy, Community conservation Assistance Programs, and county-level nature preserves, organizations, and programs. County-level programs cover a variety of conservation actions, such as working with landowners, land trusts, and other stakeholders to protect and restore important natural resources, acquire land and conservation easements, and reduce nonpoint source pollution.  North Carolina’s SWAP (NCWRC 2015) recommend the following conservation actions as priorities for implementation across aquatic communities:   1. Status and distributional surveys for aquatic macroinvertebrates (snails, crayfish, mussels) and fish 2. Monitoring populations to assess trends and species and ecosystem health 3. Development of long-term monitoring studies and climate change monitoring protocols 4. Monitoring non-native invasive, effects of base flows on SGCNs, and agriculture and forestry BMPs 5. Research to support conservation of species and habitats, such as habitat use preferences, genetics, factors limiting population viability, food web dynamics, species vulnerability assessments, and improved propagation techniques. 6. Expand and improve management practices to mitigate negative impacts on species and habitats and enhance resource resiliency to existing and future stressors. Examples include expanding hatchery facilities to accommodate increased needs of non-game and priority species propagation, and implementation of BMPs to reduce pollution and erosion from stormwater and agriculture runoff. 7. Partnerships and cooperative efforts and incentive and conservation programs to promote protection and enhancement of natural communities, habitat, and biodiversity. |
| *Ohio.—* | The Ohio SWAP (OHDW 2015) reports on the conservation measures that have been implemented over the past 10 years (2006–2015) in support of Ohio’s first Comprehensive Wildlife Conservation Strategy (2006). Efforts beneficial to aquatic ecosystem—which have cascading benefits on Popeye Shiners—include, but are not limited to:   1. Riparian forest conservation in developing landscapes 2. Acquisition of conservation easements to protect habitat 3. Statewide stream conservation programs and fish inventories and distribution assessments 4. Ohio River restoration and protections 5. Rare stream fishes restoration program 6. Development of dam removal strategies to benefit aquatic SGCNs   The following are several conservation actions recommended for Ohio River Tributaries as listed in Table 42 of Ohio’s SWAP (OHDW 2015):   1. Protection of riparian corridors (e.g., acquisition of land, conservation easements, partnerships) 2. Restore riverine connectivity and improve water quality through (prioritized) dam removals 3. Create wetlands for improving water quality through acting as stormwater filters 4. Stabilize eroding streambanks 5. Reconnect stream channels with natural floodplains 6. Control pH of abandoned mine land effluents 7. Assess population status, suitability of habitat, and probability of restoration for SGCNs. 8. Increase outreach, education and awareness on    1. pesticides and herbicides and their associated negative impacts to wildlife    2. nuisance and exotic species and their negative impacts    3. private land management, conservation practices, and water quality 9. Support minimum flow requirements and increased or additional stormwater regulations   Other needs identified in the Ohio SWAP (OHDW 2015) include:   1. Long-term monitoring of critical habitats 2. Development of a centralized GIS database that incorporates species and habitat temporal data and provides managers with a conservation tool for improving conservation effort effectiveness. 3. Addressing high-priority data gaps through monitoring programs |
| *Pennsylvania.—* | Acquisition of land, private land agreements, conservation and management area designations to protect essential habitats.  Research needs identified in Pennsylvania’s SWAP (2015) include enhancing knowledge related to fish habitat use, causes of population declines, reintroduction potential. Other conservation actions for fish that were identified as needing to be addressed include surveys to assess species distributions and status and habitat conditions, expansion of existing surveys into new drainages, developing standardized protocols for monitoring, and continued long-term monitoring to assess population trends. |
| *Tennessee.—* | Over the past 10 years, since the first Tennessee SWAP (2005), the Tennessee Wildlife Resources Agency (TWRA) and TNC have collaborated to acquire and protect lands containing critical habitat and imperiled species (TN-SWAPT 2015). The TWRA’s Kyle’s Ford Wildlife Management Area is one such location that surrounds a critical reach of the upper Clinch River that contains a highly diverse and dense mussel shoal. Protections and restorations at this site not only benefit imperiled mussel species within the boundaries of the parcel but are beneficial to a wide diversity of aquatic biota and habitats in downstream reaches, which includes the Popeye Shiner.  There are several private and public agencies, and conservation programs and organizations, which work independently and collaboratively on projects, research, land acquisitions, and education programs in support of protecting and restoring aquatic ecosystem health and biodiversity. Several examples include TWRA, TNC, USDA Natural Resources Conservation Service, Tennessee Department of Environment and Conservation (TDEC), the Clinch and Powell River Resource Conservation and Development Council, Inc., Clinch-Powell Watershed Alliance, and Appalachia CARES (AmeriCorps). |
| *Virginia.—* | Addressing Pollution: Substantial reductions in point source pollution and improvements in water quality have been achieved since the 1970s implementation of the Clean Water Act.  Riverine Connectivity: The VDGIF Fish Passage program has worked to improve aquatic connectivity through modification and removal of dams and other barriers to fish dispersal (VDGIF 2015; VDGIF-FPP).  Habitat: The Virginia Department of Conservation and Recreation (VADCR) and VDGIF developed planning documents that identified critical habitat types and areas for biodiversity in need of protection, and conservation actions in need to conserve and enhance Virginia’s native biota and habitats.  Climate Change: Kane et al. (2013) addressed the need for Virginia-specific climate change information, forecasts, potential impacts, and modeling and vulnerability assessments to the status and distribution of SGCNs. In 2009, VDFIG et al. prepared a document to provide resource managers with guidance and recommended adaption strategies to conserve and enhance species and their habitats in the face of impending changes in climate that are expected to exacerbate existing stressors.  The VA SWAP (2015) Tier 2c designation of this species recommends the identification and improved understanding of Popeye Shiner habitat requirements.  Non-point source pollution continues to be a significant threat to aquatic ecosystems in the state. Many waterbodies have been designated as impaired by the Virginia Department of Environmental Quality (DEQ) standards. In response to this, the DEQ have created a Water Quality Improvement Plan that identifies over 300 watersheds as conservation priorities and actions needed to improve water quality. The following are several of the conservations actions recommended to restore water quality that benefits wildlife and aquatic habitats (VDGIF 2015):   1. Exclusion of livestock from streams (working with landowners) 2. Minimizing erosion through establishment of riparian buffer zones along streams, reforesting erodible areas, stream bank plantings and stabilization 3. Expanding and improving management of stormwater and agriculture runoff to reduce herbicides, pesticides, bacteria, manure, phosphorus, sediment pollution 4. Replacement or repairing failing septic systems; elimination of straight pipes 5. Reduction in pet waste runoff   Climate-induced changes in the environment should be considered when developing species (and habitat) management and conservation plans (VDGIF et al. 2009; Kane et al. 2013) |
| *West Virginia.—* | West Virginia’s USDA Natural Resources Conservation Service implements programs to reduce soil erosion and increase and restore habitat and water quality. The West Virginia Conservation Agency implements the Stream Protection and Restoration Program and Non-Point Source Pollution Program. The West Virginia Water Resource Center provides education and training on various aquatic-related issues (e.g., non-point source pollution and solutions) and fund stream and riparian restoration projects.  Conservation actions recommended for the Lower Elk Conservation Focus Area (CFA), habitat that supports Popeye Shiner and other rare freshwater fish populations, include (WVDNR 2015):   1. Outreach and education for local environmental groups and the public to increase aquatic resource awareness and understanding of issues 2. Partnerships with local-level public and government groups to reduce pollution and prevent toxic spills into waterways 3. Identification of factors driving algae blooms and develop strategies for its management. |

# FOR SPECIES THAT ARE BEING REMOVED FROM CANDIDATE STATUS

Not applicable

\_\_\_\_ Is the removal based in whole or in part on one or more individual conservation efforts that you

determined met the standards in the [Policy for Evaluation of Conservation Efforts When Making Listing Decisions](http://www.gpo.gov/fdsys/granule/FR-2003-03-28/03-7364/content-detail.html) (PECE)?

# DESCRIPTION OF MONITORING

From 1866–1892, Popeye Shiner was reported to be abundant in two localities: White River, at Indianapolis, Indiana (Academy of Natural Sciences of Philadelphia [ANSP] 16488, as cited in Gilbert 1969), and Cypress Creek, near Florence, Alabama (Gilbert 1891; Gilbert 1969). Although it was distributed widely across several localities in the Ohio, Tennessee, and Cumberland drainages, very few number of individuals were encountered in all other locations (i.e., not common but not uncommon to rare). From 1890s–1940s, very few individuals were encountered at any localities; however, historically occupied sites were not reassessed during this period and thus population abundances over this time frame cannot be inferred (Gilbert 1969). When several historically occupied sites in Kentucky were resurveyed 50 years later in the 1940s, Popeye Shiner was found to occur at the same relative abundances as previous surveys.

From the 1860–1970s, Popeye Shiner populations have experienced fluctuating locality occurrences and abundances. From 1920s to 1950s, fish collections in the Powell and Rockcastle rivers failed to collect Popeye Shiner, whereas surveys in the same localities in the 1960s reported its presence and as being a commonly encountered species. This suggests that Popeye Shiners may have occurred at undetectable levels in these rivers the 1920s–1950s and that populations were increasing in the 1960s. Masnik (1974) reported populations to be increasing in the Powell and Clinch rivers since its first detection in 1963. Gilbert (1969) believed that these populations increased significantly in the 1960s and concluded that it was not by chance that the species was not reported over the 30-year period of extensive collections by experienced ichthyologists.

While Popeye Shiners still occur in the Powell, Clinch, and North Fork Holston rivers of Virginia, they are now a rarely encountered species during fish collections (VaFWIS 2017; M. Pinder, Virginia Department of Game and Inland Fisheries [VDGIF], personal communication). Popeye Shiners are now believed to be extirpated from Alabama and Pennsylvania, historically occupied states. They are listed by the state of Indiana as extirpated, but one recent survey (2006) documented individuals in at least one locality (Simon et al. 2015). Still today, most of occupied localities can be found centralized in and around Tennessee, Kentucky, West Virginia, and Virginia.

# LITERATURE CITED

#### Ahlstedt, S.A., M.T. Fagg, R.S. Butler, J.F. Connell, and J.W. Jones. 2016. Quantitative monitoring of freshwater mussel populations from 1979–2004 in the Clinch and Powell Rivers of Tennessee and Virginia, with miscellaneous notes on the fauna. Freshwater Mollusk Biology and Conservation 19:1–18.

#### Alabama Department of Conservation and Natural Resources (ADCNR). 2015. Alabama Wildlife Action Plan. Prepared by Terwilliger Consulting Inc. and Conservation Southeast Inc. for the Division of Wildlife and Freshwater Fisheries. i–ixi + 503 pp.

#### Ankley, G.T., D. Feifarek, B. Blackwell, J.E. Cavallin, K.M. Jensen, M.D. Kahl, S. Poole, E. Randolph, T. Saari, and D.L. Villeneuve. 2017. Re-evaluating the significance of estrone as an environmental estrogen. Environmental Science & Technology 51:4705-4713.

#### Department of Vertebrate Zoology, Research and Collections Information System, National Museum of Natural History, Smithsonian Institution (NMNH). Division of Fishes Collections. Available https://collections.nmnh.si.edu/search/fishes/

#### Etnier, D.A. and W.C. Starnes. 1993. The fishes of Tennessee. The University of Tennessee Press, Knoxville, Tennessee, USA.

#### Frimpong, E., J. Huang, and Y. Liang. 2015. Historical stream fish distribution database for the conterminous United States (1950–1990): IchthyMaps. U.S. Geological Survey, Reston, Virginia. Available [http://dx.doi.org/doi:10.5066/F7M32ST8>http://journals.plos.org/plosone/s/journal-information](http://dx.doi.org/doi:10.5066/F7M32ST8%3ehttp://journals.plos.org/plosone/s/journal-information)

#### Froese, R., and D. Pauly, eds. 2017. FishBase. World Wide Web electronic publication. Available www.fishbase.org, version 10/2017.

#### GBIF Secretariat (GBIF). 2017. GBIF Backbone TaxonomyChecklist Dataset: *Notropis ariommus* doi.org/10.15468/39omei. Available http://www.gbif.org/species/236337

#### GBIF Occurrence Download. *Notropis ariommus*. doi:10.15468/dl.nfi1k9 Available GBIF.org.

#### Georgia Department of Natural Resources, Law Enforcement Division. Laws related to wildlife. Available <http://gadnrle.org/laws-native-wildlife>

#### Georgia Department of Natural Resources, Wildlife Resources Division (GADNR). 2009. Species fact sheet for Popeye Shiner (Notropis ariommus). Available <http://georgiawildlife.com/sites/default/files/wrd/pdf/fact-sheets/popeye_shiner_2016.pdf>

#### Georgia Department of Natural Resources (GADNR). 2015. Georgia State Wildlife Action Plan. Social Circle, GA: Georgia Department of Natural Resources. i–xv + 246 pp.

#### Georgia Secretary of State (GSOS). Rules and Regulations of the State of Georgia. Department 391. Rules of Georgia Department of Natural Resources. Available http://rules.sos.ga.gov

#### Gilbert, C.R. 1969. Systematics and distribution of the American cyprinid fishes *Notropis ariommus* and *Notropis telescopus*. Copeia 1969:474–492.

#### Gilbert, C.H. 1891. Notes on explorations made in Alabama during 1889, with notes on the fishes of the Tennessee, Alabama and Escambia rivers. Bulletin of the United States Fish Commission 9:143–159.

#### Indiana Department of Natural Resources, Division of Fish and Wildlife (IDNR-DFW). 2015. Indiana State Wildlife Action Plan. 300 pp.

#### Integrated Taxonomic Information System (ITIS). ITIS Report: Notropis ariommus (Cope, 1867). Taxonomic Serial No. 163425. Available via https://www.itis.gov/

#### Jackson, D.A., and N.E. Mandrak. 2002. Changing fish biodiversity: predicting the loss of cyprinid biodiversity due to global climate change. In: Fisheries in a Changing Climate. N.A. McGinn (ed) 2002. American Fisheries Society Symposium 32. American Fisheries Society, Bethesda, Maryland. 10 pp.

#### Jenkins, R.E. and N.M. Burkhead. 1993. Freshwater Fishes of Virginia. American Fisheries Society, Bethesda, Maryland. 1079 pp.

#### Kane, A., T.C. Burkett, S. Klopfer, and J. Sewall. 2013. Virginia’s Climate Modeling and Species Vulnerability Assessment: How Climate Data Can Inform Management and Conservation. National Wildlife Federation, Reston, Virginia. i–iii + 63 pp.

#### Kentucky Department of Fish and Wildlife Resources (KYDFWR). 2013. Kentucky's Comprehensive Wildlife Conservation Strategy. Available http://fw.ky.gov/WAP/Pages/Default.aspx

#### Kitchel, H.E., 1985. Life history of the endangered shiny pigtoe pearly mussel, *Fusconaia edgariana*, in the North Fork Holston River, Virginia. Master’s Thesis. Virginia Polytechnic Institute and State University, Blacksburg. 129 pp.

#### Konrad C. P. 2010. Monitoring and evaluation of environmental flow prescriptions for five demonstration sites of the Sustainable Rivers Project. US Geological Survey Open File Report 2010-1065.

#### Kuhne, E.R. 1939. A guide to the fishes of Tennessee and the mid-South. Division of Game and Fish, Tennessee Department of Conservation, Nashville.

#### Labashosky, C. 2017. Removal of Lock and Dam 6 completed on Green River, Kentucky. Available https://www.army.mil/article/190355/removal\_of\_lock\_and\_dam\_6\_completed\_on\_green\_river\_kentucky

#### LAWriter, LLC. 2018. Ohio Laws and Rules, Ohio Revised Code. Title XV Conservation of Natural Resources, Division of Wildlife. Chapters 1531, 1533. Available http://codes.ohio.gov/orc/15

#### Lee, D. S., C. R. Gilbert, C. H. Hocutt, R. E. Jenkins, D. E. McAllister, and J. R. Stauffer, Jr. 1980. Atlas of North American freshwater fishes. North Carolina State Museum of Natural History, Raleigh, North Carolina. i–x + 854 pp.

#### Lessard, J.L, and D.B. Hayes. 2003. Effects of elevated water temperature on fish and macroinvertebrate communities below small dams. River Research and Applications 19:721–732.

#### Ligon, F.K., W.E. Dietrich, and W.J. Trush. 1995. Downstream ecological effects of dams: a geomorphic perspective. BioScience 45:183–192.

#### Margraf, F.J., and C.T. Knight. 2002. Evaluation of fish sampling using rotenone in a navigation lock. Fisheries Research 55:297–305.

#### Martin, R.G., and R.S. Campbell. 1953. The small fishes of Black River and Clearwater Lake, Missouri. University of Missouri Studies. The Curators of the University of Missouri, Columbia. Pages 45–66.

#### Masnik, M.T. 1974. Composition, longitudinal distribution, and zoogeography of the fish fauna of the upper Clinch system in Tennessee and Virginia. PhD Dissertation, Virginia Polytechnic Institute and State University, Blacksburg. 401 pp.

#### McDonald, R.I., P.J. Marcotullio, B. Güneralp. 2013. Urbanization and Global Trends in Biodiversity and Ecosystem Services. In: Elmqvist T. et al. (eds) Urbanization, Biodiversity and Ecosystem Services: Challenges and Opportunities. Springer, Dordrecht. Available https://doi.org/10.1007/978-94-007-7088-1\_3

#### McReynolds, H.E., and J.L. Janisch. 1977. Recent fish collections from Blue River, Washington County, Indiana. Proceedings of the Indiana Academy of Science 3:238–241.

#### Mickey, J.H. 1984. Fishery management activities on the New River drainage in North Carolina. New River Gorge; Proceedings of the New River Symposium 1984. April 12–14, 1984. Boone, North Carolina.

#### NatureServe. 2017. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://explorer.natureserve.org

#### NatureServe and International Union for Conservation of Nature (NatureServe-IUCN). 2014. *Notropis ariommus*. The IUCN Red List of Threatened Species. Version 2014.4. http://www.iucnredlist.org

#### Neves, R.J., and J.C. Widlak. 1988. Occurrence of glochidia in stream drift and on fishes of the Upper North Fork Holston River, Virginia. The American Midland Naturalist 119:111–120.

#### North Carolina Wildlife Resources Commission (NCWRC). 2015. North Carolina Wildlife Action Plan. i–xxx + 1298 pp.

#### Ohio Division of Wildlife (OHDW). 2015. Ohio’s State Wildlife Action Plan. Columbus, Ohio, USA.

#### Page, L. M., and B. M. Burr. 1991. A field guide to freshwater fishes: North America north of Mexico. Houghton Mifflin Company, Boston, Massachusetts. 432 pp.

#### Pennsylvania Fish and Boat Commission (PAFBC). Pennsylvania Fishes: Carps and Minnows, Family Cyprinidae Overview. Available http://www.fishandboat.com/Fish/PennsylvaniaFishes/GalleryPennsylvaniaFishes/Pages/CarpsandMinnows.aspx

#### Pennsylvania Game Commission and Pennsylvania Fish & Boat Commission (PGC-PFBC). 2015. Pennsylvania Wildlife Action Plan 2015–2025. C. Haffner and D. Day, editors. Pennsylvania Game Commission and Pennsylvania Fish & Boat Commission, Harrisburg, Pennsylvania.

#### Poff, N.L., J.D. Allan, M.B. Bain, J.R. Karr K.L. Prestegaard, B.D. Richter, R.E. Sparks, and J.C. Stromberg. 1997. The natural flow regime: a paradigm for river conservation and restoration. BioScience 47:769–784

#### Rachel, F.J., and J.D. Owens. 2008. Assessing the effects of climate change on aquatic invasive species. Conservation Biology 22:521–533.

#### Shelton-Nix, E (ed). 2013. Alabama Wildlife, Volume 2. The University of Alabama Press Tuscaloosa.

#### Shelton-Nix, E (ed). 2017. Alabama Wildlife, Volume 5. The University of Alabama Press Tuscaloosa.

#### Simon, T.P. 2006. Biodiversity of fishes in the Wabash River: status, indicators, and threats. Proceedings of the Indiana Academy of Science 115:136–148.

#### Simon T., C. Morris, J. Robb, and W. McCoy. 2015. Biological diversity, ecological health and condition of aquatic assemblages at National Wildlife Refuges in Southern Indiana, USA. Biodiversity Data Journal 3: e4300. doi: 10.3897/BDJ.3.e4300

#### Stauffer, J.R., Jr., J.M. Boltz, and L.R. White. 1995. The Fishes of West Virginia. Proceedings of the Academy of Natural Sciences of Philadelphia 146:1–389.

#### Tennessee State Wildlife Action Plan Team (TN-SWAPT). 2015. Tennessee State Wildlife Action Plan 2015. Tennessee Wildlife Resources Agency. Nashville, TN.

#### The Nature Conservancy (TNC). 2013. West Virginia watershed assessment pilot project: Elk River watershed assessment. Prepared for the West Virginia Department of Environmental Protection and the United States Environmental Protection Agency. 172 pp.

#### Thomas, M., and S.L. Brandt. 2016. Surveys for the Diamond Darter (*Crystallaria cincotta*), an endangered species known historically from the Green River in Kentucky. Mammoth Cave Research Symposia. Paper 4. April 18, 2016. Available http://digitalcommons.wku.edu/mc\_reserch\_symp/11th\_Research\_Symposium\_2016/Research\_Posters/4

#### Terwilliger, K., Coordinator. 1991. Virginia’s Endangered Species: Proceedings of a Symposium. Virginia Department of Game and Inland Fisheries. The McDonald and Woodward Publishing Company. 672 pp.

#### U.S. Geological Survey (USGS). 1996. Fishes of the White River Basin, Indiana. Water-Resources Investigations Report 96-4232 prepared by C.G. Crawford, M.J. Lydy, and J.W. Frey. Indianapolis, Indiana. 9 pp.

#### Virginia Fish and Wildlife Information Service (VaFWIS) of the Virginia Department of Game and Inland Fisheries. Available at http://vafwis.org/fwis/

#### Virginia Department of Game and Inland Fisheries Fish Passage Program (VDGIF-FPP), Available https://www.dgif.virginia.gov/fishing/fish-passage/

#### Virginia Department of Game and Inland Fisheries (VDGIF). 2015. Virginia’s 2015 Wildlife Action Plan.

#### Virginia Department of Game and Inland Fisheries, National Wildlife Federation, and Virginia Conservation Network (VDGIF et al.). 2009. Virginia’s Strategy for Safeguarding Species of Greatest Conservation Need from the Effects of Climate Change. Virginia Department of Game and Inland Fisheries, Richmond, Virginia. 24 pp.

#### West Virginia Division of Natural Resources (WVDNR). 2015. 2015 West Virginia State Wildlife Action Plan.

#### Wood, P.J., and P.D. Armitage. 1997. Biological effects of fine sediment in the lotic environment. Environmental Management 21:203–217.

# SPECIES ASSESSMENT/LISTING PRIORITY ASSIGNMENT FORM – DEVELOPMENT

**Indicate which State(s) (within the range of the species) provided information or comments on the species or latest species assessment:**

Pennsylvania, Virginia, West Virginia

**Indicate which State(s) did not provide any information or comment:**

Kentucky, Ohio, Tennessee, North Carolina, Indiana, Georgia, Alabama

**State Coordination:**

The Northeast Association of Fish and Wildlife Agencies (NEAFWA) and Conservation Management Institute (CMI, Virginia Tech) compiled the above information regarding the status of, and threats to, Popeye Shiners. Popeye Shiners are not federally listed or of concern. They are listed as State Endangered in Georgia and Ohio, and as a Species of Greatest Conservation Need (SGCN) in Alabama, Georgia, Ohio, Virginia, and West Virginia’s most recent (2015) State Wildlife Action Plans.

The NatureServe (NatureServe-IUCN 2014; NatureServe 2017) conducted a biological assessment of Popeye Shiner in 2012 and concluded that it should be listed as a species of Least Concern; a status indicating there are likely 21–100 Popeye Shiner (sub)populations (i.e., occurrences) remaining today (as defined by the IUCN), most of which are centralized in Kentucky and Tennessee.

----------------------------------------------------------------------------------------------------------------------------

*Following Section for U.S. Fish and Wildlife Service Use Only*

**Priority Table**

|  |  |  |  |
| --- | --- | --- | --- |
| Magnitude | Immediacy | Taxonomy | Priority |
| High | Imminent | Monotypic genus | 1 |
| Species | 2 |
| Subspecies/Population | 3 |
| Non-Imminent | Monotypic genus | 4 |
| Species | 5 |
| Subspecies/Population | 6 |
| Moderate to Low | Imminent | Monotypic genus | 7 |
| Species | 8 |
| Subspecies/Population | 9 |
| Non-Imminent | Monotypic genus | 10 |
| Species | 11 |
| Subspecies/Population | 12 |

**Rationale for Change in Listing Priority Number:**

**Magnitude:**

**Imminence:**

\_\_\_\_ Have you promptly reviewed all of the information received regarding the species for the purpose of determination whether emergency listing is needed?

**Emergency Listing Review**

\_\_\_\_ Is Emergency Listing Warranted?