# An Atlas of the Freshwater Fishes of Anne Arundel County, Maryland

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Cover photo credits (top to bottom): Tessellated Darter (Johnathan Freedman, USGS), White Sucker (Brian Gratwicke), Eastern Mudminnow (Keith Petrosky), Pumpkinseed (Simon Barrette), Least Brook Lamprey (Romain Clément).

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# Introduction

The Anne Arundel County Bureau of Watershed Protection and Restoration, part of the Department of Public Works, is pleased to present the first full characterization of the distribution of nontidal fishes in the watersheds of Anne Arundel County.

In 2004, Anne Arundel County began the Countywide Biological Monitoring Program (Program). The purpose of the Program is to understand the ecological health of the County's nontidal streams and rivers by sampling the biological communities live in these systems. In the beginning, only stream insect communities were assessed. In 2017, the Program began assessing the health of fish communities. The sampling work underpinning this document occurred between 2017 and 2021. In total, 49 individual species were identified across the 13 major watershed areas of the County (see Figure 1).

It is not cost-effective or necessary to sample every stream in the County to characterize Countywide stream conditions. The Program employs a random sampling approach to characterize aquatic communities in an unbiased, scientifically rigorous way using tried and true methods based on those developed by the State of Maryland. Details about the methods used by the Program can be found here:

https://www.aacounty.org/departments/public-works/wprp/ecological-assessment-and-evaluation/biological-monitoring/

Since not every stream reach is sampled, it is possible that a fish species not observed in a particular watershed during our sampling effort could still be present in that watershed. Our random sampling approach, however, makes the chances of it occurring in large numbers likely quite low. Lastly, the Program is designed to assess nontidal streams and, thus, only nontidal fishes are presented here. Fishes found exclusively in tidal waters are not included.

# Stream Habitats: Small and Large Scale

Most fish species are typically found in particular places in streams and rivers. The homes, known as habitats, which certain species choose are not random. Since many species are found only in certain parts of the stream system, the distribution and abundance of high quality habitat conditions are important in maintaining fish populations. Features like pools, riffles, woody debris jams and beaver dams, undercut banks, and submerged aquatic vegetation are some of the features used by the fishes that inhabit County streams.

In addition to stream-specific habitat conditions, the large scale geological and climatological characteristics where a river system is located can have a great impact on the distribution of fishes. In Maryland, there are several of these physiographic regions, with two meeting along the northwestern border of the County—the Piedmont and the Coastal Plain. This distinct change in landform character influences the fishes found in the County, with several species found only in watersheds along this border area.

# Document Organization

Each species is lumped into broad categories (known as families) based on how they are related to each other. A brief, general description about each family is provided. The introductory

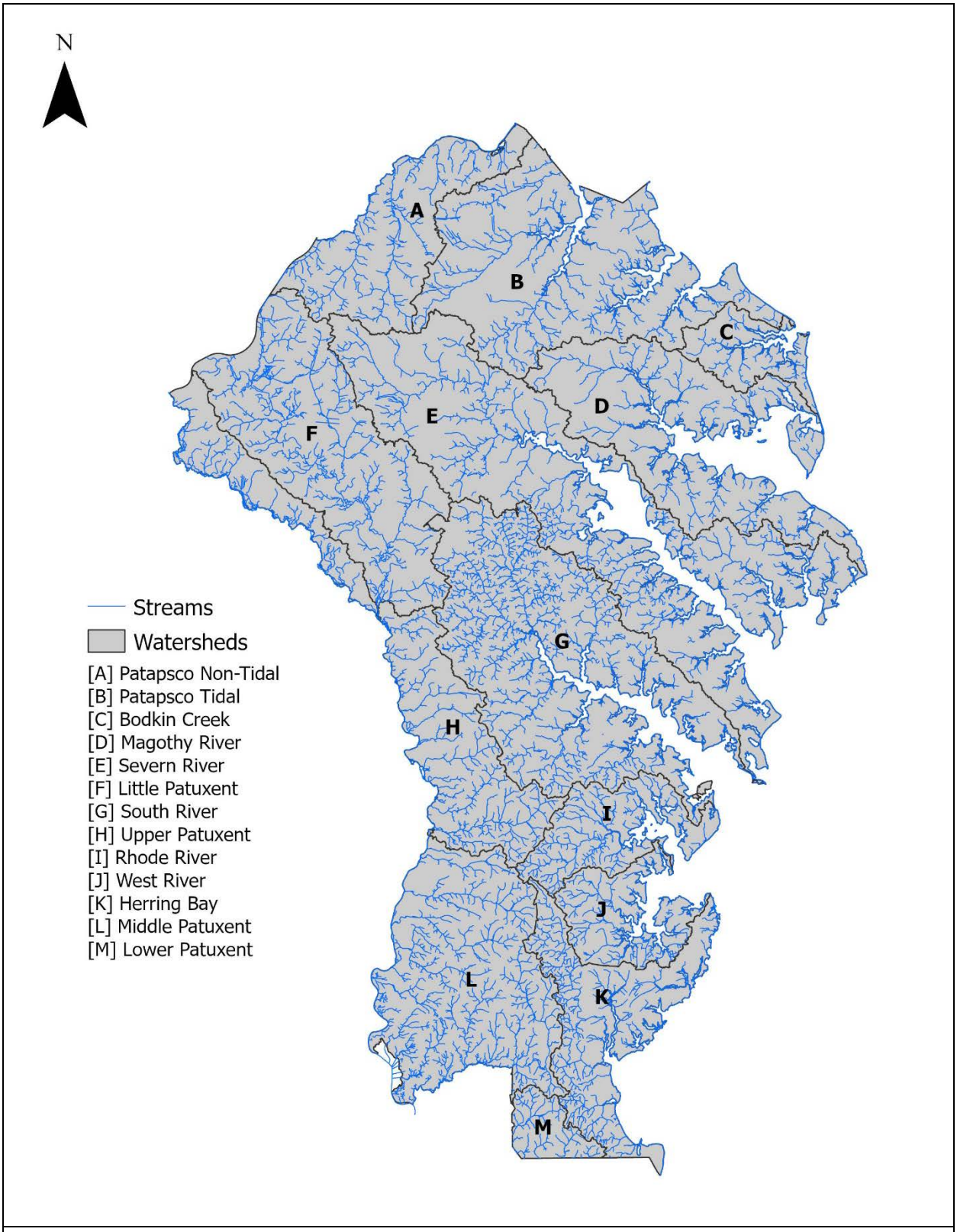



**Figure 1. The watersheds of Anne Arundel County.**

information about the different families is summarized from two primary references used in this document (1, 2). Some of these fish families, like Sunfishes and Minnows, will be familiar to many people. Others, like Lampreys and Sculpins, may not be. Table 1 is provided to guide you to the right family to look up any fish you might encounter in a nontidal, freshwater County stream.

For each species, a map showing its distribution in the County is provided along with a brief narrative that characterizes its distribution in the County (see Appendix A for definitions of the categories used in these write ups), whether it is native to the County, its conservation or regulatory status, and its physical appearance, preferred habitat, breeding habits, feeding behaviors, and estimated life span, if known. Pictures and/or scientific illustrations of each species are also included. Illustrations are usually crafted to highlight ideal examples of the typical patterns and colors found across individuals while the photos give you an idea of what the "real world" colorations of these species are like. Providing both, along with written descriptions of important physical characteristics, all should help in identifying a particular species.

Species within a Family group are organized by its prevalence during sampling, meaning that the first few species listed in a particular group are the species of that family you are most likely to encounter in a County nontidal stream, with the rarer species found towards the end of the grouping. Appendix B lists all the species found in order of the total number collected during the assessment.

While an attempt is made to use as little scientific jargon and technical language as possible, the descriptions in the species write ups sometimes use technical terms to describe different parts of fish that are useful in identifying a particular species. Figure 2 provides a guide to these terms for your reference.

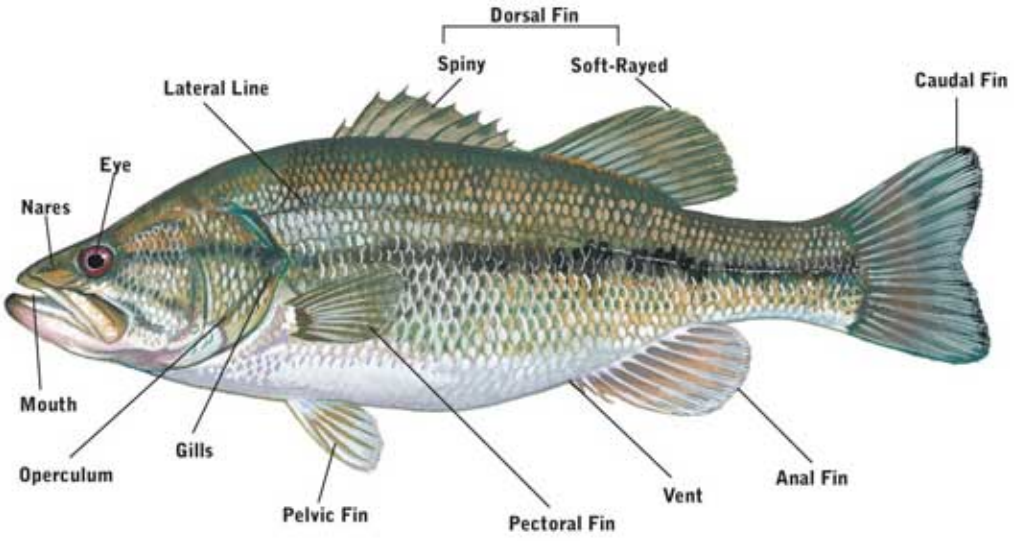



**Figure 2. Basic external anatomy of a fish. Image courtesy of the South Carolina Department of Natural Resources.**

| Table 1. Visual Key to Fish Families. | | |
|---|---|---|
| **If it looks like this…** | **Click here…** | **I'm not sure. How can I tell?** |
|  | Lampreys<br>p. 6 | • Snake-like in appearance<br>• Lacks pelvic and pectoral fins<br>• Does not have a mouth with jaws—has a round disk with small teeth that radiate around the opening |
|  | Freshwater Eels<br>p. 11 | • Snake-like in appearance<br>• Has a true mouth with jaws<br>• Has pectoral fins<br>• Does not have pelvic fins |
|  | Minnows<br>p. 14 | • Small, cylindrical, slender, "minnow-like" fish!<br>• Forked tail<br>• No teeth in the mouth<br>• Less than 10 rays in dorsal fin<br>• May have many white bumps on head during spring and summer |
|  | Suckers<br>p. 47 | • Shows a downturned mouth with large, fleshy lips<br>• Has a rounded, torpedo-shaped body<br>• Always one dorsal fin<br>• Forked tail |
|  | Bullhead Catfishes<br>p. 54 | • Four pairs of barbels, often called whiskers, along mouth<br>• No scales<br>• Sharp pectoral and dorsal fin spines<br>• Dark color on body, bright white belly |
|  | Pikes<br>p. 63 | • Very elongated, torpedo-like, resembling a Barracuda<br>• A duck-like snout, strong jaws, and lots of sharp teeth<br>• Forked tail<br>• Often found in vegetation |
|  | Mudminnows<br>p. 68 | • Has a dark band at the base of the tail<br>• Rounded tail<br>• No spines in fins<br>• Often found in warm, still streams and ponds |

| Table 1, cont. Visual Key to Fish Families. | | |
|---|---|---|
| **If it looks like this…** | **Click here…** | **I'm not sure. How can I tell?** |
|  | Trouts<br>p. 71 | • Elongate body shape<br>• No spines in their fins<br>• Small fin (adipose fin) on back between dorsal fin and tail<br>• Found in cooler streams |
|  | Topminnows and Killifishes<br>p. 74 | • Stout body and short snout<br>• Can have 12-15 vertical stripes along body<br>• No spines in fins<br>• Dorsal and anal fins originate past or at body midpoint<br>• Oval cross section |
|  | Livebearers<br>p. 79 | • Minnow-like, but is deeper across the midsection and not cylindrical<br>• Males have modified elongated anal fin rays used to internally fertilize females<br>• Lays live young and not eggs |
|  | Perches<br>p. 82 | • Long and slender with a two part dorsal fin (may or may not be joined)<br>• Has stout, downward turned pectoral fins for moving along the bottom<br>• Body long and not rounded |
|  | Sculpins<br>p. 89 | • Torpedo-shaped body<br>• Large, fan-shaped, pectoral fins angled downward<br>• Orange fins and large vertical blotches<br>• Large head and mouth |
|  | Sunfishes<br>p. 92 | • Compressed and round with typical stout "sunfish" shape<br>• Dorsal fin continuous with several hard rays in the beginning and soft rays in the back half<br>• No spine on the gill cover |
|  | Snakeheads<br>p. 115 | • Long dorsal and anal fins<br>• Large mouth with lots of teeth<br>• Tail is uniform size and rounded<br>• No scales on bottom of lower jaw |

# LAMPREYS
## (Family *Petromyzonidae*)

Lampreys are an ancient group of fishes that have changed little since they first appeared in the fossil record about 280 million years ago. A total of 19 species are found in the freshwaters systems of North America. Three species occur in Maryland, but only two species from this group observed in the County:

- Least brook lamprey (*Lampetra aepyptera*) p. 7
- Sea lamprey (*Petromyzon marinus*) p. 9

Least Brook Lamprey

## Least Brook Lamprey
## (*Lampetra aepyptera)*

Image: Voucher specimen (2020).

## Distribution:

Common and somewhat frequent where found. Found mostly in the Patuxent, South, and Patapsco River watersheds.

## Origin:

Native to Maryland, but confined to Coastal Plain watersheds of the western and eastern shore.

## Conservation Status:

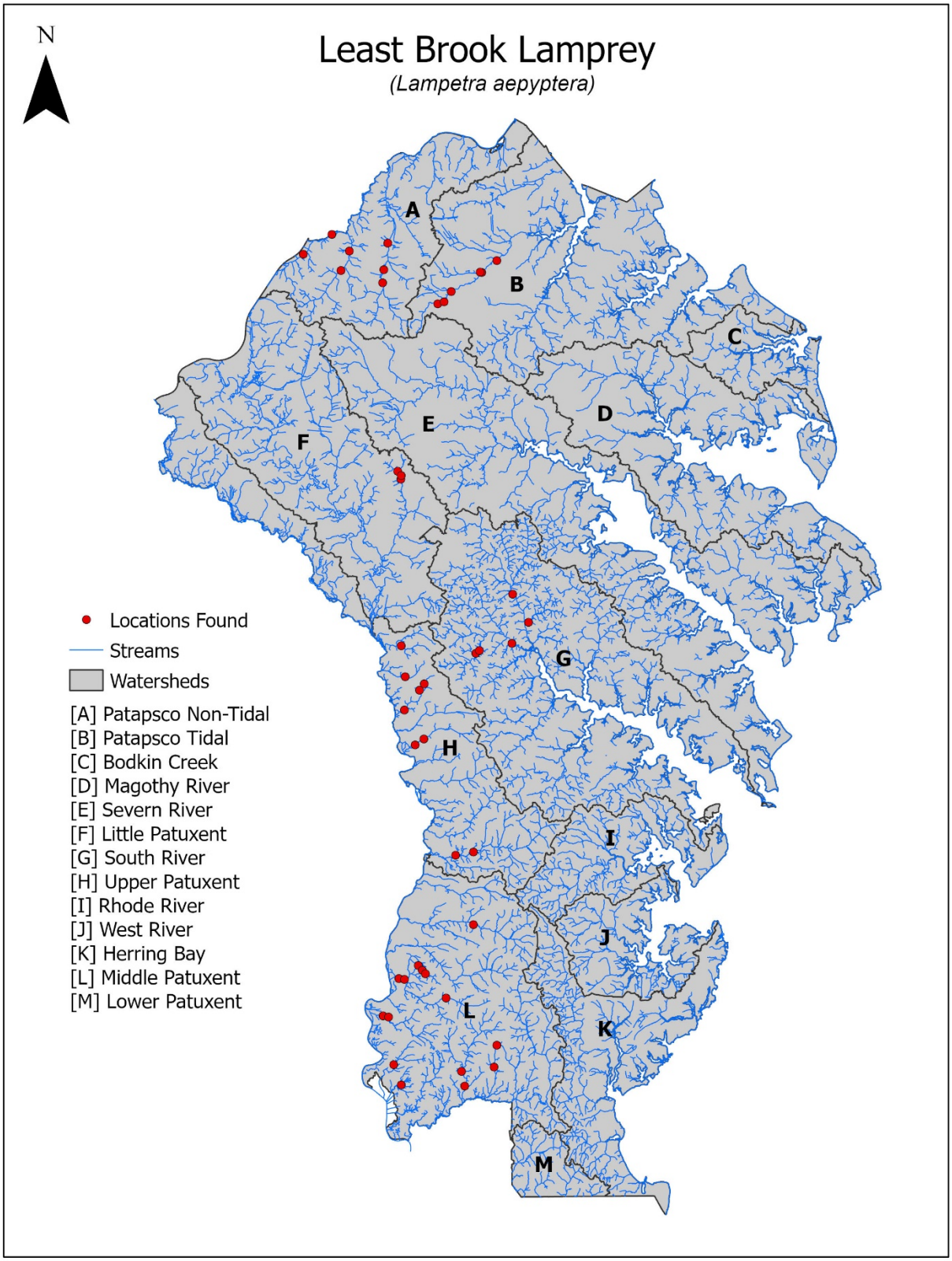
No special protections under state or federal law.

## Description:

One of two lampreys found in the County, the adult Least Brook Lamprey ranges in size from 3.5 to almost 6 inches (1). Teeth are poorly developed and rudimentary on their oral disk compared to other Maryland lampreys (2). The tail membranes are lighter in color than the tail itself, which, like the body, is brown in color (2). For the rarely seen larval stage (called an ammocoete), the body is transparent and does not have the sucker disk mouth typical of the adult form (1).

## Life History and Habitat:

This species is found in small streams and rivers that are warm and have sand bottoms (1, 16). The Least Brook Lamprey is a non-parasitic lamprey, which means that the adult form does not feed after metamorphosis (1). The larval forms often reside in streams for 2.5 to 5 years, where they burrow themselves into fine sand bottoms and live as filter feeders before transforming into adults, which occurs in from late summer into the fall (38, 39). After metamorphosis, the adults overwinter and spawning occurs late in the following spring, where groups of adults construct shared circular nests in sand and fine gravel (38). Adults die after spawning (39), so maximum age is estimated at 6 years.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[L] Middle Patuxent
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## Sea Lamprey
## (*Petromyzon marinus*)

Images: North Carolina Wildlife Resources Commission (left) and a 2018 voucher photo (right).

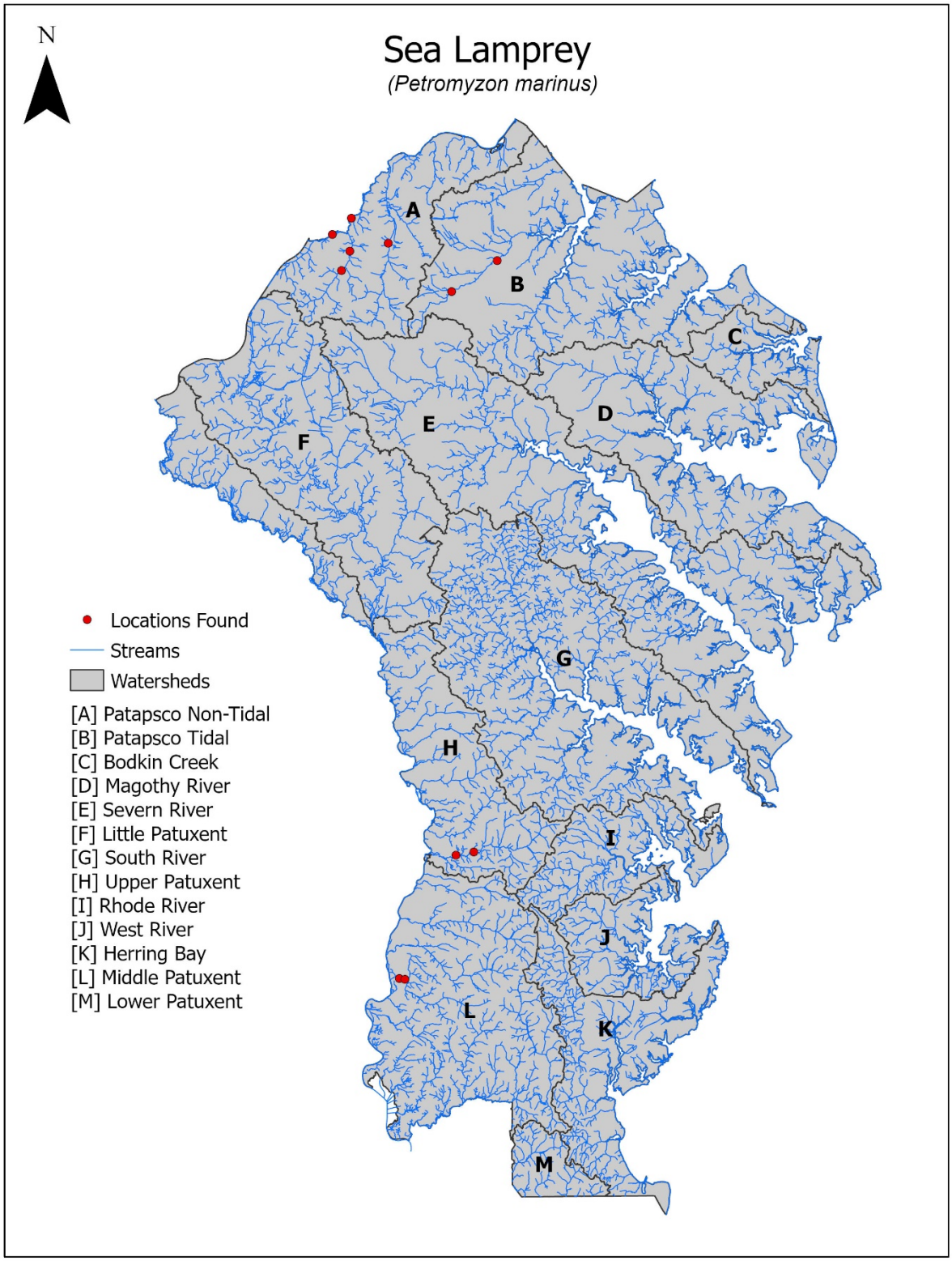
## Distribution:
Uncommon and infrequent where collected. This species occurs primarily Patapsco Nontidal watershed.

## Origin:
Native to Maryland.

## Conservation Status:
No special protections under state or federal law.

## Description:
The Sea Lamprey has a somewhat snakelike appearance and, like all lampreys, lacks jaws and has a series of gill openings along the side of the head (2). Adults have a disc shaped sucker-like mouth with several rows of sharp teeth (1). Color varies considerably depending upon age and can be clear or brown above and yellow-green below, a brown-green-yellow mottled color, or blue black (1, 33). Sizes range from five inches to nearly four feet, depending upon age (1).

## Life History and Habitat:
The Sea Lamprey is somewhat sensitive to pollution and has a complicated life history. This species spends its early life history as a non-parasitic larval form (ammocoetes), living in soft bottomed areas of freshwater streams and rivers, where they spend anywhere from 3 to 17 years (33). Then the larva metamorphose and acquire their adult form as they make their way to the sea, where they spend up to 2 years feeding on a variety of large fish species (2,33). Then, adults return to freshwater creeks and rivers, becoming sexually mature as they migrate upstream, where they spawn and then die soon after (1, 33). Larval stages are filter feeders, eating plankton and detritus (33). Mature forms are parasitic, attaching to and feeding on a variety of large fish species (1). This species is known to be quite destructive to sports fishing in places where it has been accidentally introduced, but aggressive control measures exist such that the threat from this species can be largely mitigated (1, 33).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# FRESHWATER EELS
## (Family Anguillidae)

Freshwater eels are found all over the world and are an important commercial fishery. There are a total of 16 species in this family, only one of which, the American Eel, is present in the North America:

- American Eel (*Anguilla rostrata*) p. 12

## American Eel
*(Anguilla rostrata)*

Images: Ellen Edmonson, NYDEC (left) and a voucher photo of eels collected in 2020.

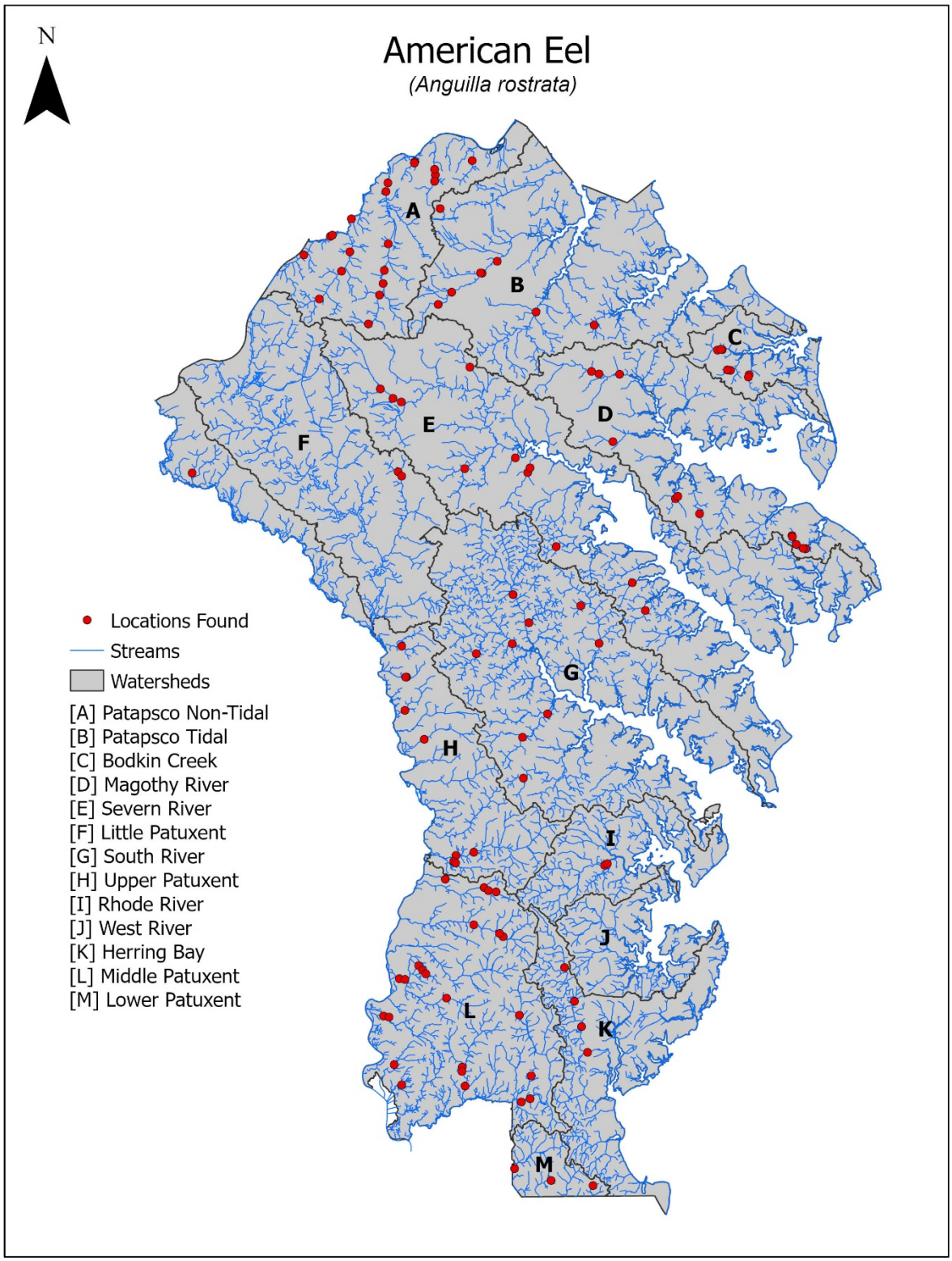
## Distribution:
Widespread in the County and somewhat frequent when observed, this fish is found in nearly all County watersheds.

## Origin:
Native to Maryland.

## Conservation Status:
No special protections under state or federal law.

## Description:
The American Eel is a long, slender, snakelike fish that can grow to a lengths between 24 inches (males) and 60 inches (females) (1). The scales are so small that it appears naked (1). The body is covered in copious quantities of mucus, making it challenging to pick up during capture. Colors range from dark yellow-green to almost silver-grey on the back, grading to a white color on the belly. It possesses pectoral fins, but lacks pelvic fins, one feature distinguishing it from the similar looking lamprey species with which it can co-occur (2).

## Life History and Habitat:
This species lives in soft bottom streams and is found in streams of all sizes, from large rivers to small, headwater systems. American Eel are generalist predators and will eat a wide variety of prey, including fish, insects, worms and whatever they can scavenge (1). This is a catadromous fish, meaning that after hatching in salt water, it migrates from the ocean—from breeding grounds in the Sargasso Sea—and moves up into the freshwater rivers along the US east coast (1). Individuals grow to maturity in these rivers before beginning the journey downstream to the ocean to begin the reproductive cycle again (1). Individuals are thought to live from 5 to 7 years (1).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# MINNOWS
## (Family *Cyprinidae*)

Minnows comprise the largest family of fishes, with over 2,100 species found across the world. Approximately 10% are found in the North America. While most people think of any small fish as a "minnow", this family includes fish like the Giant Barb (*Catlocarpio siamensis*), an Asian species that grows up to 10 feet long! This fish group is the most frequently observed in County nontidal streams, with 16 species found during this assessment:

## Eastern Blacknose Dace
## *(Rhynichthus atratulus)*

Images: Voucher specimen (2020) (left) and Ellen Edmonson, NYDEC, right.

## Distribution:

Widespread in the County and frequent when observed. The most frequently observed fish during this baseline. Found in most watersheds in the County.

## Origin:

Native to Maryland.

## Conservation Status:

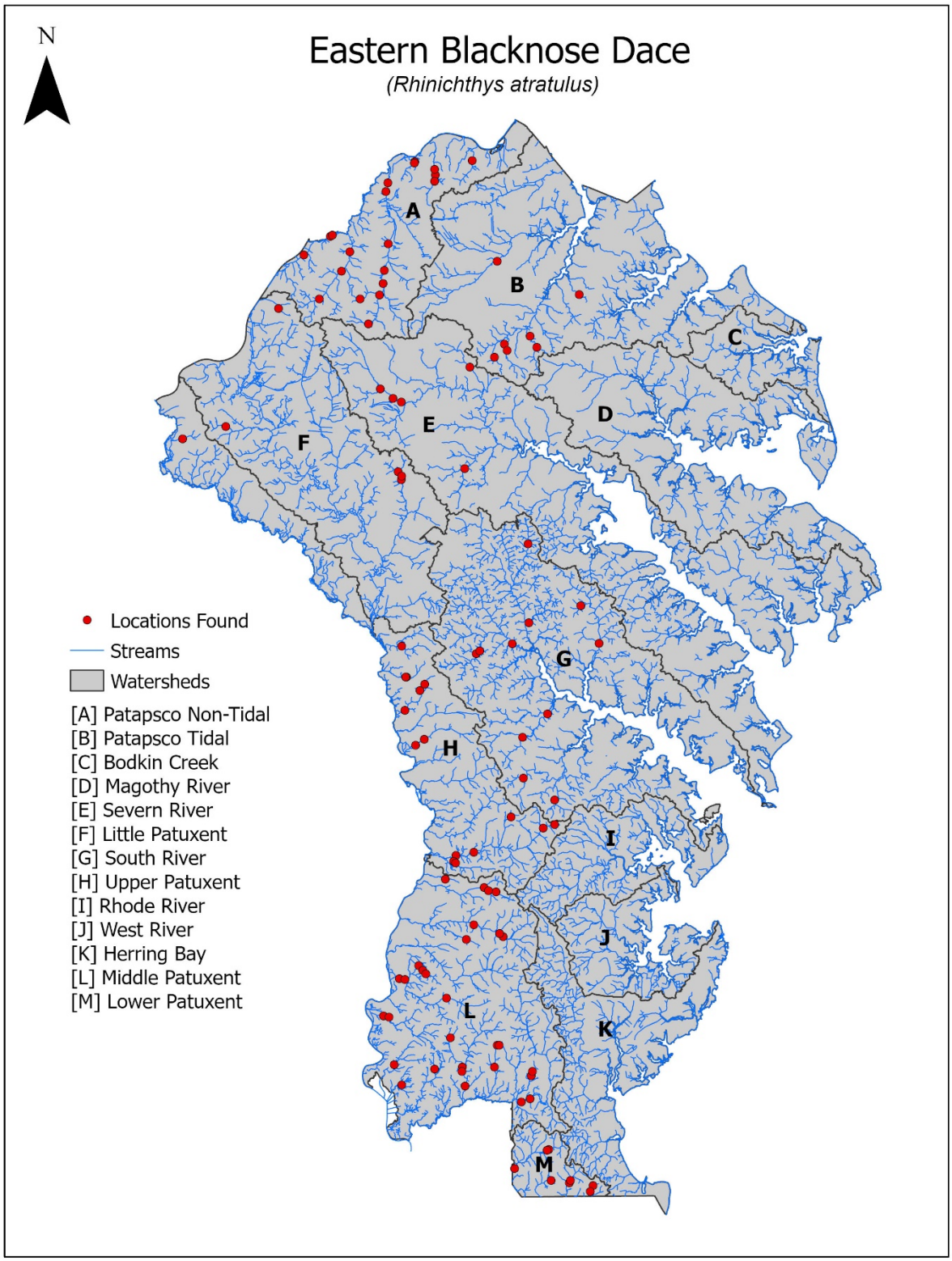
No special protections under state or federal law.

## Description:

The Eastern Blacknose Dace is a minnow species with a black lateral band that extends from its pointed snout to the base of the tail (1, 2). It has very small scales, which give it a smooth appearance (1). It is distinguished from its cousin the Longnose Dace by its shorter snout that does not extend much past its mouth and that the center of its pupil is in line with the lateral stripe across its face (1). Adults are 2.5 to 5 inches long (1).

## Life History and Habitat:

The Eastern Blacknose Dace is a common, pollution-tolerant fish found in a variety of different stream habitats, from clear, running waters to still pools (1). As a generalist and omnivore, they feed on an assortment of stream insects and algae (4). Spawning takes place from late spring to early summer, where both males and females construct nests of small pebbles. Breeding males may appear reddish in color during the breeding season (1). Maximum life expectancy is thought to be three to four years (4).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## Creek Chub
## *(Semotilus atromaculatus)*

Images: Brian Gratwicke (left) and voucher specimen (2019) (right).

## Distribution:

Common in the County and somewhat frequent where found. Found mostly in the Patapsco and Patuxent River watersheds.

## Origin:

Native to Maryland.

## Conservation Status:

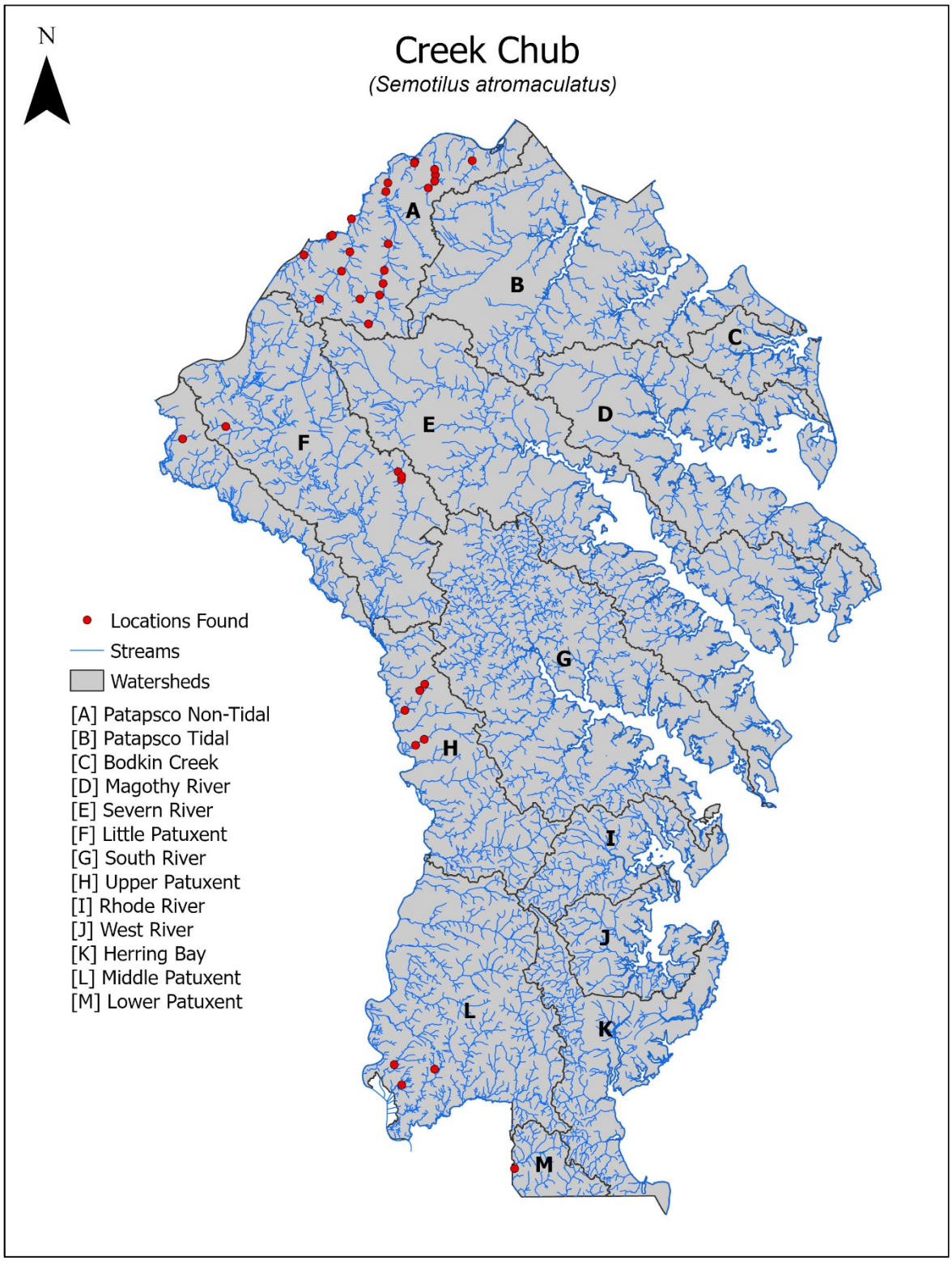
No special protections under state or federal law.

## Description:

The Creek Chub is a silvery-green minnow ranging in size from 3 to 12 inches (1). The dark spot at the front base of the dorsal fin is a key identifier (1, 2). It has a large mouth that extends past the front of the eye (1). It has a dark olive back with a silver-white belly and often has a black stripe down its side, although this is usually more prominent on younger individuals and is weakly expressed on mature adults (1, 2). Dorsal and caudal fins can have a light red tint, but are often grey-white, with considerable variation between individuals.

## Life History and Habitat:

The Creek Chub is an adaptable fish that feeds on a variety of stream insects, fish, and mollusks (1, 8), depending upon its life history stage (8). It prefers small to medium sized streams with gravel bottoms, but will live over a variety of substrates (8). This species prefers deep pool areas with abundant instream cover like aquatic vegetation and woody debris (8). Creek Chubs spawn from late March to early May (1). The Creek Chub excavates a nest pit in the stream bottom, which is vigorously guarded as it attempts to attract females with which to mate. As eggs are laid, the male covers them with gravel and digs another pit just downstream and repeats the process (1). Highly successful males may thus create a ridge of nests that can be a few feet in length (1). The species reaches an age of at least seven years (1, 8).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## Fallfish
*(Semotilus corporalis)*

Images: Ellen Edmonson, NYDEC, (left) and 2018 voucher specimen (right).

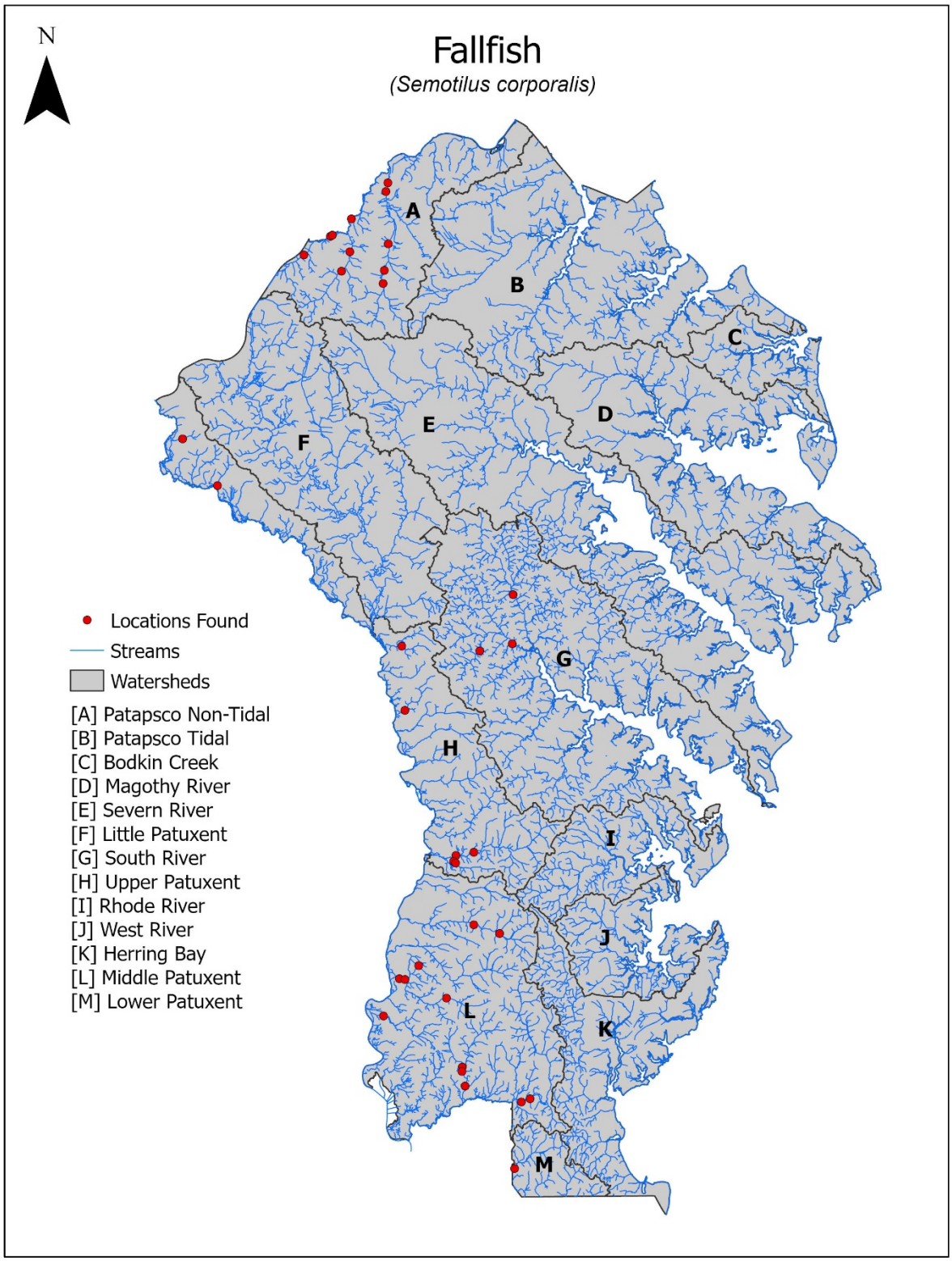
## Distribution:
Somewhat common in the County and somewhat frequent where found. Found mostly in the Patuxent, Patapsco, and South River watersheds.

## Origin:
Native to Maryland, but only found in the Chesapeake Bay drainage. Maryland represents the southern edge of its range.

## Conservation Status:
No special protections under state or federal law.

## Description:
Known as the largest native minnow in Eastern North America, the Fallfish is a silvery fish with large scales; breeding males can also have a purplish sheen (1). The body scales can have crescent-shaped dark bars at their bases and the dorsal fin origin is directly over the pectoral fin origin (2). Individuals can range up to 20 inches in length (1, 20).

## Life History and Habitat:
The Fallfish is a somewhat pollution-sensitive fish that prefers medium to large creeks with rubble, sand or gravel bottoms, although this species will use silt-bottomed areas, too (1). Fallfish are omnivorous, feeding on aquatic and terrestrial insects, crustaceans, algae, and fish (21). Spawning takes place in the spring when males construct large nests of sand and gravel; the nest-building males, secondary males, and several females may all spawn together (20, 21). This species is known to reach 11 years of age (21).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## Rosyside Dace
*(Clinostomus funduloides)*

Images: Ryan Hagerty, USFWS (left), and a 2018 voucher photo (right).

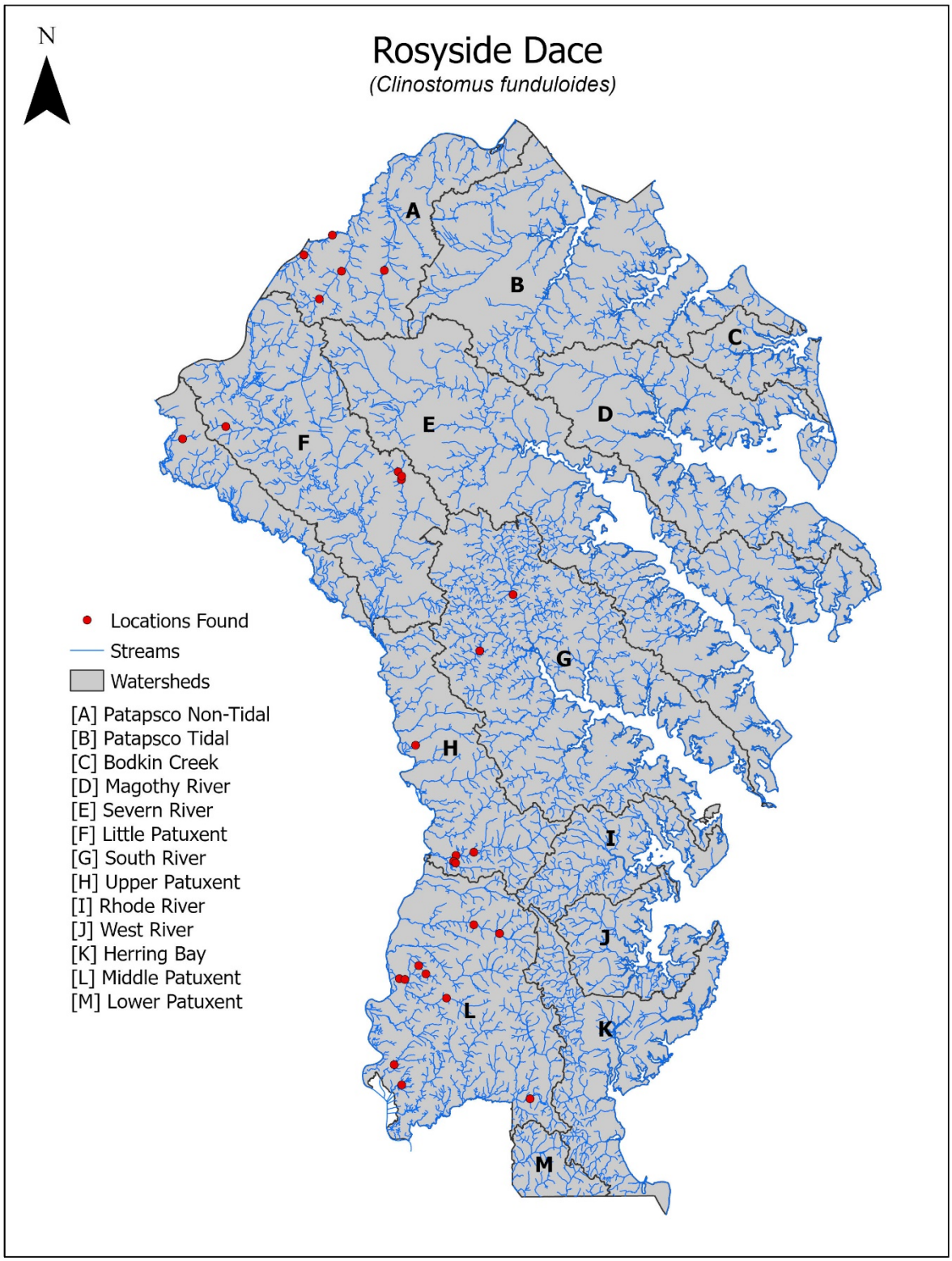
## Distribution:
Somewhat common in the County and somewhat frequent where collected. Found mostly in the Patuxent and Little Patuxent River watersheds.

## Origin:
Native to Maryland.

## Conservation Status:
No special protections under state or federal law.

## Description:
The Rosyside Dace is olive green with a midline stripe that is diffuse (1). During breeding, males will develop a bright red lower side, from which this species' common name is derived (1). After breeding season, males—and females all year—usually have a red patch or slash just behind the gill covering (1). The eye diameter is also equal to the snout length, which is somewhat rounded in shape (2). Individuals range in size between 2 and 4 inches (1).

## Life History and Habitat:
This species is found in flowing pools in a range of stream sizes, from headwater creeks to small rivers (1). This species feeds on a variety of terrestrial and aquatic insects by drift feeding in flowing pools and other habitat areas (1, 14). Spawning takes place from spring to early summer (1) and individuals are believed to live a maximum of four years.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[J] West River
[K] Herring Bay
[L] Middle Patuxent
[M] Lower Patuxent

## Swallowtail Shiner
*(Notropis procne)*

Images: Hugh Chrisp, NYDEC (left), and a voucher specimen from 2017.

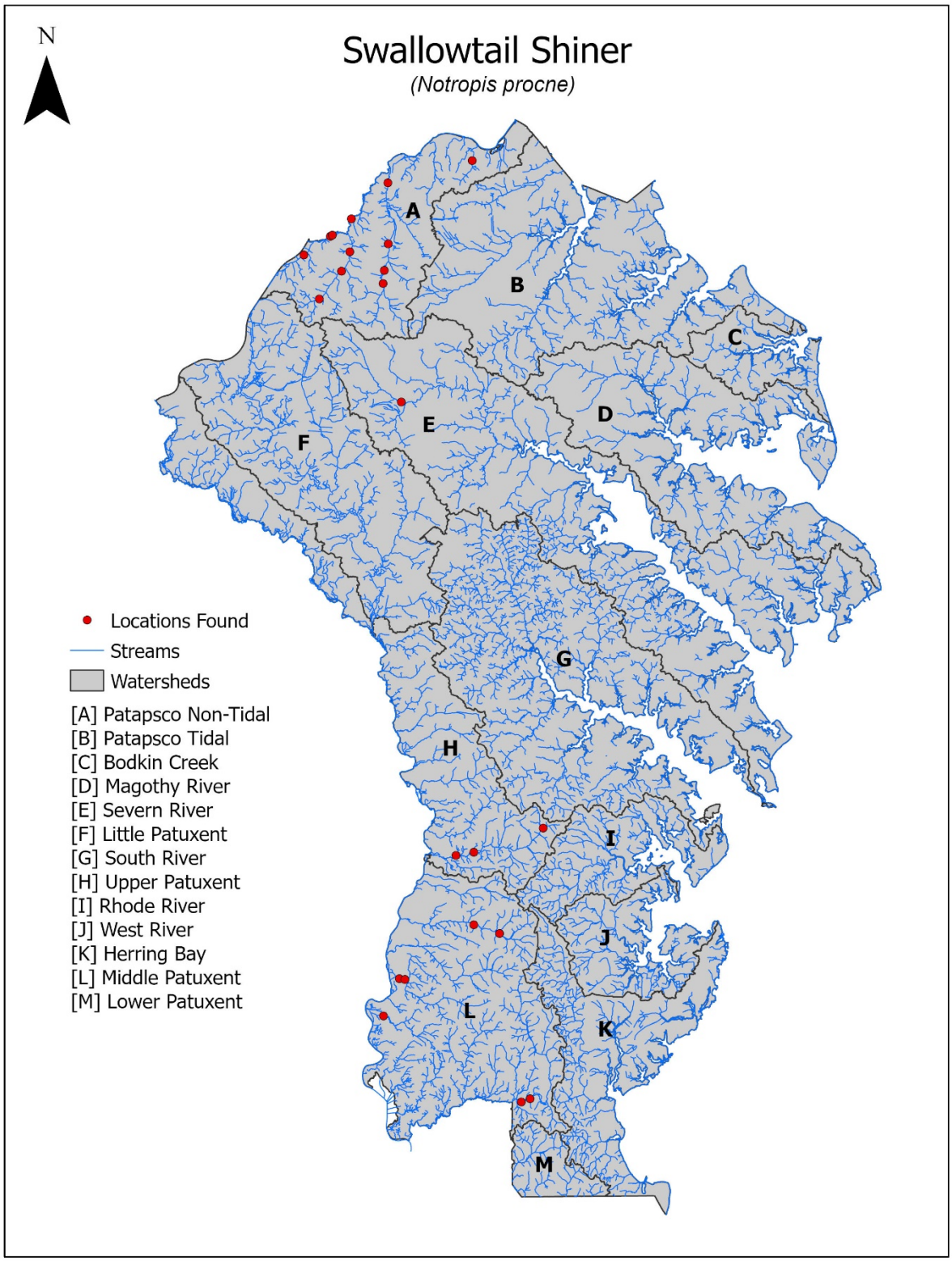
## Distribution:
Somewhat common in the County and somewhat frequent where found. Found mostly in the Patuxent, Severn, and Patapsco River watersheds.

## Origin:
Native to Maryland.

## Conservation Status:
No special protections under State or federal law.

## Description:
One of several shiners found in the County, the Swallowtail Shiner ranges in size from 1.5 to almost 3 inches. A somewhat delicate species, one identifying characteristic is the stripe along the midline, which appears to have dash-like markings that extend downward from the lateral line (2). The midline stripe does not continue forward of the eye, although there may be a dark spot on the snout (1).

## Life History and Habitat:
This species can occur in headwater creeks to smaller rivers. Preferred habitat includes pools and runs with sand or gravel bottoms (1, 9). Swallowtail Shiners eat larva of aquatic and terrestrial insects, along with diatoms, algae, and small crustaceans (13). Spawning is presumed to occur from spring to early summer, with males establishing small territories in shallow run or riffle areas of moderate velocity over substrates of sand and fine gravel (13). A male will breed with multiple females. It is unknown if either parent provides care to the eggs or fry. Individuals are thought to live a maximum of three years (13).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[J] West River
[K] Herring Bay
[L] Middle Patuxent
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## Golden Shiner
*(Notemigonus crysoleucas)*

Images: Noel Burkhead, USGS (left), and a 2018 voucher photo (right).

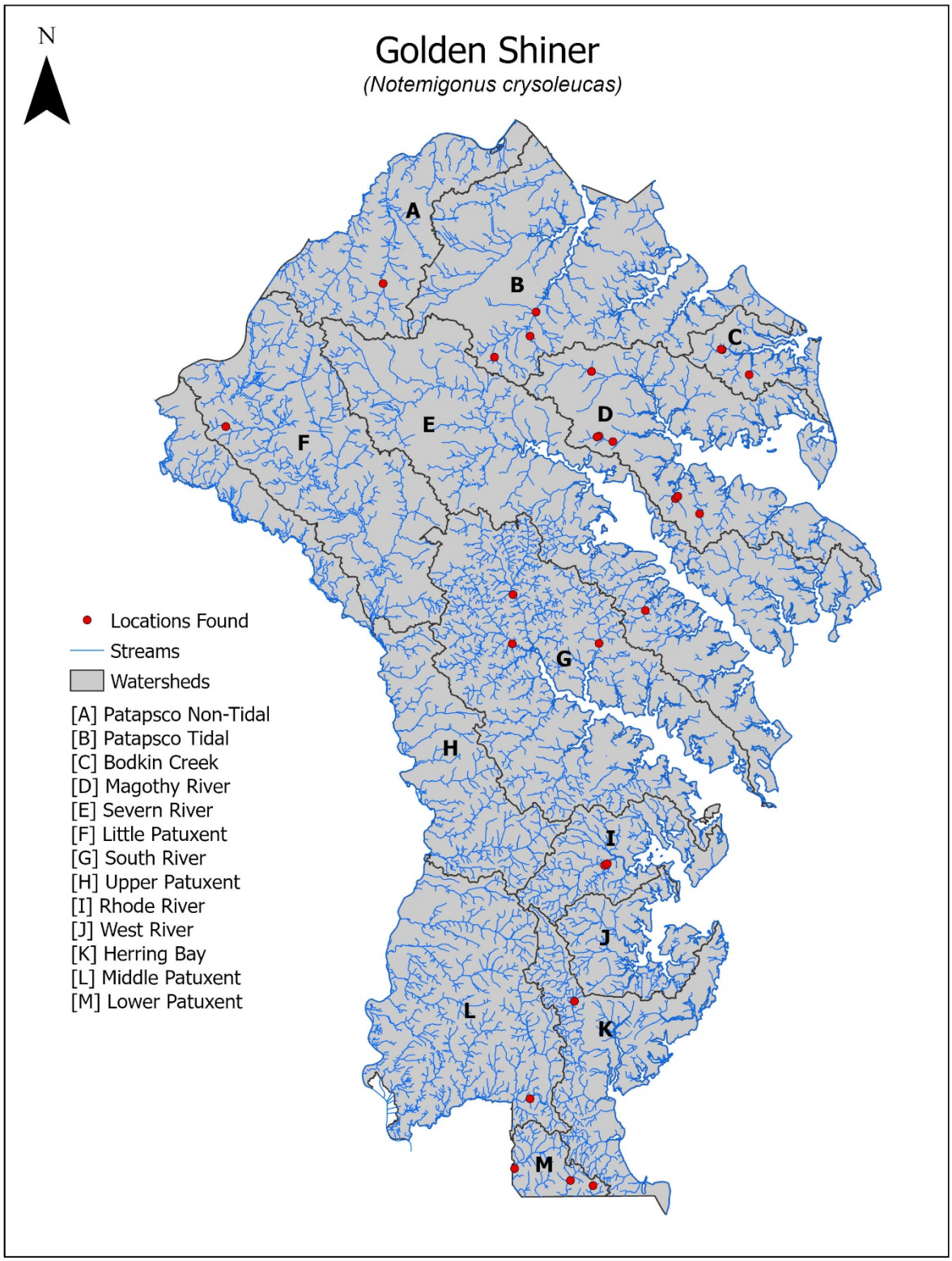
## Distribution:
Somewhat common in the County and somewhat frequent where found. Found mostly in the Magothy, South, and Patapsco River watersheds.

## Origin:
Native to Maryland.

## Conservation Status:
No special protections under state or federal law.

## Description:
The Golden Shiner is a silver to brass colored fish with a short and sharp keel present, just forward of the anus (1, 2). Fin color can vary from light brown-grey to medium orange-red. The lateral line is sharply curved in a downward arc along the slab sided body, unlike most fish in County streams where the lateral line is straight across the midpoint of the body (1, 2). Individuals can range up to 12 inches in length (1).

## Life History and Habitat:
The Golden Shiner is a somewhat pollution-tolerant fish that prefers vegetated, soft-bottomed habitat areas and tends to live in slower moving parts of rivers and creeks or in lakes or wetlands (1). This species is omnivorous, feeding on aquatic and terrestrial insects, crustaceans, algae, and fish (1). Spawning takes place from spring to late summer, where the sticky eggs are scattered over rooted plants or filamentous algae and abandoned (1). It is a favorite forage fish for a variety of predatory fish and water bird species.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[K] Herring Bay
[L] Middle Patuxent
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## Fathead Minnow
*(Pimephales promelas)*

Images: Duane Raver, USFWS (left), and a 2018 voucher photo (right).

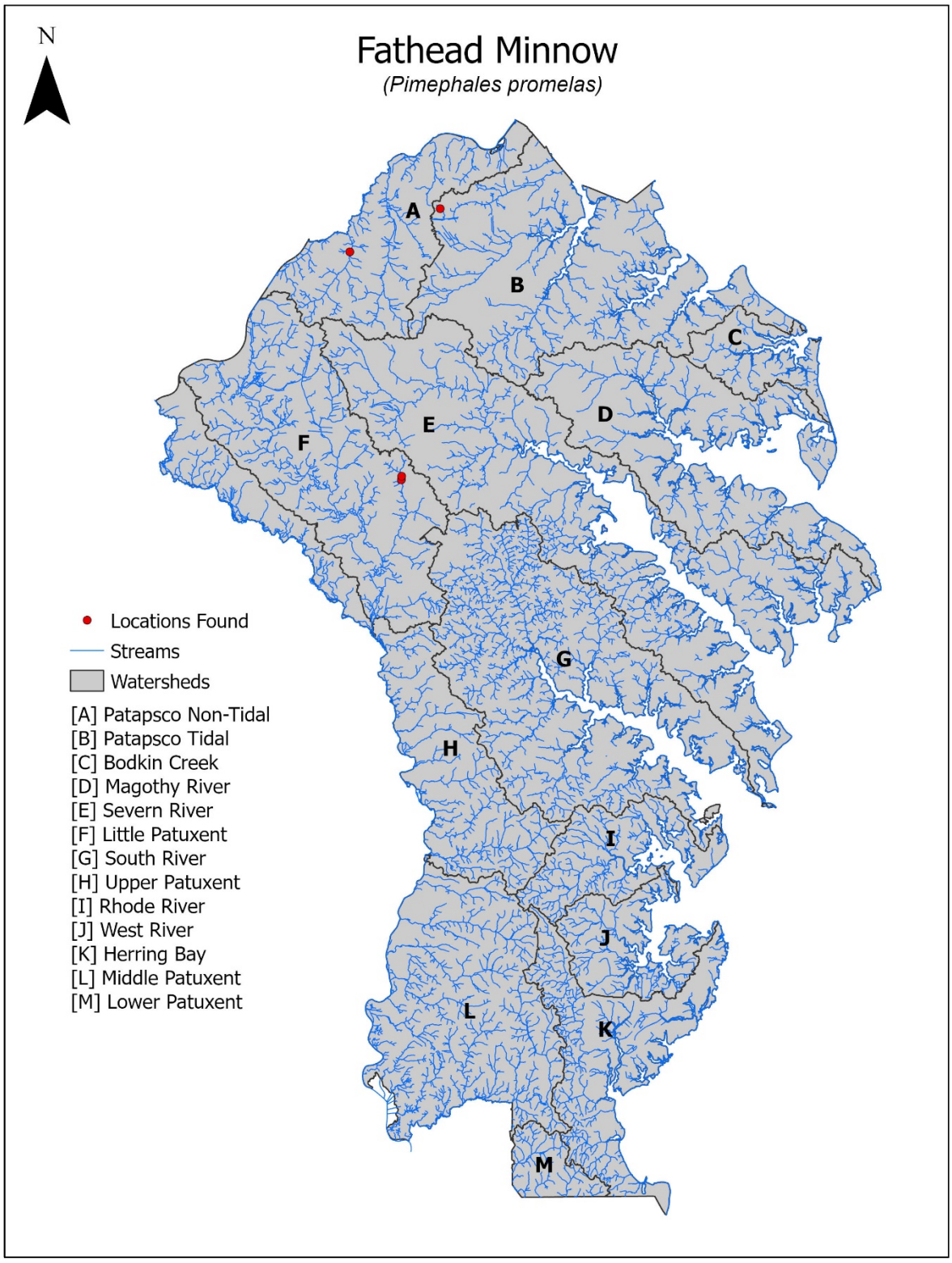
## Distribution:
Uncommon in the County, but somewhat frequent where found. Observed mostly in the Patapsco River watershed (Sawmill Creek).

## Origin:
Not native to Maryland, but introduced all over the state due to extensive use as a bait fish.

## Conservation Status:
No special protections under state or federal law.

## Description:
The Fathead Minnow has a dark green upper body and is sliver below (22) and can have herringbone type markings along its side (1, 2). The lateral line is incomplete (2). The head is blunt and the upturned mouth extends to the tip of the snout (2). Males are generally larger than females and, during breeding, develop black heads with several rows of bumps (tubercles) on the snout forward of the eye (2, 22). Individuals can range up to 3 inches in length (23).

## Life History and Habitat:
The Fathead Minnow is a pollution-tolerant fish that is commonly found in slow moving parts of streams, wetland areas, and ponds and lakes (22). This species is omnivorous and sifts through mud and silt to find food (23). Spawning takes place from summer to early fall, where males prepare nests on the underside of horizontal objects and will spawn with multiple females in a season (23). Nests are aggressively defended by males until the eggs hatch (23). This species can live up to 4 years in captivity (23).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[K] Herring Bay
[L] Middle Patuxent
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## Satinfin Shiner
*(Cyprinella analostana)*

Images: Noel Burkhead, USGS (left), and a 2020 voucher photo (right).

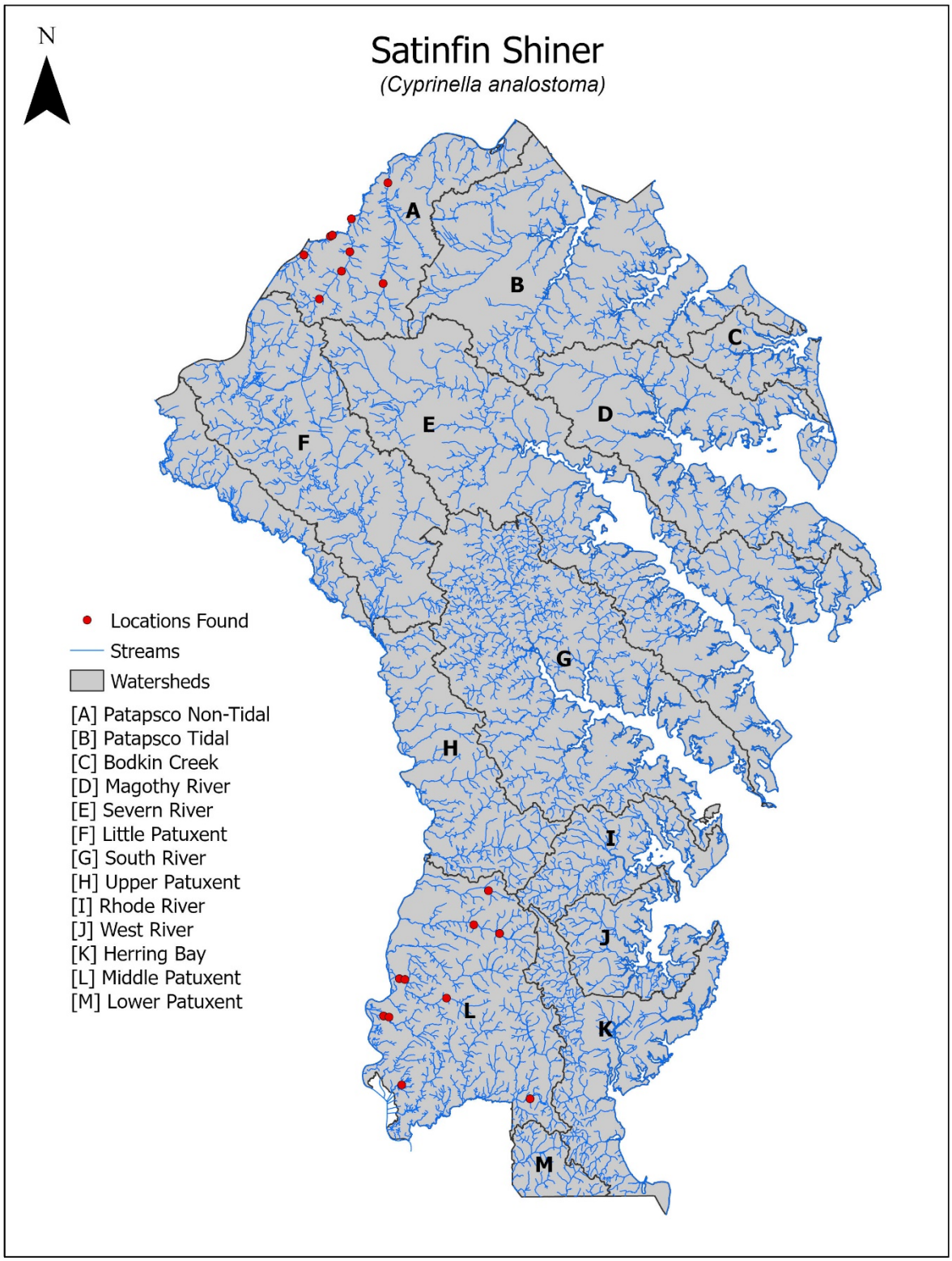
## Distribution:
Somewhat common in the County and somewhat frequent where found. Observed mostly in the Patapsco and Patuxent River watersheds.

## Origin:
Native to Maryland.

## Conservation Status:
No special protections under state or federal law.

## Description:
The Satinfin Shiner is a nondescript minnow species that ranges in size from 2 to 4 inches long (1). This species can be difficult to identify (1), but distinctive characteristics include a black blotch on the back half of the dorsal fin and dark speckles on the rest of the fin (1). Scales can also appear somewhat diamond shaped due to the dark pigment along their margins (2). Males, during breeding season, may exhibit a silver-blue color that graduates to white on the belly and a milky-white border along all fins (28).

## Life History and Habitat:
This species is found in runs and pools of small to medium sized rivers, often over gravel and/or rocky bottoms (1, 28), and is somewhat intolerant to impaired water quality conditions. A sight feeder, this species feeds on drifting items in the water column, including fish eggs and larvae, algae, and insects (1, 28). Breeding begins in May and can continue to August (1, 28). Males establish territories that are vigorously defended and lure females to nesting areas using various vocalizations (28). Nests and young are not cared for after breeding occurs (1). The Satinfin Shiner lives between three and four years (48).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[K] Herring Bay
[L] Middle Patuxent
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## Central Stoneroller
## *(Campostoma anomalum)*

Images: Ellen Edmonson, NYDEC (left), and Robert Aguilar, SERC / MD Biodiversity Project (right).

## Distribution:

Uncommon in the County and infrequent where collected, this species occurs only in the Patapsco Nontidal River watershed.

## Origin:

Native to Maryland.

## Conservation Status:

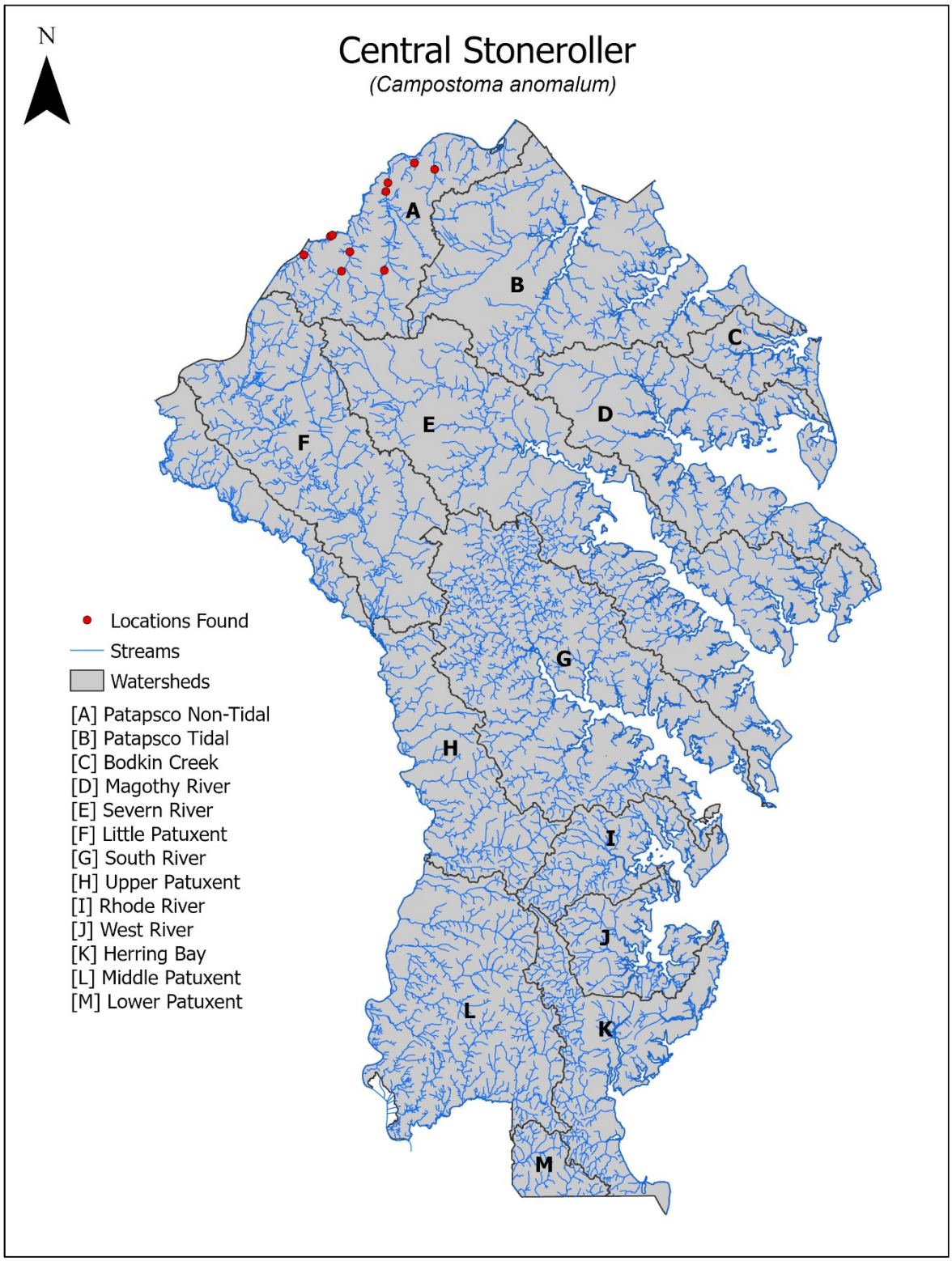
No special protections under state or federal law.

## Description:

The Central Stoneroller is a round bodied minnow that has a distinct hard ridge along the lower jaw (1, 2). Colors range from tan to brown, but during breeding season, males become more distinctive, developing orange-red fins, distinct black bands on the dorsal and anal fins, whitish lips, and extensive and distinctive bumps (called tubercles) along the upper part of the body (1). Individuals range from 5 to 10 inches long (1).

## Life History and Habitat:

The Central Stoneroller is a pollutant-intolerant species that prefers to inhabit rocky riffles and run areas in streams of moderate current, but will also be found in pool areas (1). Primarily an herbivore, the Central Stoneroller uses its sharp lower lip to scrape algae off of stones (1), but they will also consume macroinvertebrates and larval fish (31). Spawning occurs from mid to late spring. The males make circular nests in the shallow water at the head of riffles, moving large stones with the back and head, giving this species its name (1). The eggs are sticky and are not cared for by either parent (1). This species lives up to five years (1).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[K] Herring Bay
[L] Middle Patuxent
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## Longnose Dace
*(Rhinichthys cataractae)*

Images: Ellen Edmonson, NYDEC (left), and Emilio Concari, MD Biodiversity Project (right).

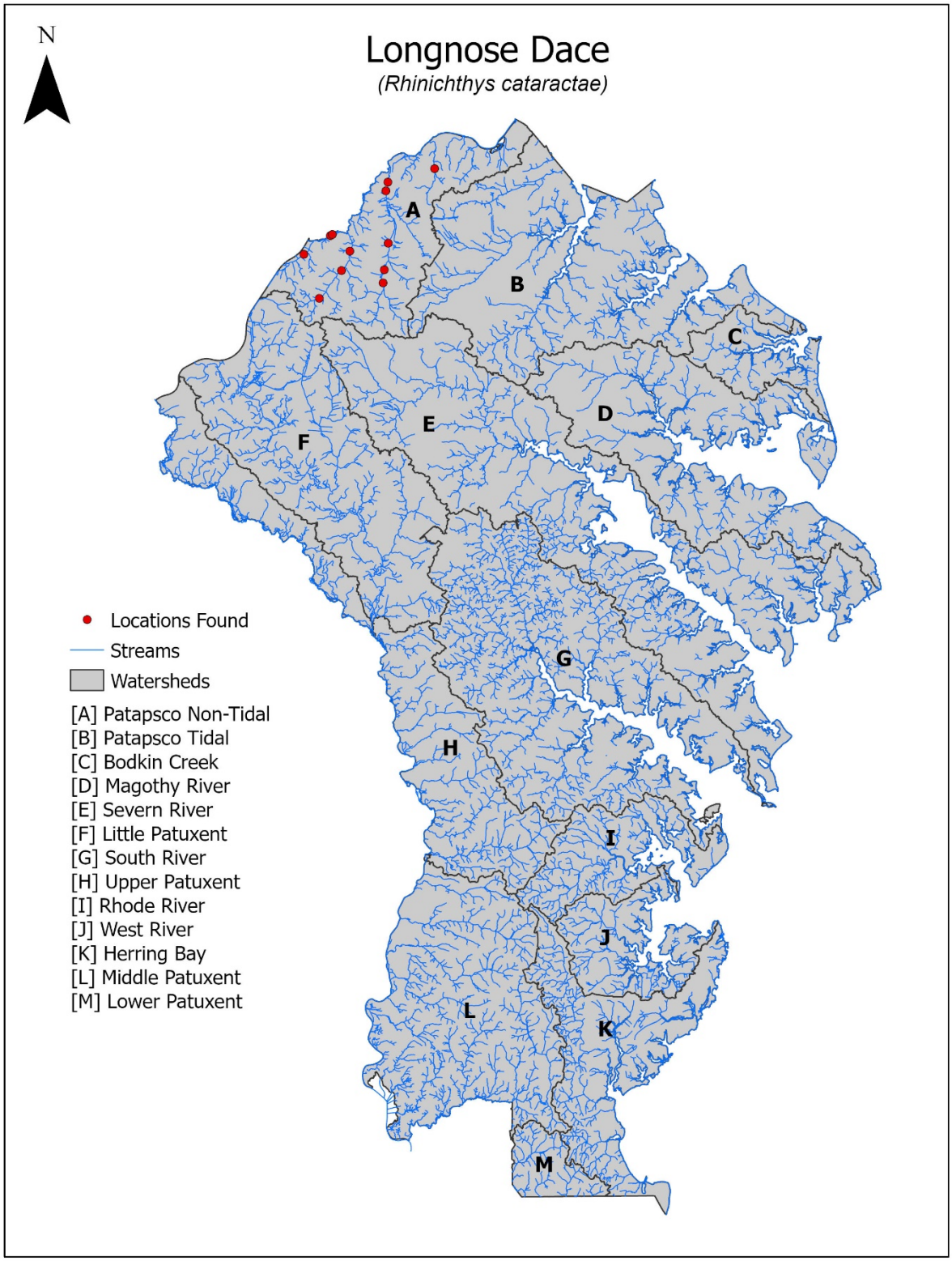
## Distribution:
Uncommon in the County and infrequent where collected, this species was observed only in the Patapsco Nontidal River watershed.

## Origin:
Native to Maryland.

## Conservation Status:
No special protections under state or federal law.

## Description:
The Longnose Dace has a diffuse black line that runs along the side of the body where at the front of the head, it crosses the eye below its center instead of crossing through the center, as it does with the very similar and more common Blacknose Dace (1, 2). The snout is also quite long, ending well past the end of the mouth (2). Individuals range from 3 to 6 inches long (1).

## Life History and Habitat:
The Longnose Dace is a somewhat pollutant tolerant (32) minnow species often found in gravel or cobble riffles having current speeds approaching two feet per second (1, 32), although they are also found in slower moving parts of the stream (1). An omnivore, this species eats algae, aquatic insects, crustaceans, and worms (1). Spawning occurs from late spring (32) to mid-summer (2) when males construct nests in gravel riffles, in fast moving water, that are defended against other males (32). Longnose Dace live at least five years (2, 32).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[K] Herring Bay
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## Bluntnose Minnow
*(Pimephales notatus)*

Images: Maynard Reece, Iowa DNR (left), and Ryan Hagerty, USFWS (right).

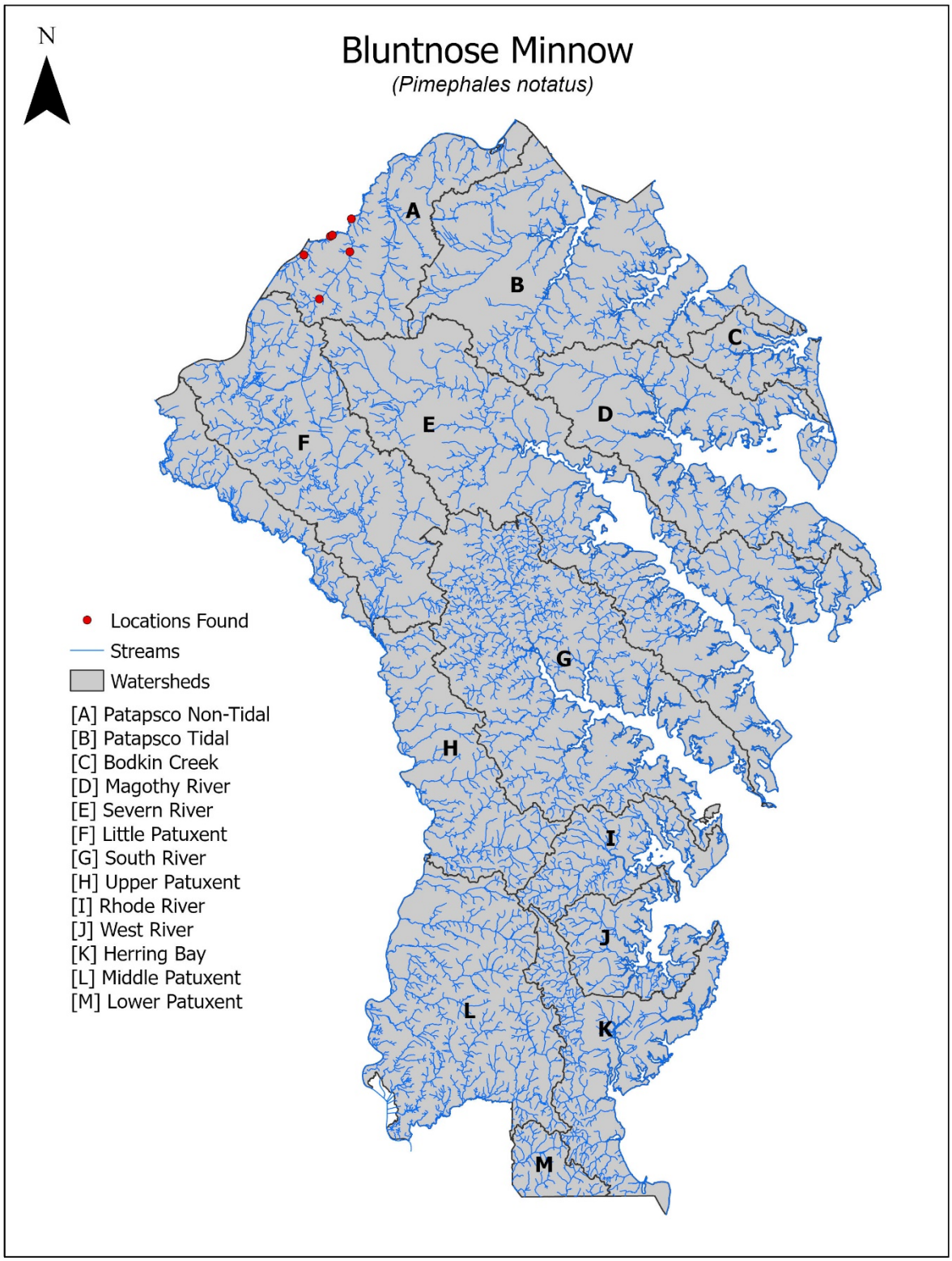
## Distribution:
Uncommon in the County and infrequent when found. Found only in the Patapsco River watershed.

## Origin:
Native to Maryland.

## Conservation Status:
No special protections under state or federal law.

## Description:
The Bluntnose Minnow is a somewhat slender minnow with an almost cylindrical cross section, with a snout that extends to just past the end of the mouth (1, 40). The color on the back is a dark olive green with a slivery belly and a dusky grey to black stripe along the midline, with a dark spot present at the base of the tail (1). Scales are crowded and irregular in shape along the top quarter of the fish, above the midline and forward of the dorsal fin, and all scales have a dark outline (1, 40). Individuals range in size from 1.5 to 4.5 inches (1).

## Life History and Habitat:
Tolerant of warm water, this somewhat pollutant-tolerant species is found in quiet parts of medium to large sized creeks and rivers with low turbidity (1, 40). Bluntnose Minnows also prefer gravel or rock bottoms (1). This species primarily feeds on algae, larval insects, small crustaceans, and diatoms (1, 40). Breeding takes place from May to August, with males constructing a nest under a rock or log, after which a female enters and attaches her eggs to the underside of the sheltering object (1). Males maintain and defend the nest (1). Bluntnose Minnows can live up to five years (41).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[K] Herring Bay
[L] Middle Patuxent
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## Spottail Shiner
*(Notropis hudsonius)*

Images: Ellen Edmonson, NYDEC (left), and 2020 voucher specimen (right).

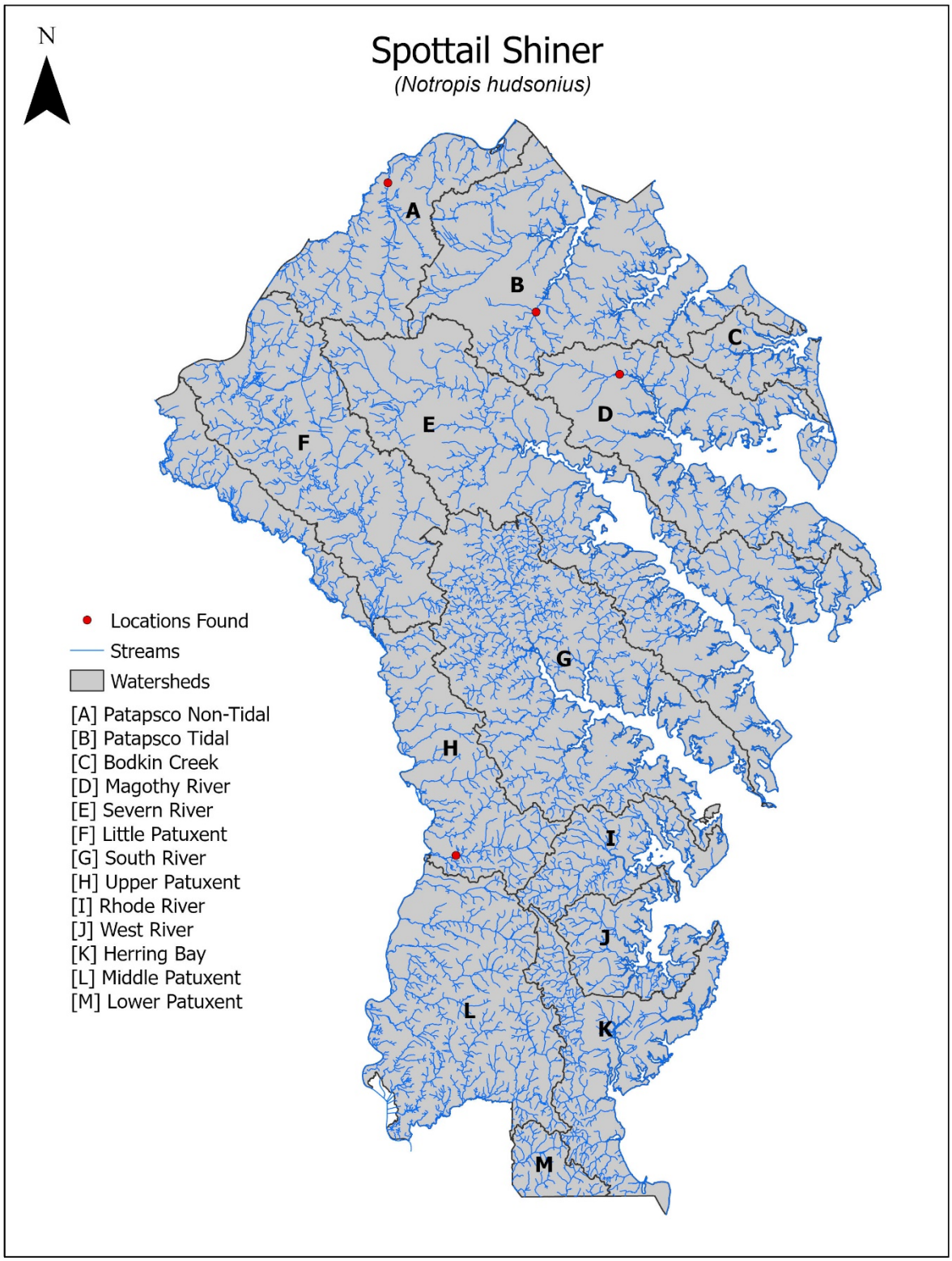
## Distribution:
Uncommon in the County and infrequent when found. Found primarily in the Patapsco Tidal and Nontidal River watersheds.

## Origin:
Native to Maryland.

## Conservation Status:
No special protections under state or federal law.

## Description:
The Spottail Shiner is a silvery fish with a dark spot at the base of the tail and a dorsal fin that can be slightly curved along its back edge, giving it a slightly indented edge (2). It often has an incomplete lateral stripe and the mouth does not reach to the end of the snout (2). Individuals range from 2 to 5 inches (49).

## Life History and Habitat:
Considered somewhat sensitive to pollution, the Spottail Shiner is generally found in shallower parts of streams and rivers over gravel or rock bottoms (1). This species feeds on aquatic and terrestrial insect larvae, algae, small crustaceans, and diatoms (2). Spawning likely occurs in spring and summer over sand and gravel bottoms (1, 49). Spottail Shiners live around two to three years (50).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## Common Shiner
*(Luxilus cornutus)*

Images: Ellen Edmonson, NYDEC (left), and Emilio Concari, MD Biodiversity Project (right).

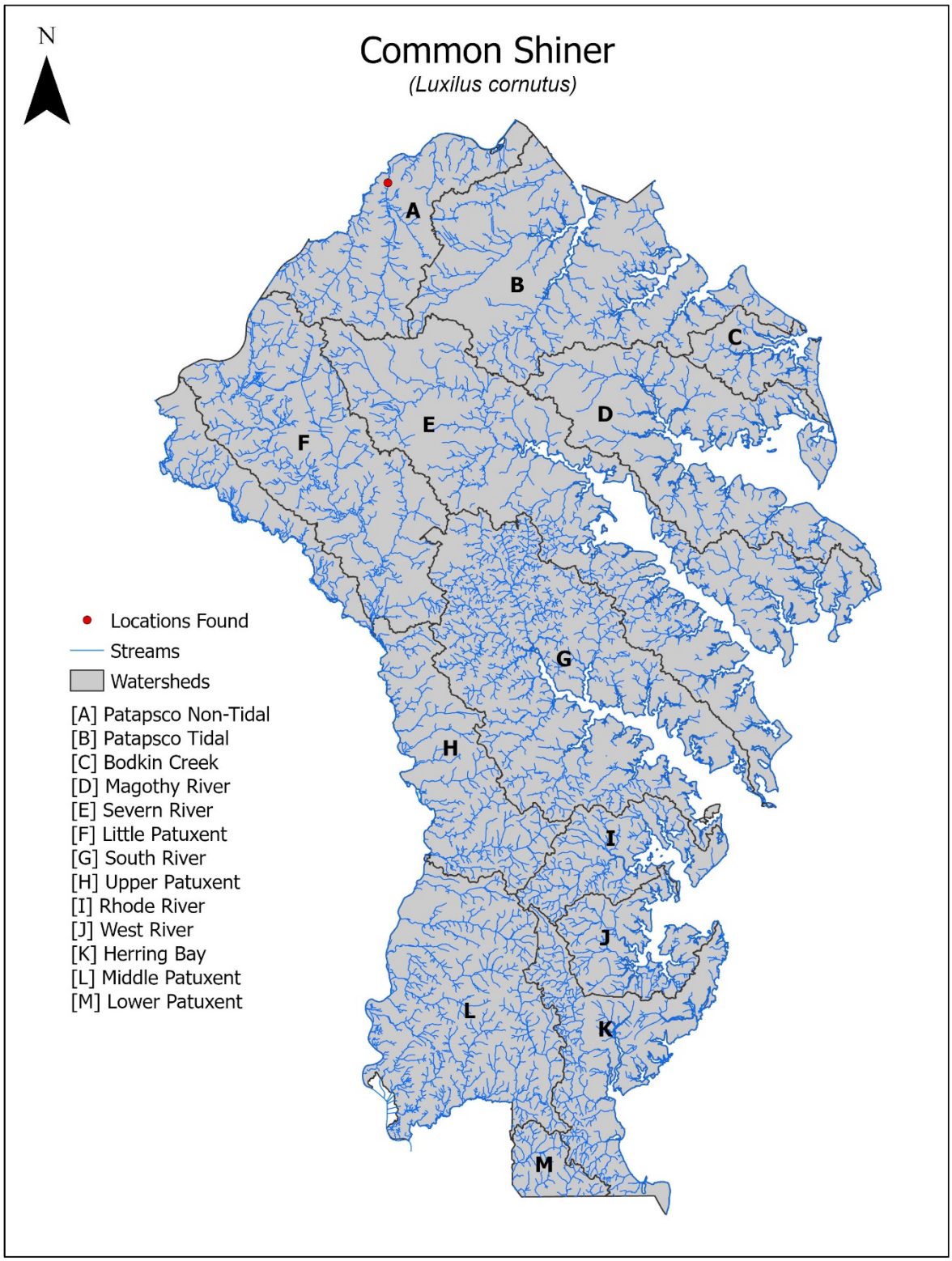
## Distribution:
Uncommon in the County and infrequent when found. Found only in the Patapsco Nontidal River watershed.

## Origin:
Native to Maryland.

## Conservation Status:
No special protections under state or federal law.

## Description:
A difficult species to distinguish from other shiners, the Common Shiner has a series of faint dusky lines along the upper part of the body that do not converge on the back (as they do with the Striped Shiner, a close relative) (1, 2). Scales along the lateral line are also about two times as tall as wide and the dorsal fin starts behind the origins of the pelvic fins (2). Lengths range from 3 to 8 inches (1).

## Life History and Habitat:
The Common Shiner is somewhat sensitive to water quality disturbances. Individuals are found over gravel and sand riffle areas and in pool areas with moving water present (1, 52). This species is a generalist feeder and takes a variety of insect larvae, algae, and detritus as food (1). Occurring from mid-spring to mid-summer, nesting and spawning is reported to occur preferentially over rock riffles (52) and also occurs in the abandoned nests of other riffle-nesting species (1). No parental care is reported. The Common Shiner can live up to four years (1).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## Cutlip Minnow
## *(Exoglossum maxillingua)*

Images: Benji Beluga, MD Biodiversity Project (left), and close up of a 2018 voucher specimen showing the lower jaw (right).

## Distribution:

Uncommon in the County and very infrequent when found. Found only in the Patapsco Nontidal River watershed.

## Origin:

Native to Maryland.

## Conservation Status:

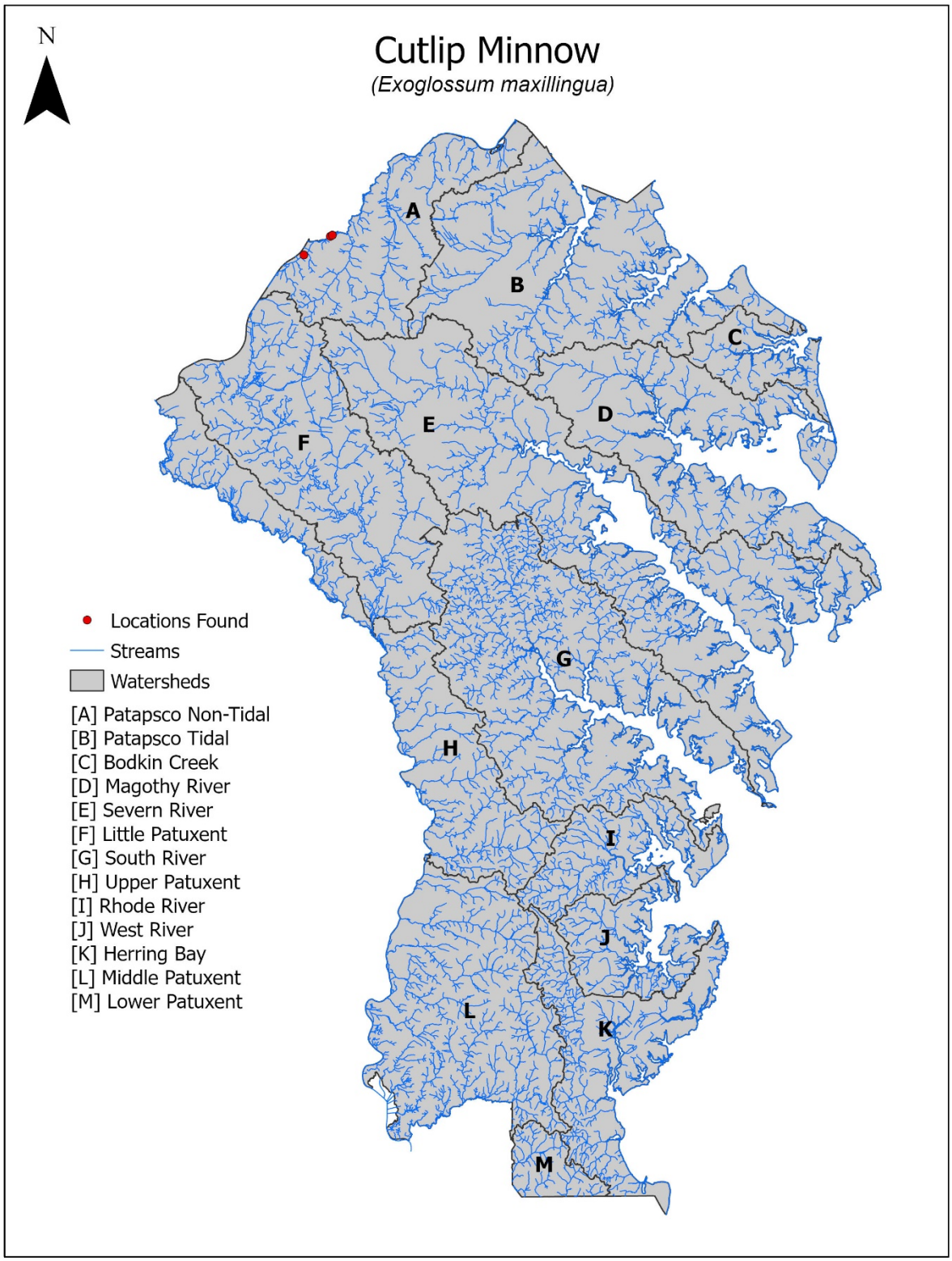
No special protections under state or federal law.

## Description:

The Cutlip Minnow is grey-yellow above and pale on the belly (1). The distinguishing characteristics are the three lobes found on the lower jaw-- two fleshy ones on the sides and a thinner, bonier one in the middle (see circle in picture, above right) (1, 2). Individuals range from 4 to 6 inches (1).

## Life History and Habitat:

The Cutlip Minnow is found in small to moderate streams and rivers, preferring gravel, cobble and boulder bottoms and undercut bank areas (1). The diet for this species consists entirely of aquatic insect larvae, with smaller individuals eating mostly non-biting midge larvae and larger specimens eating caddisflies and mayflies (53). Males construct large nests of stones and gravel, which are vigorously defended against other males (1, 53). After the eggs are laid, males stay on the nest and keep it free of silt, with young remaining on the nest for a few days after hatching (1). The Cutlip Minnow lives up to four years (53).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## River Chub
*(Nocomis micropogon)*

Images: Hugh Chrisp, NYDEC (left), and Ryan Douglas, MD Biodiversity Project (right).

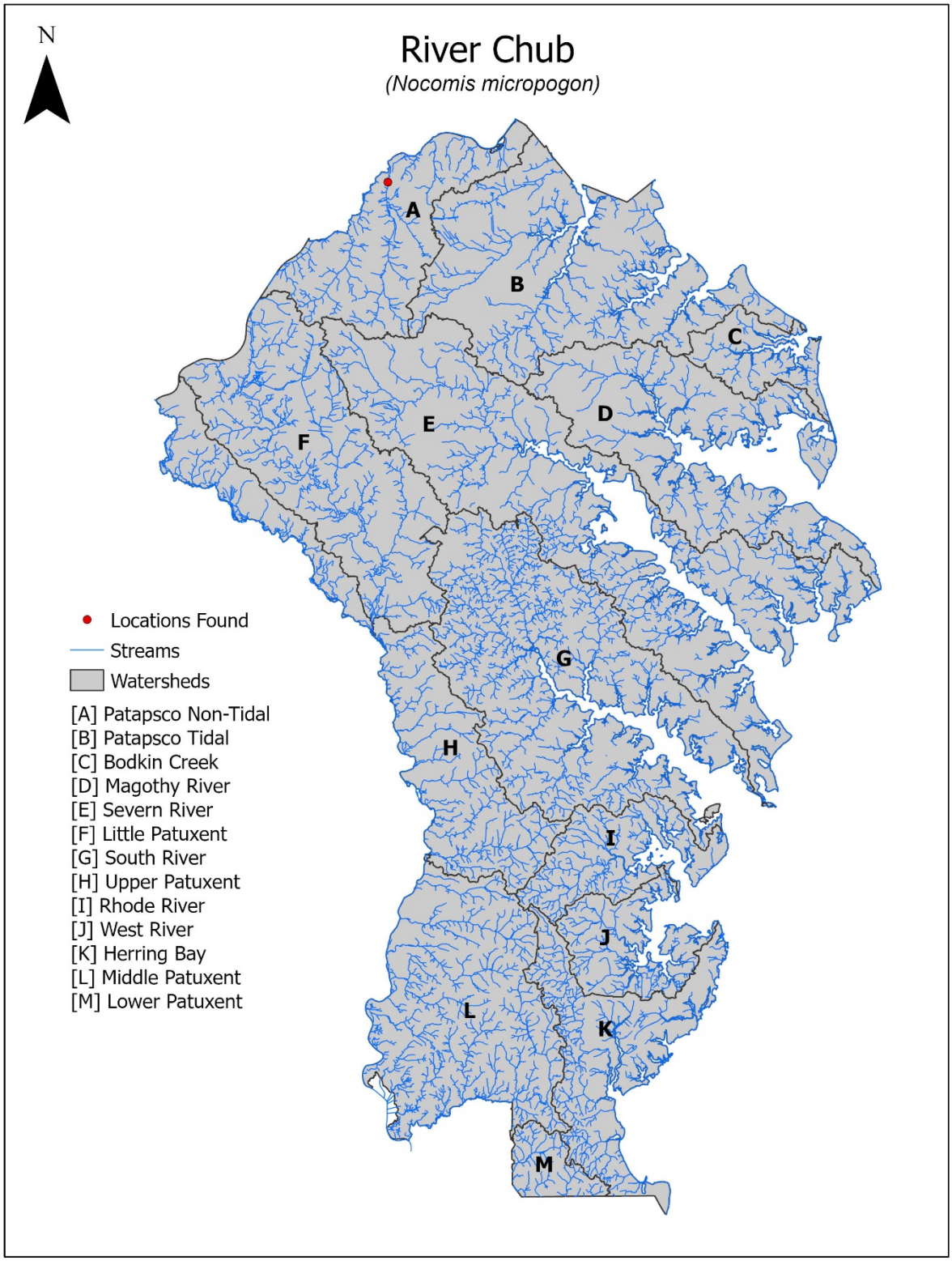
## Distribution:
Seldom found in the County and very infrequent when found. Observed only in the Patapsco Nontidal River watershed.

## Origin:
Native to Maryland.

## Conservation Status:
No special protections under state or federal law.

## Description:
The River Chub is a sturdy minnow with an overall bronze color that, in breeding males, can transition to a light pink along the belly (1). Also, males will develop small white bumps called breeding tubercles over their heads (1, 2), although it should be noted that other related minnow species develop these tubercles, too (1, 2). Other identifying characteristics include small barbels at the corners of its mouth and an upper lip that is separate and not attached to the skin of the head along its length (1, 2). Individuals range from 3.5 to 13 inches (1).

## Life History and Habitat:
This species prefers clean, clear and fast moving water, with bottoms varying from sand to large cobbles (1, 56), although they have been observed over grass beds in certain locations (56). River Chubs eat aquatic insects and their larvae, small fish and crustaceans, and plants (1, 56). Males construct very large nests of mounded pebbles that have been reported to nearly four feet in diameter and six to seven inches high (1, 56). After courtship, females and males simultaneously release eggs and milt into a trench at the upstream edge of the nest, allowing the fertilized eggs to settle into the gravel (1, 56). Many other species of minnows use River Chub nests for their breeding, which likely explains the high number of hybrids between River Chubs and other species (1, 56). The likely maximum age for this species is five years (56).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## Goldfish
*(Carassius auratus)*

Images: Voucher photos from 2018.

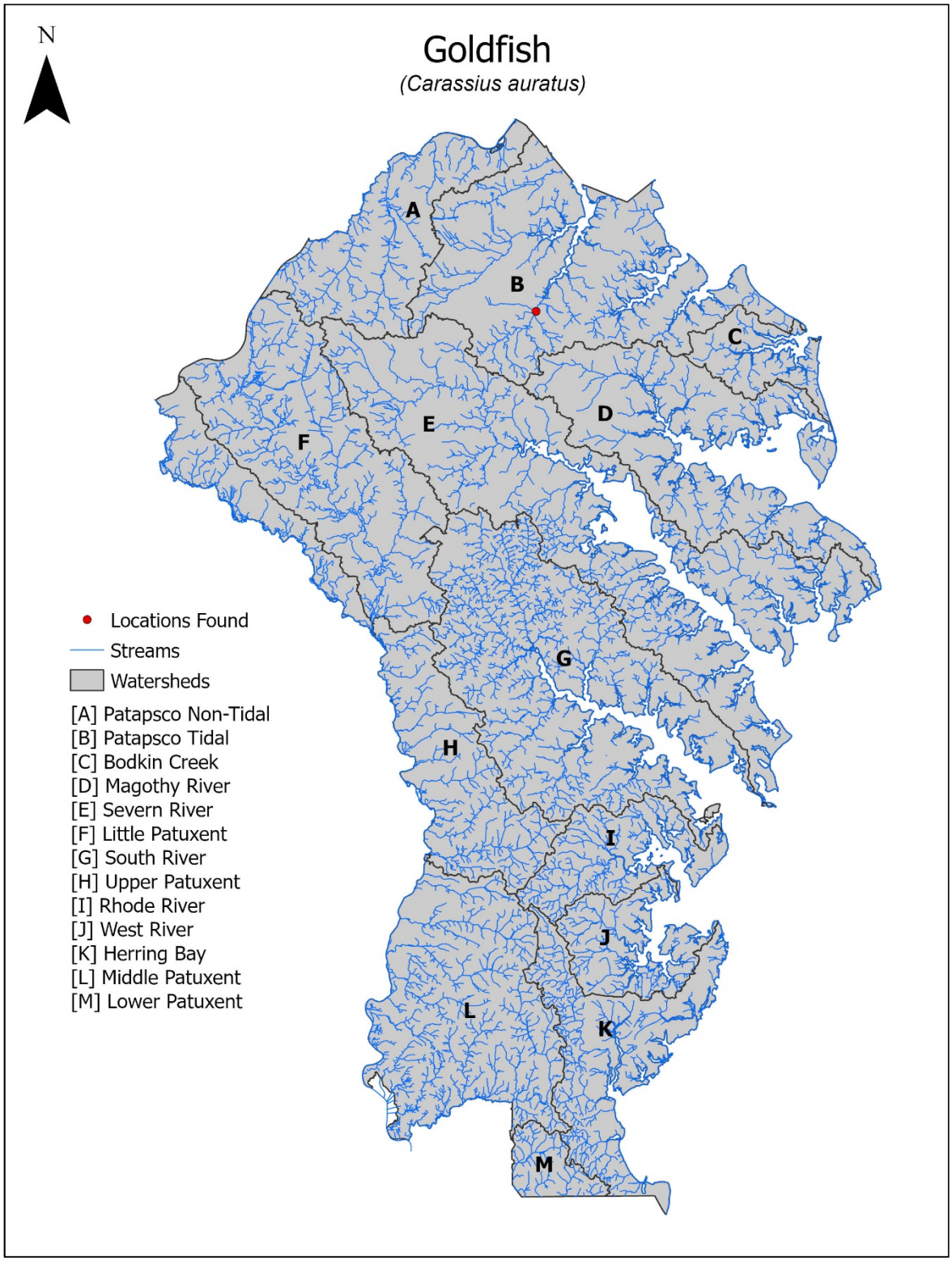
## Distribution:
Seldom found in the County and very infrequent when found. Observed only in the Patapsco Tidal River watershed.

## Origin:
Not native, but naturalized and found throughout Maryland.

## Conservation Status:
No special protections under state or federal law.

## Description:
The Goldfish is perhaps the world's most popular minnow. In the wild, it reverts to its silver-olive color as it breeds, but recently introduced individuals may still be found with the bright silver, orange (see above photo, right), and black colors popular in the aquarium trade (1). It has a stiff ray at the beginning of its dorsal fin that is serrated (1). Scales are large and lack the black dots found in the Common Carp, its close relative. Another key difference from the Common Carp is its lack of barbels on the upper jaw (1). These species hybridize, however, so intermediate forms are possible (1). Individuals range from about 5 inches to 16 inches (1).

## Life History and Habitat:
A tolerant species, the Goldfish prefers clear and slow waters found in slow rivers or lakes and is found over silt or other soft bottoms near submerged aquatic vegetation (1). This species will feed on a variety of live animals and plants and is also considered a scavenger (1). In Maryland, spawning likely occurs from mid-spring to early-fall, as this species will spawn as long as water temperatures are over 60 °F (1). Eggs are attached to aquatic vegetation or other objects, then fertilized, and large females can lay several thousand eggs in a season (1). Goldfish are known to live as long as 30 years, but six to seven years is considered more typical (1).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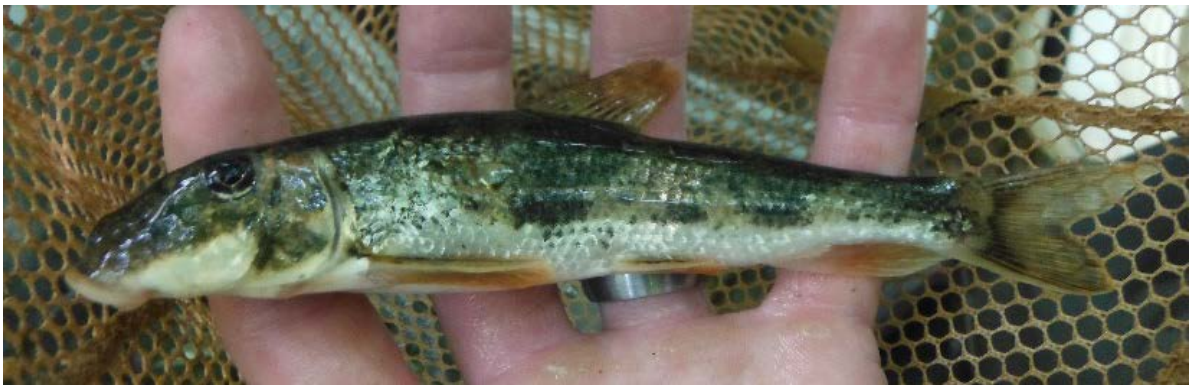
# SUCKERS
## (Family *Catostomidae*)

Characterized by the distinctive downturned mouth on the underside of the head, suckers are found all over North America, with about 25 species found in the Mid-Atlantic region, seven of which are found in Maryland. Of the species found in Maryland, three were observed in the County:

- White Sucker (*Catostomus commersonii*) p. 48
- Creek Chubsucker (*Erimyzon oblongus*) p. 50
- Northern Hogsucker (*Hypentelium nigricans*) p. 52



Northern Hogsucker

## White Sucker
## *(Catostomus commersonii)*

Images: Brian Gratwicke (left) and 2018 voucher specimen (right).

## Distribution:

Common in the County and somewhat frequent where found. Found in the Patuxent, Little Patuxent, Patapsco, and Severn River watersheds.

## Origin:

Native to Maryland.

## Conservation Status:

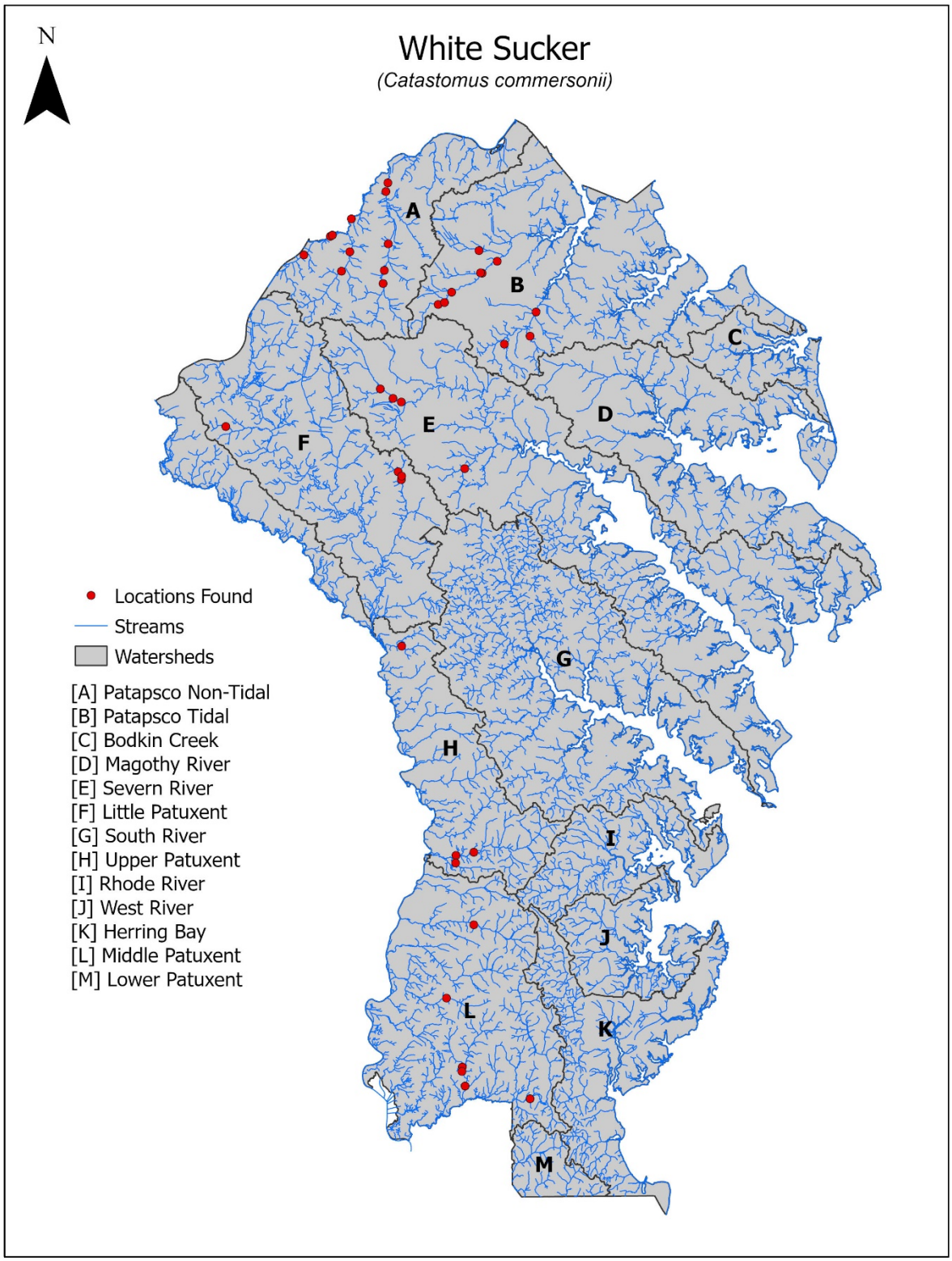
No special protections under state or federal law.

## Description:

The White Sucker is a silver-white fish ranging from 10 to 25 inches in length with a round, torpedo shaped body (1). It has a somewhat short snout that just projects beyond the end of the upper lip (2) and a horizontal, fleshy, down-facing mouth (1) often associated with sucker-type fishes.

## Life History and Habitat:

The White Sucker is a somewhat pollution-tolerant fish found in a variety of different stream habitats, from clear, running waters to still pools (1, 17, 18). As a bottom-feeding generalist and omnivore, they feed on an assortment of stream insects and algae (17). Spawning takes place in March and April and occurs over areas in the system where gravel is present (1, 17). Nests are prepared by the males and eggs typically hatch in 8 to 11 days (1). White Suckers can live to be 15 years old (1).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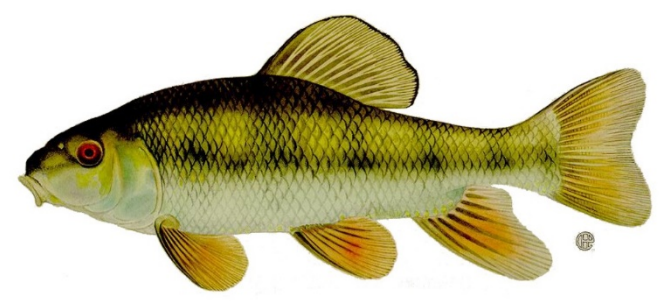
## Creek Chubsucker
*(Erimyzon oblongus)*



Images: Hugh Chrisp, NYDEC (left), and a 2018 voucher photo (right).

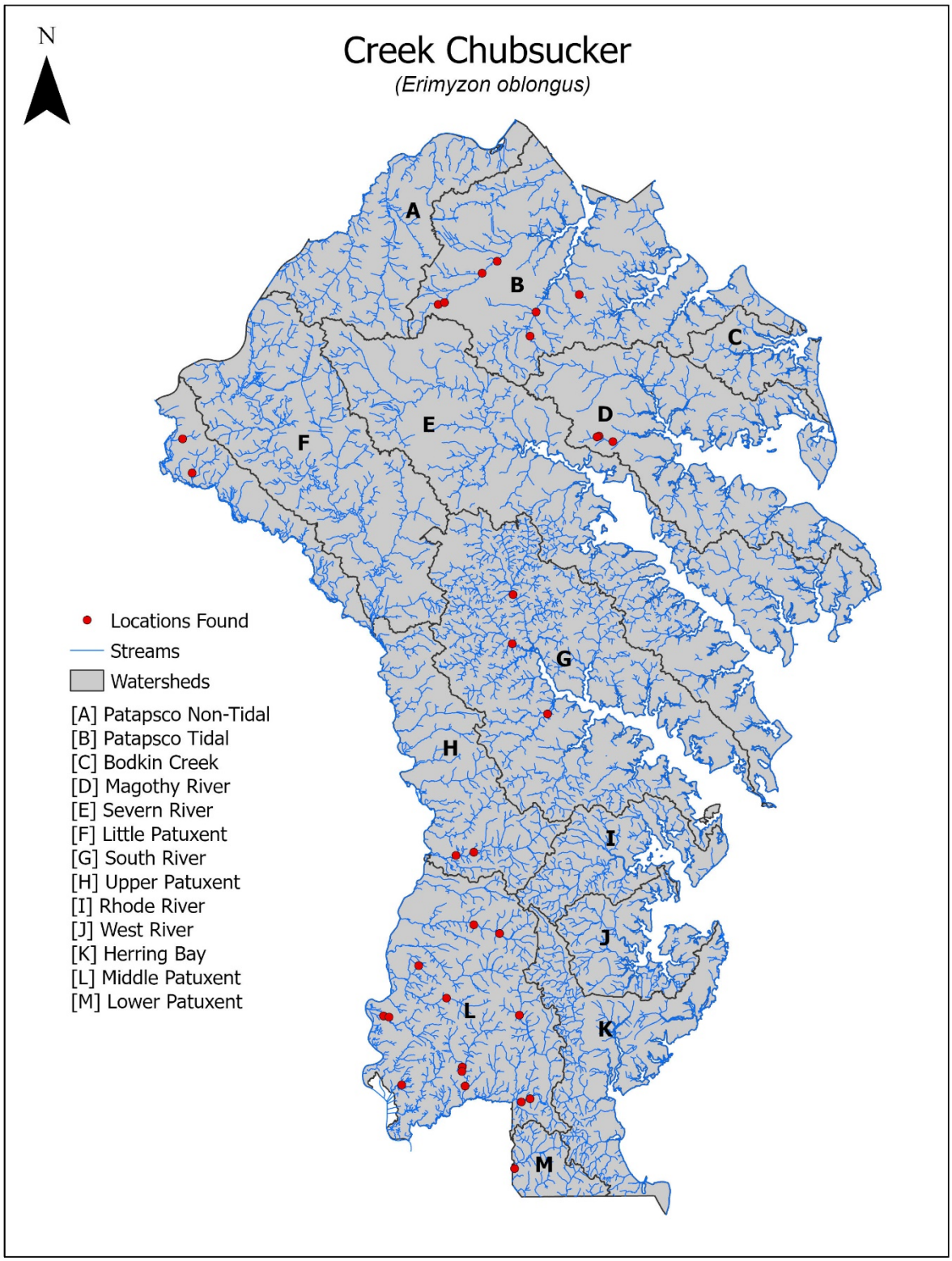
## Distribution:
Somewhat common in the County and somewhat frequent where found. Observed mostly in the Patapsco and Patuxent River watersheds, with limited occurrence in the Magothy and South River watersheds.

## Origin:
Native to Maryland

## Conservation Status:
No special protections under state or federal law.

## Description:
The Creek Chubsucker is a sucker with a stout body and coloration that varies meaningfully with age. Young fish have a silver white body and a distinct black band along the middle of the body (see picture, above right) while in adult and sub adult fish, this band becomes a series of vertical bands (see illustration, above left) or a more uniform yellow green color (1). The mouth is fleshy and angled upward rather than flat like many suckers (2). Importantly, this species lacks a lateral line, which is a key diagnostic feature (1, 2). Individuals range from 4.5 to 14 inches (1).

## Life History and Habitat:
The Creek Chubsucker is found in mostly slow-moving water in clear creeks and over bottoms of silt, sand or gravel, often with aquatic vegetation present, but is also found in lakes, ponds and other impoundments (1). This species feeds on a variety of aquatic insects, crustaceans, and algae (1). Breeding occurs from mid to late spring: males move to areas of sand (1) or gravel (26) with fairly fast current where they guard a patch of substrate without making a formal nest, although they may use the abandoned nests of other species (26). Creek Chubsuckers spawn in pairs or small groups (26). It is thought that this species can live up to six years (1).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[J] West River
[K] Herring Bay
[L] Middle Patuxent
[M] Lower Patuxent

## Northern Hogsucker
*(Hypentelium nigricans)*

Images: Hugh Chrisp, NYDEC (left), and 2018 voucher photo (right).

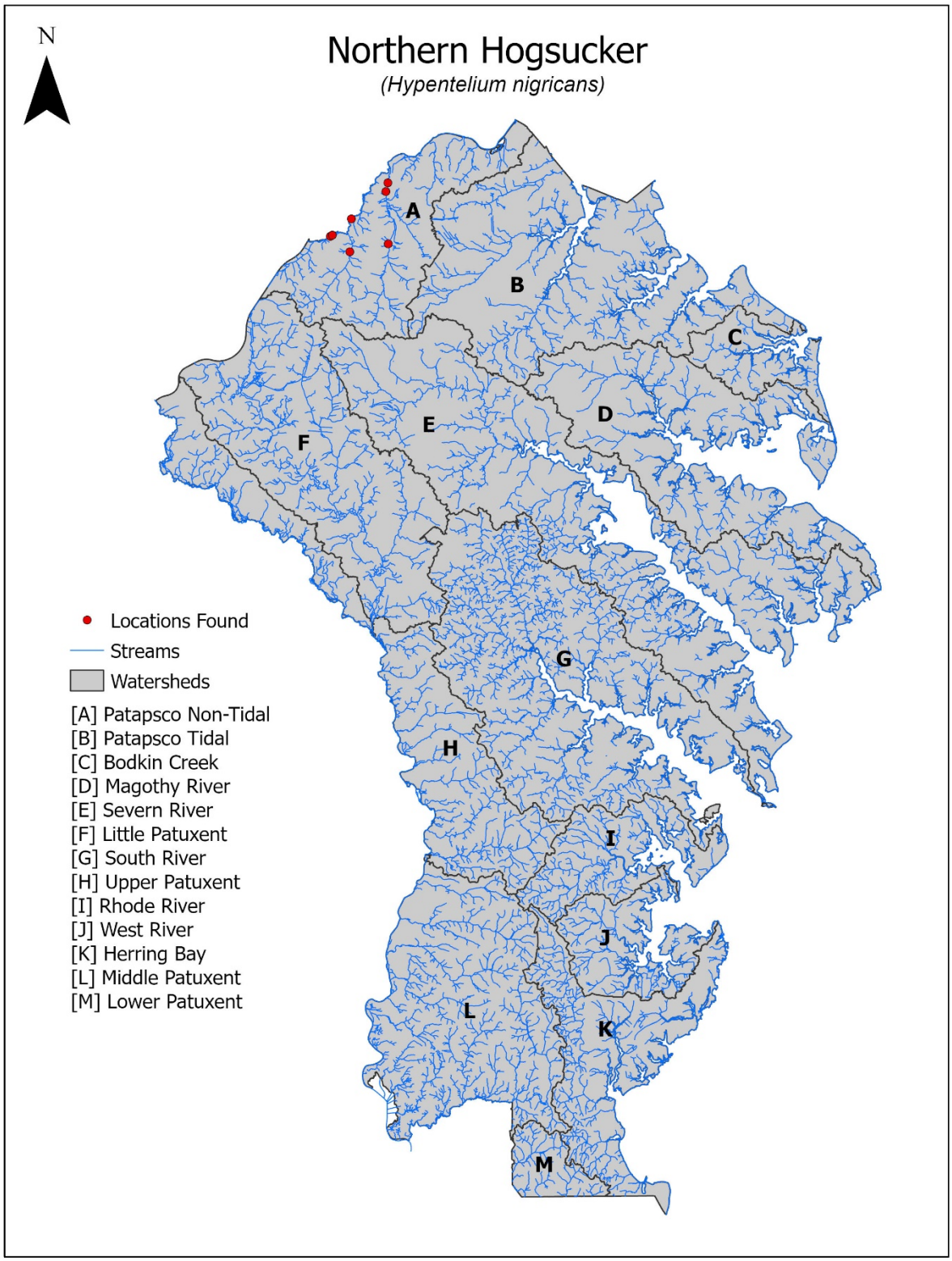
## Distribution:
Uncommon in the County and infrequent when found. Found only in the Patapsco Nontidal River watershed.

## Origin:
Native to Maryland.

## Conservation Status:
No special protections under state or federal law.

## Description:
The Northern Hogsucker is a yellowish-brown fish with three to six dark, saddle-like markings across its body and often has a light band at the base of the tail (1, 2). A key diagnostic feature for this species, however, is the concave, sunken appearance of the skull between the eyes in adult fish (1, 2). Typical of suckers, the mouth is turned downward and is surrounded by fleshy lips. Individuals range from 4 to 24 inches (1).

## Life History and Habitat:
A sensitive species, the Northern Hogsucker is found in clear and fast-moving creeks and rivers, often over gravel and larger substrates (1, 52). This species feeds on insect larvae, crustaceans, and algae that it finds as it forages in the substrate or scrapes from larger gravel and cobbles (1). Spawning occurs from mid-spring to summer (1). Eggs are scattered and fertilized over gravel riffles and the parents provide no care to the eggs (1). This species lives for up to 11 years (1).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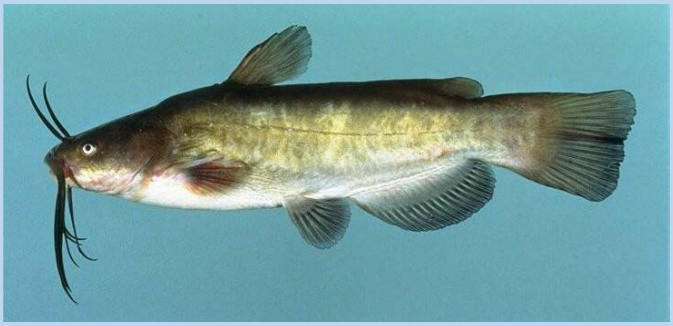
# BULLHEAD CATFISHES
## (Family *Ictaluridae*)

The distinct fleshy, whisker-like barbels, a lack of scales, and sharp spines in the pectoral and dorsal fins distinguish this fish family. The larger members of this group are commercially important. There are about 45 species distributed across North and Central America. Of the 18 species that occur in the Mid-Atlantic region, nine occur in Maryland. Four species were observed in the County:

- Brown Bullhead (*Ameiurus nebulosus*) p. 55
- Yellow Bullhead (*Ameiurus natalis*) p. 57
- Margined Madtom (*Noturus insignis*) p. 59
- Tadpole Madtom (*Noturus gyrinus*) p. 61

Brown Bullhead

## Brown Bullhead
*(Ameiurus nebulosus)*



Images: Noel Burkhead, USGS (left) and 2018 voucher photo (right).

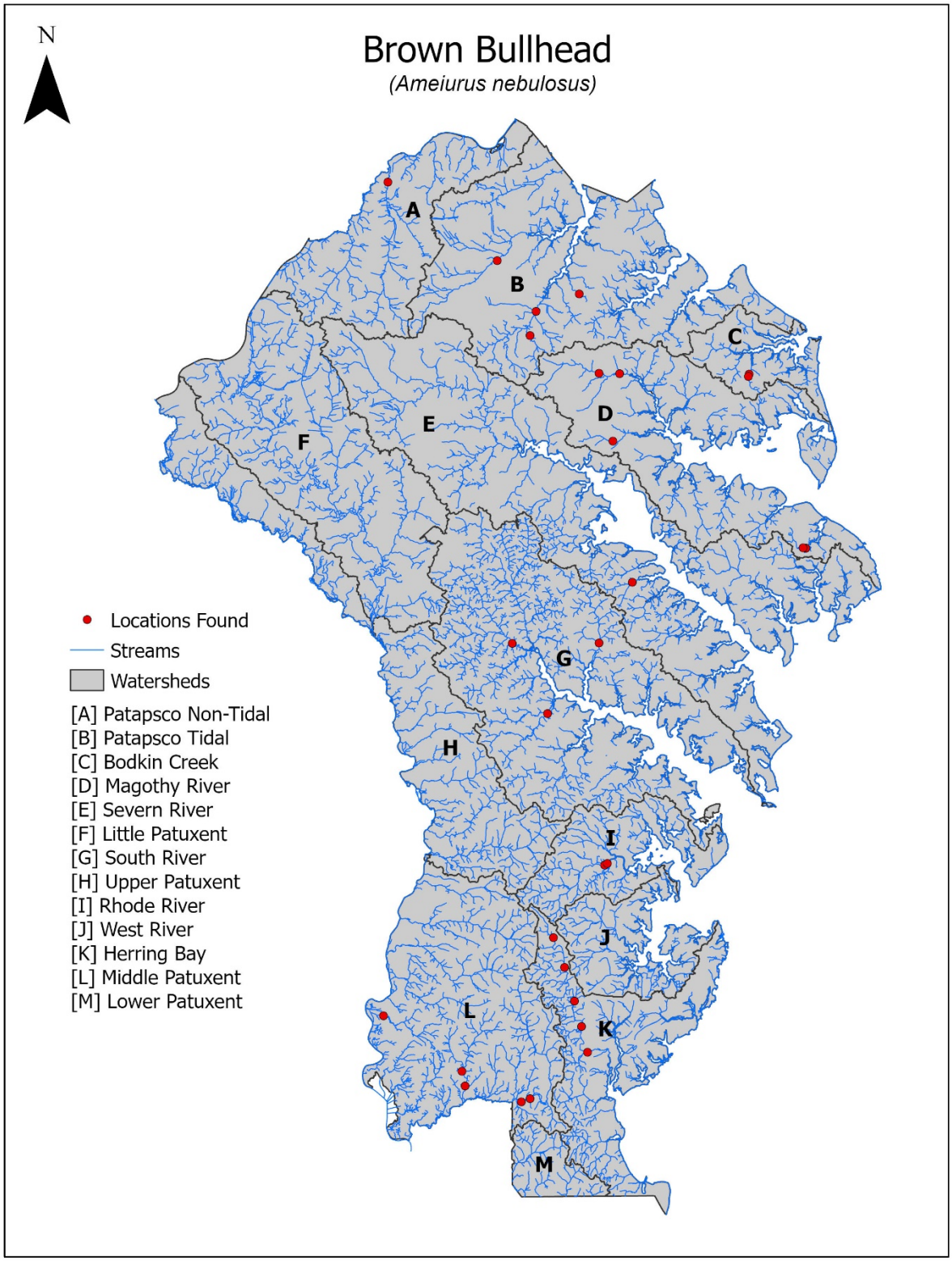
## Distribution:
Somewhat common in the County and somewhat frequent where found. Observed mostly in the Herring Bay, South, Patapsco, and Magothy River watersheds.

## Origin:
Native to Maryland

## Conservation Status:
No special protections under state or federal law.

## Description:
The Brown Bullhead is a catfish, ranging in size from 6 to 21 inches long, with colors ranging from a yellow brown to gray or black (1). Apart from the absence of scales that is true of all catfish, two distinguishing characteristics for this species include black or gray chin barbels (2) and several strong serrations along the stiff spine on each pectoral fin (1, 2). The Yellow Bullhead, in contrast, has white or grey chin barbels and weak serrations on the these pectoral fin spines (1, 2)

## Life History and Habitat:
This species is found in slow moving creeks and rivers, usually over a soft bottom (1) and is somewhat tolerant to impaired water quality conditions. A bottom feeder like most catfish, Brown Bullheads have a diverse diet and will feed on insects, worms, crustaceans, fish, and detritus, using its barbels to locate food (1, 27). Breeding occurs from April to June, with both parents guarding a circular nest made in a variety of substrates, often under the shelter of a log or other hard habitat feature (1, 27). Larvae are also guarded after hatching and the parents stay with them until they are about two inches long (1). Brown Bullheads live up to 7 years (1, 27).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[K] Herring Bay
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[M] Lower Patuxent

## Yellow Bullhead
*(Ameiurus natalis)*

Images: Duane Raver, USFWS (left) and 2018 voucher photo (right).

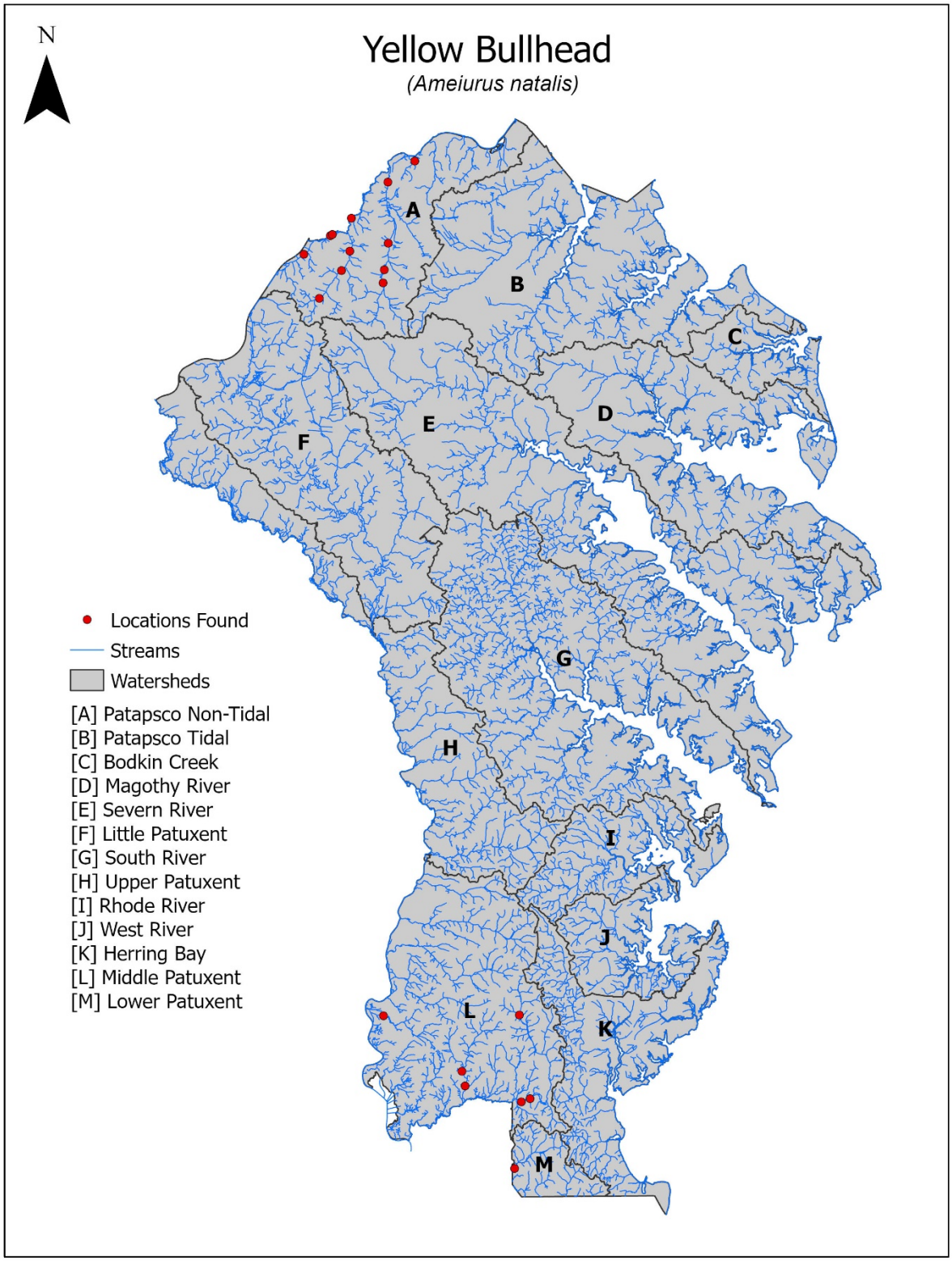
## Distribution:
Somewhat common around the County, but infrequent where observed, this species occurs mostly in the Patapsco Nontidal, Herring Bay, and Middle Patuxent River watersheds and in lesser numbers in the Magothy and South River watersheds.

## Origin:
Native to Maryland.

## Conservation Status:
No special protections under state or federal law.

## Description:
The Yellow Bullhead is a catfish with a yellow-green back and sides that become while on the belly (1). Like all catfish, this species does not have scales. A distinguishing characteristic from its close cousin, the Brown Bullhead, is the color of its chin barbels, which are predominantly white (2) instead of dark colored. The anal fin often presents with a straight margin and a dark midstripe (1). Individuals range from 7 to 19 inches (1).

## Life History and Habitat:
A moderately pollutant tolerant catfish (1), the Yellow Bullhead is often found in slow moving parts of streams and rivers, sometimes in dense vegetation, over areas with soft bottoms (1, 34). Yellow Bullhead eat a variety of aquatic insects, fish, mollusks, and algae, which they locate using the barbels found on their chin (1, 34). Spawning occurs in spring or early summer; males and females construct a nest, the female lays her eggs, and the male guards the nest and the hatched juvenile fish until they reach about 2 inches in length (2, 35). This species lives approximately seven years (35).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[K] Herring Bay
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[M] Lower Patuxent

## Margined Madtom
*(Noturus insignis)*

Images: Hugh Chrisp, NYDEC (left), and Emilio Concari, MD Biodiversity Project (right).

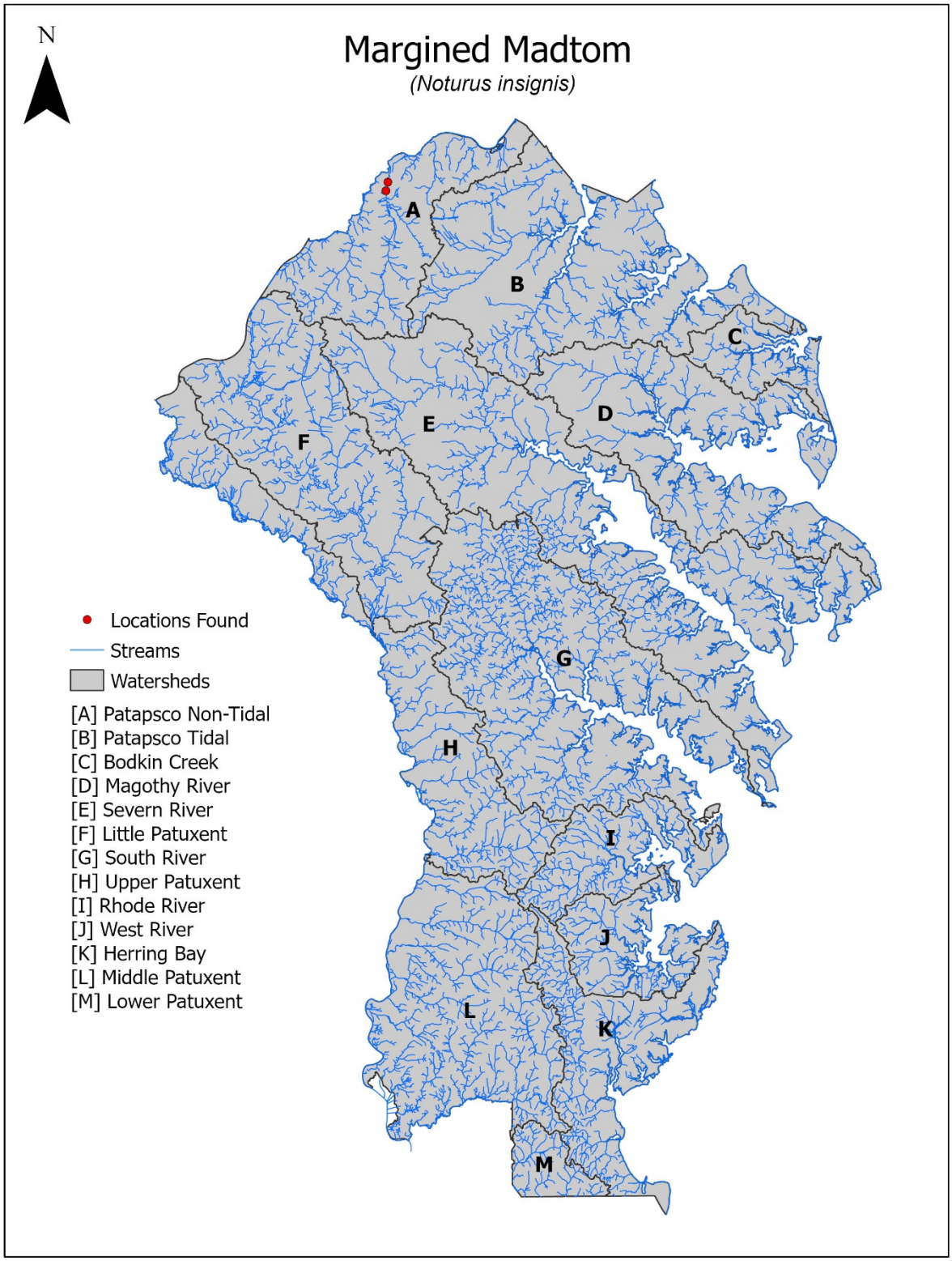
## Distribution:
Uncommon in the County and infrequent when found. Found only in the Patapsco Nontidal River watershed.

## Origin:
Native to Maryland.

## Conservation Status:
No special protections under state or federal law.

## Description:
This is a small catfish that, like all catfish in Maryland, has no scales and a collection of barbels found around the mouth at the very front of the head. This species is a uniform yellow-brown. The dorsal, tail, and anal fins all have dark margins and the spines found on the pectoral fins are strongly serrated (1, 2). The mouth also ends before the tip of the snout (1). Individuals range from two to six inches (1).

## Life History and Habitat:
Moderately tolerant to poor water quality, the Margined Madtom is found in medium to large streams in gravel or cobble riffles or in woody debris or undercut banks (1, 51). This species feeds mostly on insect larvae and small crustaceans (51). The Margined Madtom likely breeds in spring to early summer and will lay eggs on a variety of substrates, including trash like bottles or cans, or in the discarded shells of bivalves (51). Males likely care for the eggs and fry, but that is not confirmed for this species of *Noturus* (51). The exact lifespan of this species is unknown, but the genus range is one to nine years (51).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## Tadpole Madtom
*(Noturus gyrinus)*

Images: Ellen Edmonson, NYDEC (left), and Robert Aguilar, SERC (right).

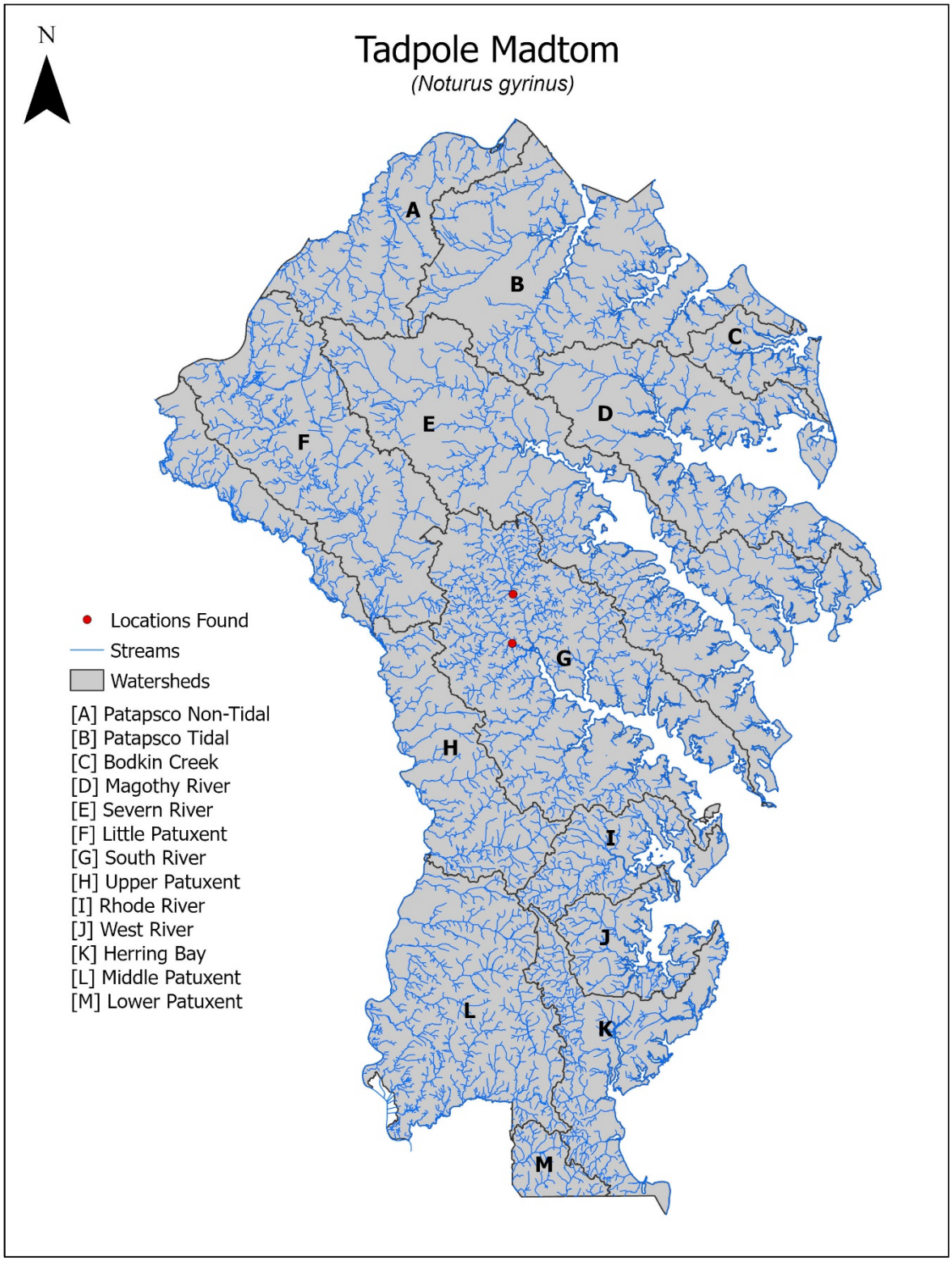
## Distribution:
Uncommon in the County and very infrequent when found. Observed only in the South River watershed.

## Origin:
Native to Maryland.

## Conservation Status:
No special protections under state or federal law.

## Description:
The Tadpole Madtom is a small catfish that is a uniform brown in color (1). Its dorsal, tail, and anal fins all lack dark margins and its pectoral and dorsal fin spines are not serrated, unlike its close and more common relative, the Margined Madtom (1, 2). The body is considered stout and may have a faint dark line on the side (1). Individuals range from 1 to 5 inches (1).

## Life History and Habitat:
The Tadpole Madtom is found in medium to small streams and rivers over a variety of substrate types (1, 57). This species feeds primarily on aquatic insects and small crustaceans (58). Spawning occurs from May until August with nests established in a variety of substrates, including human refuse like tin cans, although how often this actually occurs is unknown (1, 58). Nests appear to often be guarded by both parents (58). The Tadpole Madtom likely lives a maximum of four years (1, 58).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# PIKES

## (Family *Esocidae*)

This family includes the pikes and pickerels. A top predator, the long, torpedo-like shape and a duck-like snout full of sharp teeth characterize this group. There are five species in North America, four of which occur in Maryland, with two of those observed in the County:

- Redfin Pickerel (*Esox americanus*) p. 64
- Chain Pickerel (*Esox niger*) p. 66

Redfin Pickerel

## Redfin Pickerel
*(Esox americanus)*

Images: Duane Raver, USFWS (left), and a 2020 voucher photo (right).

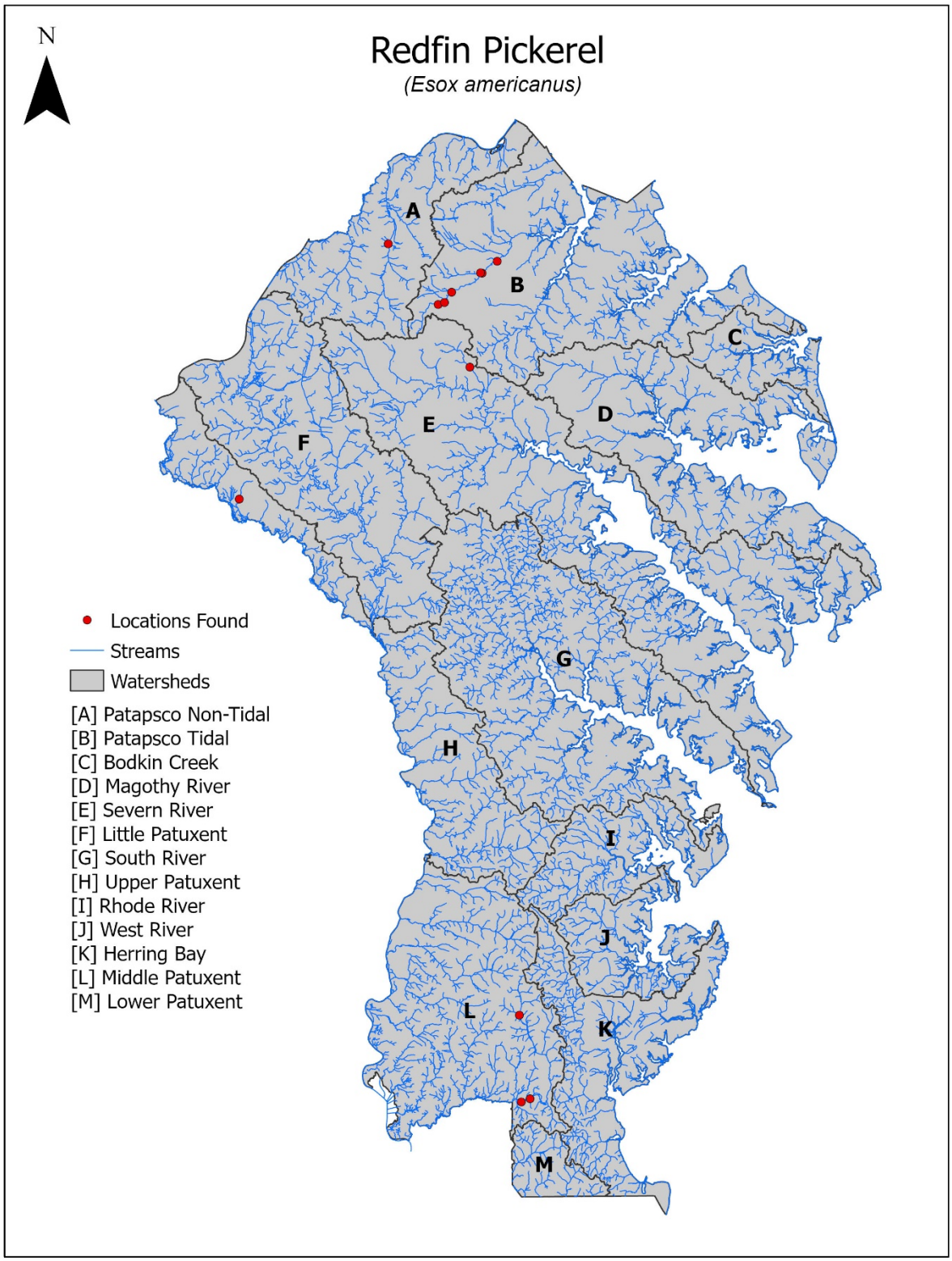
## Distribution:
Uncommon in the County and infrequent when it occurs. Found mostly in the Middle Patuxent and Patapsco Tidal River watersheds.

## Origin:
Native to Maryland.

## Conservation Status:
No special protections under state or federal law.

## Description:
The Redfin Pickerel is a long, torpedo-shaped fish with a duck-like snout full of sharp teeth (1). This species has thin, vertical blotches that run along its body, reddish fins, and a distinct bar under the eye that is noticeably slated towards the tail (1, 2). Individuals range from 10 to 15 inches long, although it rarely grows larger than 12 inches (1).

## Life History and Habitat:
This species is found in slower streams and prefers areas with abundant submerged vegetation (1, 43). Considered somewhat pollutant-tolerant, it can tolerate warm water and is sometimes observed in very shallow (1-2 inches deep) parts of streams and other habitats where it lives (1, 43). An ambush predator, this fish hides motionless in aquatic vegetation or in woody debris until it sees a prey item, which it attempts to capture with a sudden burst of speed (1). Small fish, frogs, and larger invertebrates are preferred prey (1). Spawning occurs in early spring, where eggs are scattered and fertilized in stands of aquatic vegetation; no nest is constructed and no parental care is provided (1). This species is believed to live from five to eight years (1, 43).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## Chain Pickerel
*(Esox niger)*

Images: Duane Raver, USFWS (left), and 2017 voucher photo (right).

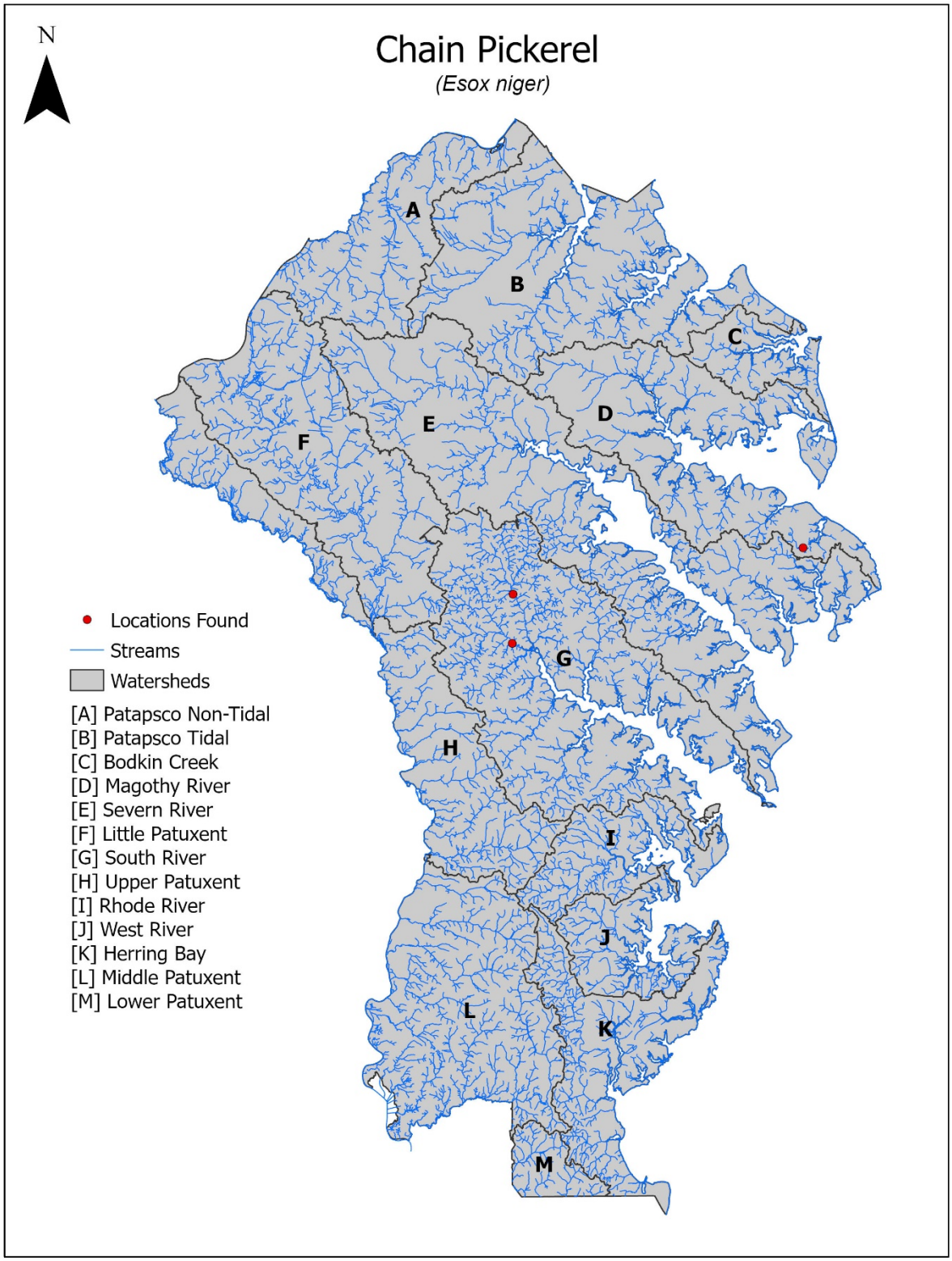
## Distribution:
Uncommon in the County and very infrequent when found. Found only in the South and Magothy River watersheds.

## Origin:
Native to Maryland.

## Conservation Status:
No special protections under state or federal law.

## Description:
The Chain Pickerel has an elongated body and a pointed, duck-like snout common in pikes (1). Markings on the yellow-brown body have a circular, chain-like appearance and the snout is longer than found on its close cousin, the Redfin Pickerel (1, 2). Individuals range from 15 to 40 inches (1).

## Life History and Habitat:
The Chain Pickerel occupies slow moving parts of streams and rivers, near aquatic vegetation or woody debris (1). An ambush predator of fish, this species will also eat a variety of other animals if it can catch them (1). The Chain Pickerel spawns in early spring in shallow areas, scattering its eggs over aquatic vegetation, with neither parent providing care to the eggs or fry (1). This species is thought to live at least eight years (1).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# MUDMINNOWS
## (Family *Umbridae*)

This group contains only five species, four in North American and one in Europe. This family is closely related to the *Esocidae*—the pikes and pickerels. Only one species is present in Maryland:

- Eastern Mudminnow p. 69

## Eastern Mudminnow
*(Umbra pygmaea)*

Images: Hugh Chrisp, NYDEC (left); voucher specimen (2020) (right).

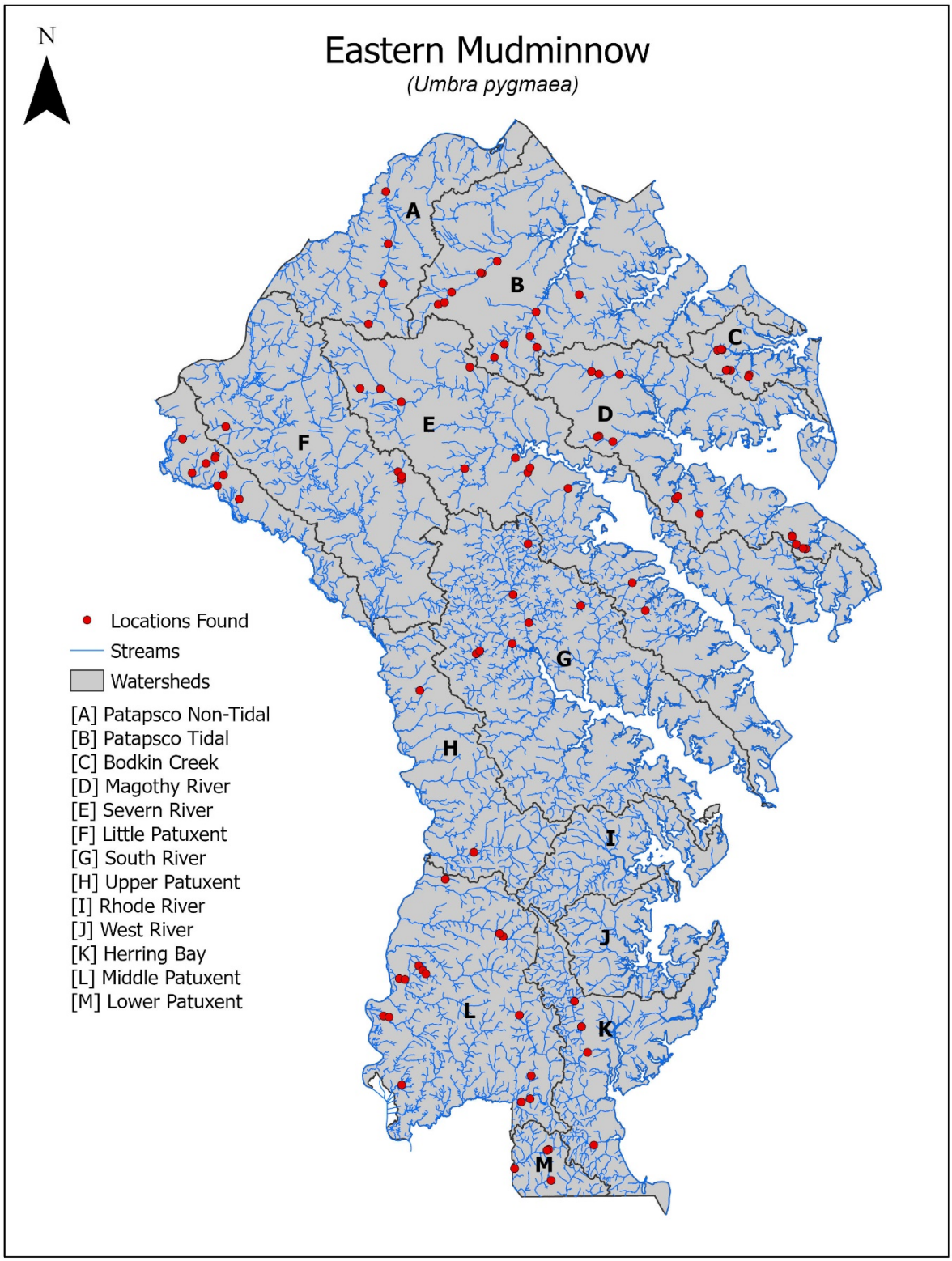
## Distribution:
Widespread in the County and frequent where observed, this species was one of the most frequently observed fish during this baseline survey. Found in many County watersheds.

## Origin:
Native to Maryland.

## Conservation Status:
No special protections under state or federal law.

## Description:
The Eastern Mudminnow is a brown fish with a rounded tail fin that has a black bar at its base (1, 2). Across its body, it also has 10 to 14 stripes from the base of the gill cover to the base of the tail (1, 2). Its body has a noticeably round shape in cross section (1, 2). Individuals are generally between 2 and 4 inches in length (1, 5). Females are generally believed to be slightly larger than males (1), although the differences are likely very slight, if they exist at all (5).

## Life History and Habitat:
The Eastern Mudminnow is often found in slow moving water like swamps, drainage ditches and backwater areas of streams and rivers. As the name suggests, it is often found in streams with mud or other soft bottom materials (1, 5). This species is tolerant of poor water quality conditions and is often found in degraded stream systems. As a generalist and omnivore, they typically feed on a variety of stream insects and crustaceans (1, 6). Spawning takes place in late spring (5). Females create nest cavities in shallow, heavily vegetated areas or will spawn under debris (1). Females guard the nest and maintain the eggs by fanning water occasionally across them (1). Individuals rarely live more than four years (1).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# TROUTS
## (Family *Salmonidae*)

In addition to the trouts, this family includes salmons, chars, graylings, and whitefishes. There are approximately 70 species, all located in the coldwater systems of the Northern Hemisphere, many comprising important commercial and recreational fisheries. In Maryland, there are five species of trout, but only one—the Brook Trout—is native to Maryland, which was the single species observed in the County:

- Brook Trout (*Salvelinus fontinalis*) p. 72

## Brook Trout
## *(Salvelinus fontinalis)*

Images: Duane Raver, USFWS (left) and a 2018 voucher photo (right).

## Distribution:

Seldom found in the County and very infrequent when found. Observed only in the Severn River watershed.

## Origin:

Native to Maryland.

## Conservation Status:

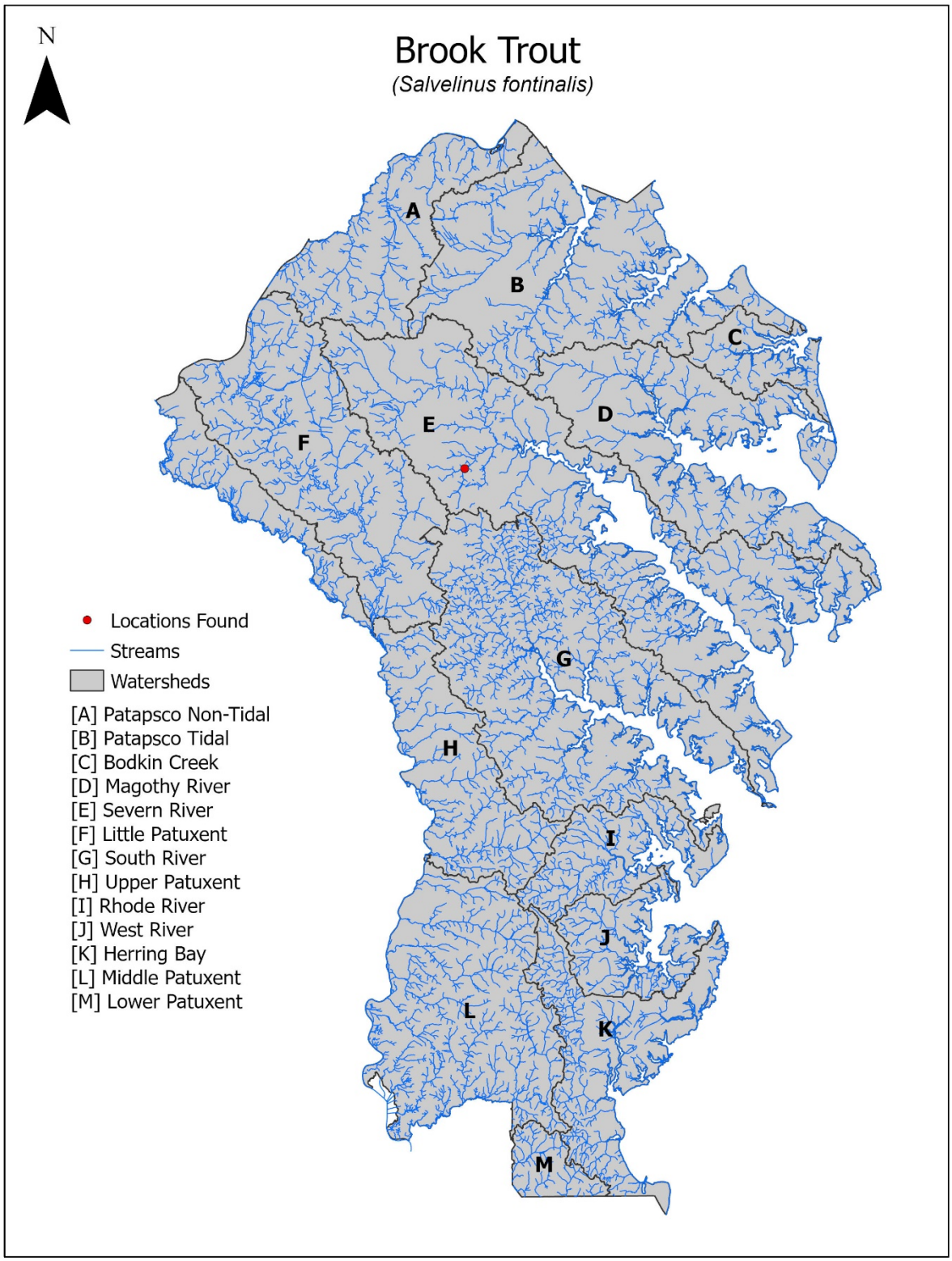
No special protections under state or federal law.

## Description:

The Brook Trout is a small trout with a dark green back covered with yellow that graduates to lighter yellow on the belly (1, 2). The body is also covered with yellow-green blotches and with red spots that are circled with blue (1, 2). The pelvic and anal fins have dark lines against white margins, a key diagnostic feature of this species (2). Individuals range from 7 to 20 inches long, but rarely exceed 10 inches in its native watersheds (1).

## Life History and Habitat:

The Brook Trout is very sensitive to pollution and is found in clear, clean, fast-moving, cold streams (63, 1), often in very small headwater channels (< 3 feet wide) (1). Breeding occurs from early to mid-Fall (1). Females find gravel riffles and dig a depression in the gravel called a redd (1). Males compete to breed with the female and once one is selected, both individuals defend the nest until spawning occurs (63). The eggs are covered with gravel and the nest is abandoned, where the eggs develop over the winter and hatch early the next spring (63). The fry stay with the redd until their yolk sacs are absorbed and they begin feeding in the stream (63). Brook Trout can live up to 10 years (64).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(Salvelinus fontinalis)
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[A] Patapsco Non-Tidal
[B] Patapsco Tidal
[C] Bodkin Creek
[D] Magothy River
[E] Severn River
[F] Little Patuxent
[G] South River
[H] Upper Patuxent
[I] Rhode River
[J] West River
[K] Herring Bay
[L] Middle Patuxent
[M] Lower Patuxent

# TOPMINNOWS AND KILLIFISHES
## (Family *Fundulidae*)

This family contains some of the world's smallest fishes. Additionally, many are found in ecosystems with highly variable environmental conditions, such as saltmarshes and freshwater wetlands, and so are tolerant of stressful waters quality conditions. Comprised of about 40 species, four fundulids are found in Maryland. Of those, two species were observed in the County:

- Mummichog (*Fundulus heterorclitus*) p. 75
- Banded Killifish (*Fundulus diaphanus*) p. 77

Banded Killifish

## Mummichog
*(Fundulus heterorclitus)*

Images: Hugh Chrisp, NYDEC (left), and a 2020 voucher photo (right).

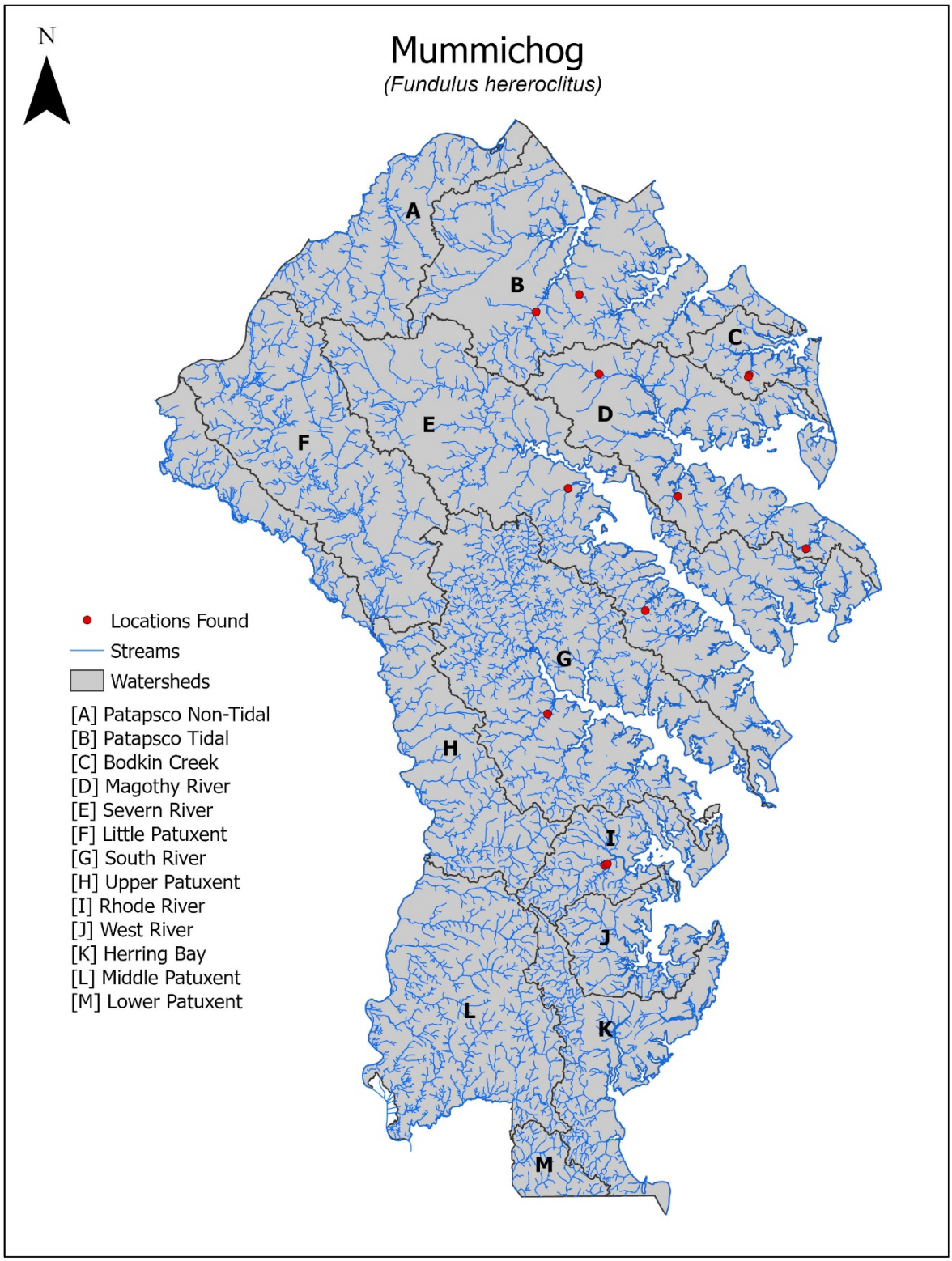
## Distribution:
Uncommon in the County and infrequent where found. Observed mostly in the Patapsco and Magothy River watersheds.

## Origin:
Native to Maryland.

## Conservation Status:
No special protections under state or federal law.

## Description:
The Mummichog is a minnow-like killifish with a stout body and short snout, with pointed teeth and a lower jaw that juts out just beyond the upper one (2, 24). Colors differ between the sexes, with males having a dark greenish-olive color, 15 vertical stripes, and abundant yellowish-white spots, while females are lighter with a brownish-green body and 12 to 15 vertical stripes (2, 24). The Mummichog can reach up to 6 inches in length (24).

## Life History and Habitat:
The Mummichog is a pollution-tolerant fish that is typically found in tidal creeks but is also found in slow moving freshwater streams and marshy, wetland areas (24, 25). It has a notable tolerance for warm water and can tolerate temperatures of up to 35 °C (95 °F) (25). To overwinter, this species will often burrow into the mud, although they will also move to deeper water to avoid freezing (25). An omnivore, Mummichogs eat a variety of things including insect larvae, fish eggs, crustaceans, and phytoplankton (24, 25). Spawning takes place from April to August in tidal areas during full moon or new moon tides. When the tide recedes, the eggs are exposed to air and develop out of the water, hatching when the next full or new moon tide occurs (24, 25). Mummichogs can live up to three years (24).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(Fundulus hereroclitus)
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[I] Rhode River
[J] West River
[K] Herring Bay
[L] Middle Patuxent
[M] Lower Patuxent

## Banded Killifish
## *(Fundulus diaphanus)*

Images: Ellen Edmonson, NYDEC (left) and 2020 voucher specimen (right).

## Distribution:

Uncommon in the County and infrequent when found. Found mostly in the Magothy and Patapsco River watersheds.

## Origin:

Native to Maryland.

## Conservation Status:

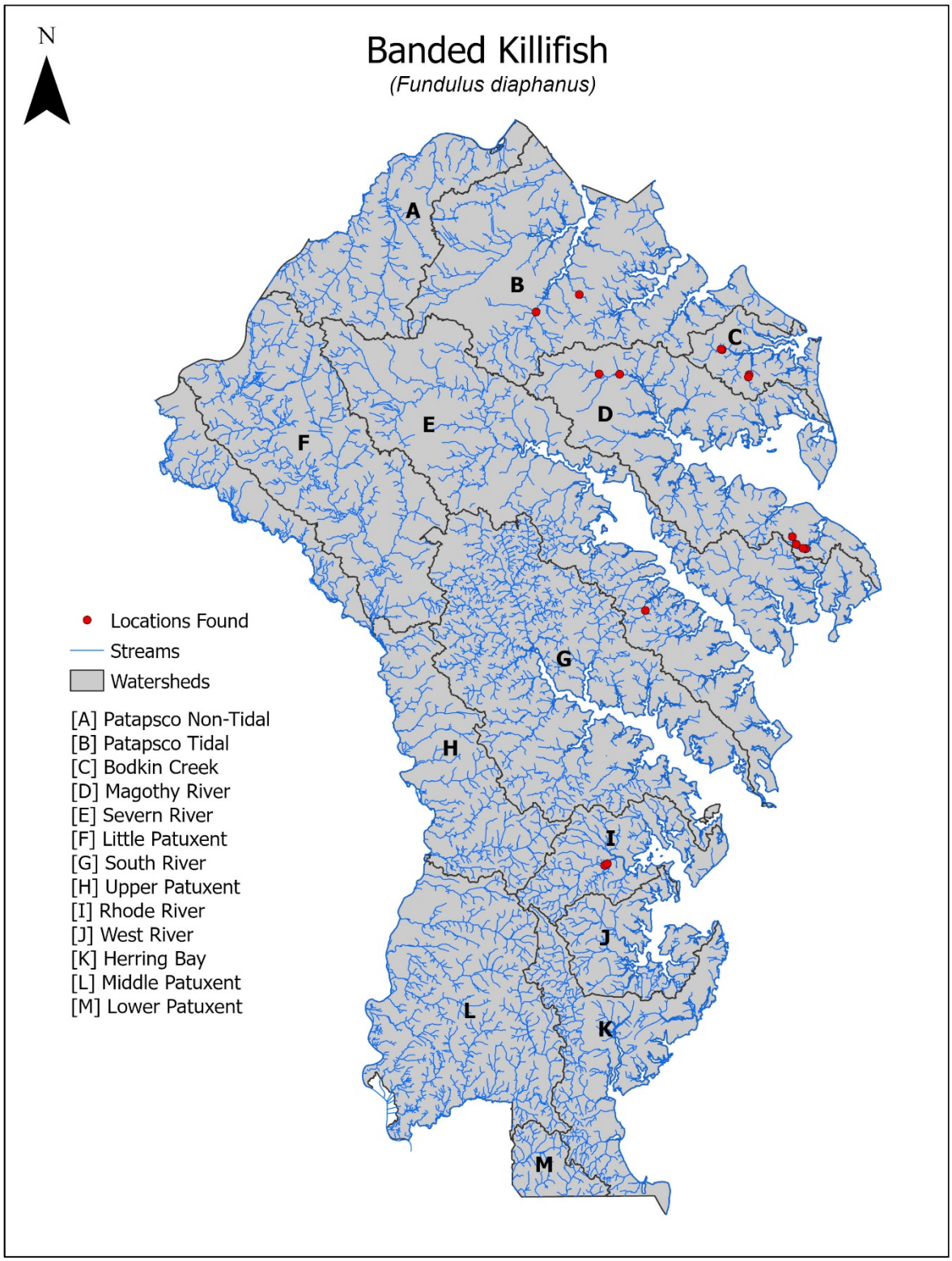
No special protections under state or federal law.

## Description:

The Banded Killifish is a small fish with a slender, elongate body and numerous narrow vertical bands running the length of its body (1, 2). Generally, colors differ slightly in males and females. Both have olive green backs that run to silver-white along the sides and white on the belly (1). Males tend to be darker green than females (1) and have 18-22 vertical bands while females only have 8-12 bands (43). Sizes range from 2 to 5 inches (1).

## Life History and Habitat:

A schooling species, the Banded Killifish is found in slow moving streams and rivers with sand and gravel bottoms and submerged aquatic vegetation (SAV) (1, 43). This species can tolerate salinities of up to 20 parts per thousand, but is somewhat rare in brackish water (1). This species feeds on small crustaceans, aquatic insects, mollusks, and worms (1). Males establish and defend a large territory where females lay eggs over filamentous algae or on the stems of SAV (1, 43). Banded Killifish live up to three years (1).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[B] Patapsco Tidal
[C] Bodkin Creek
[D] Magothy River
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[F] Little Patuxent
[G] South River
[H] Upper Patuxent
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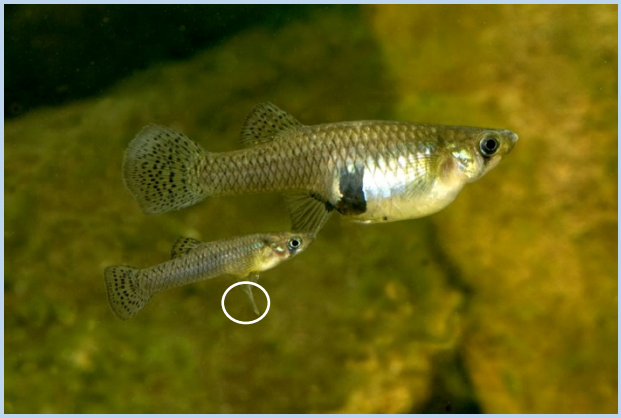
[J] West River
[K] Herring Bay
[L] Middle Patuxent
[M] Lower Patuxent

# LIVEBEARERS
## (Family *Poeciliidae*)

Of the 150 species found in this family, all but one give birth to live young. Poeciliids (pronounced pee-so-lee-ids) are distributed along the east coast of the US, into Mexico, and throughout Central and South America and the Caribbean. Only one species is found in Maryland:

- Eastern Mosquitofish (*Gambusia holbrooki*) p. 80

## Eastern Mosquitofish
## *(Gambusia holbrooki)*



Images: Male and female pair (left) by Gunther Schmidia (the male's gonopodium is circled) and a female voucher specimen from 2020 (right).

## Distribution:

Common in the County and frequent where found. One of the most frequently observed fish during this baseline. Found in many County watersheds.

## Origin:

Native to Maryland.

## Conservation Status:

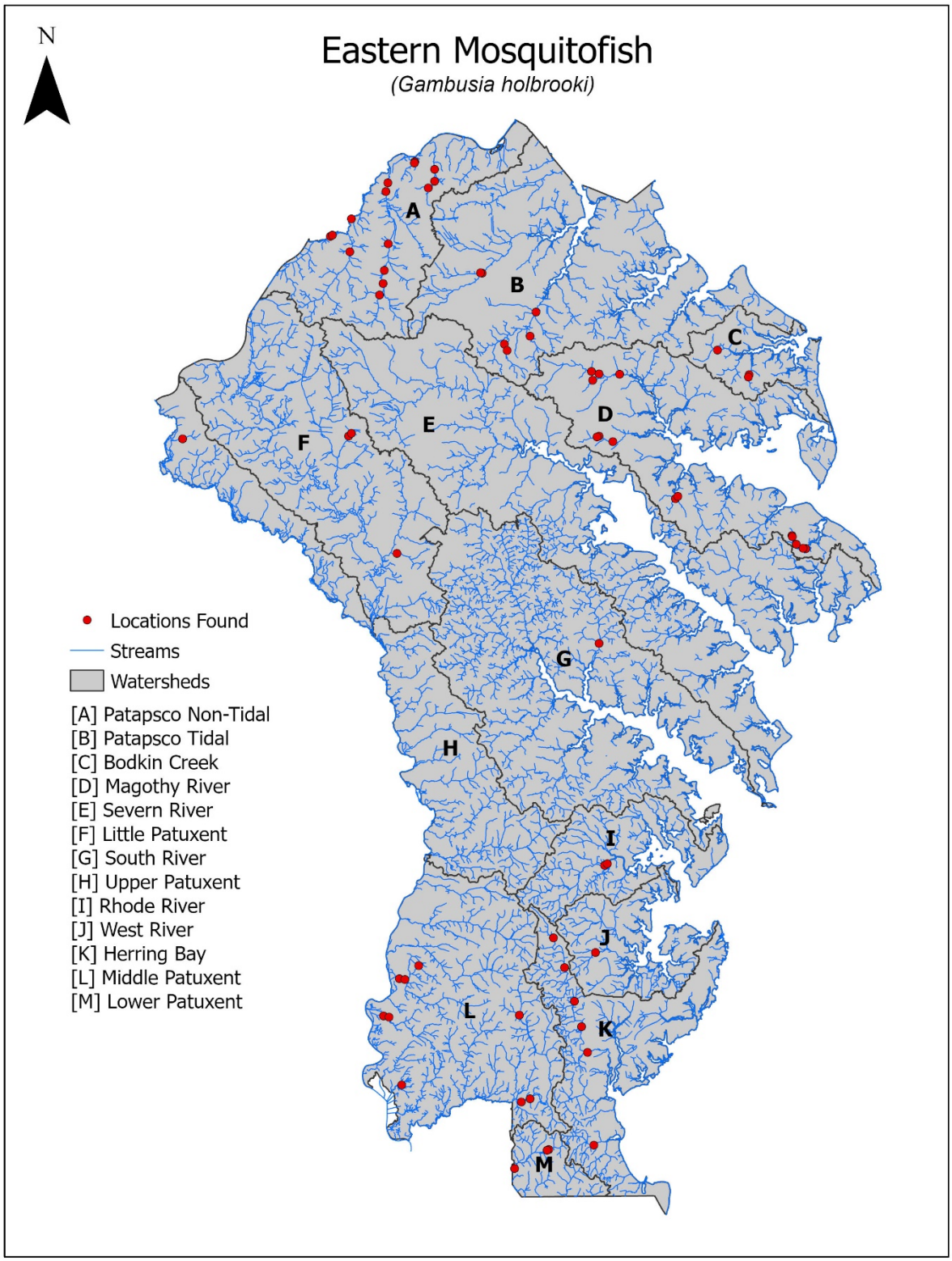
No special protections under state or federal law.

## Description:

The Eastern Mosquitofish is a small grey-silver fish that often has a black bar below its eye, a somewhat flattened head, and a dorsal fin that begins behind the anal fin (1). Males and females are different from each other (see photos); females often have a large dark patch near their vent at the front base of their anal fin while males have a modified anal fin called a gonopodium that is used to internally fertilize the female (1). Females reach a size of around 2.5 inches and are larger than males, which reach lengths of approximately 1 inch (1).

## Life History and Habitat:

The Eastern Mosquitofish is a common, tolerant fish found in a variety of different stream habitats, from clear, running waters to still pools (1). Eastern Mosquitofish are often found in degraded stream systems, as this species is quite tolerant of poor water quality conditions (1). They feed on a variety of stream insects, algae and, sometimes, their own young (1). It is often stocked in farm ponds and stormwater management facilities to reduce mosquito populations, and while considered effective for this purpose, concerns about its impacts as an invasive species are considerable (1,15). This species is a livebearer, meaning that its young are born alive instead of hatching from eggs in a nest like most fish in the County (1). Breeding occurs throughout the warm months of the year and females can produce multiple broods in a season (1). This species rarely lives more than two years in the wild (15).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[G] South River
[H] Upper Patuxent
[I] Rhode River
[J] West River
[K] Herring Bay
[L] Middle Patuxent
[M] Lower Patuxent

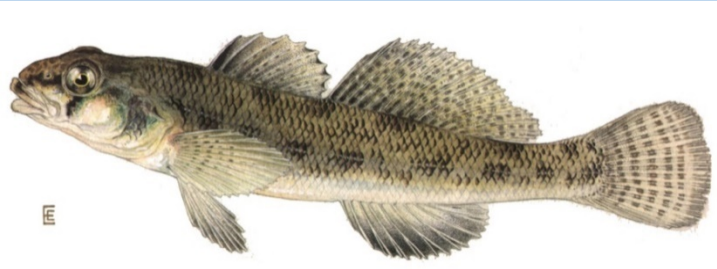
# PERCHES
## (Family *Percidae*)

Fishes in the Perch family have two dorsal fins that are often separate or just barely joined. Widely distributed across much of North America, Europe, and northern Asia, of the 160 species found in this group, about 150 are darters (which are found only in North America). Thirteen species are found in Maryland; a fourteenth species, the Maryland Darter (*Etheostoma sellare*) is believed to be extinct. Three species were observed in the County:

- Tessellated Darter (*Etheostoma olmstedi*) p. 83
- Yellow Perch (*Perca flavescens*) p. 85
- Glassy Darter (*Etheostoma vitreum*) p. 87

Tessellated Darter

## Tessellated Darter
*(Etheostoma olmstedi)*



Images: Ellen Edmonson, NYDEC (left), and a 2017 voucher specimen (right).

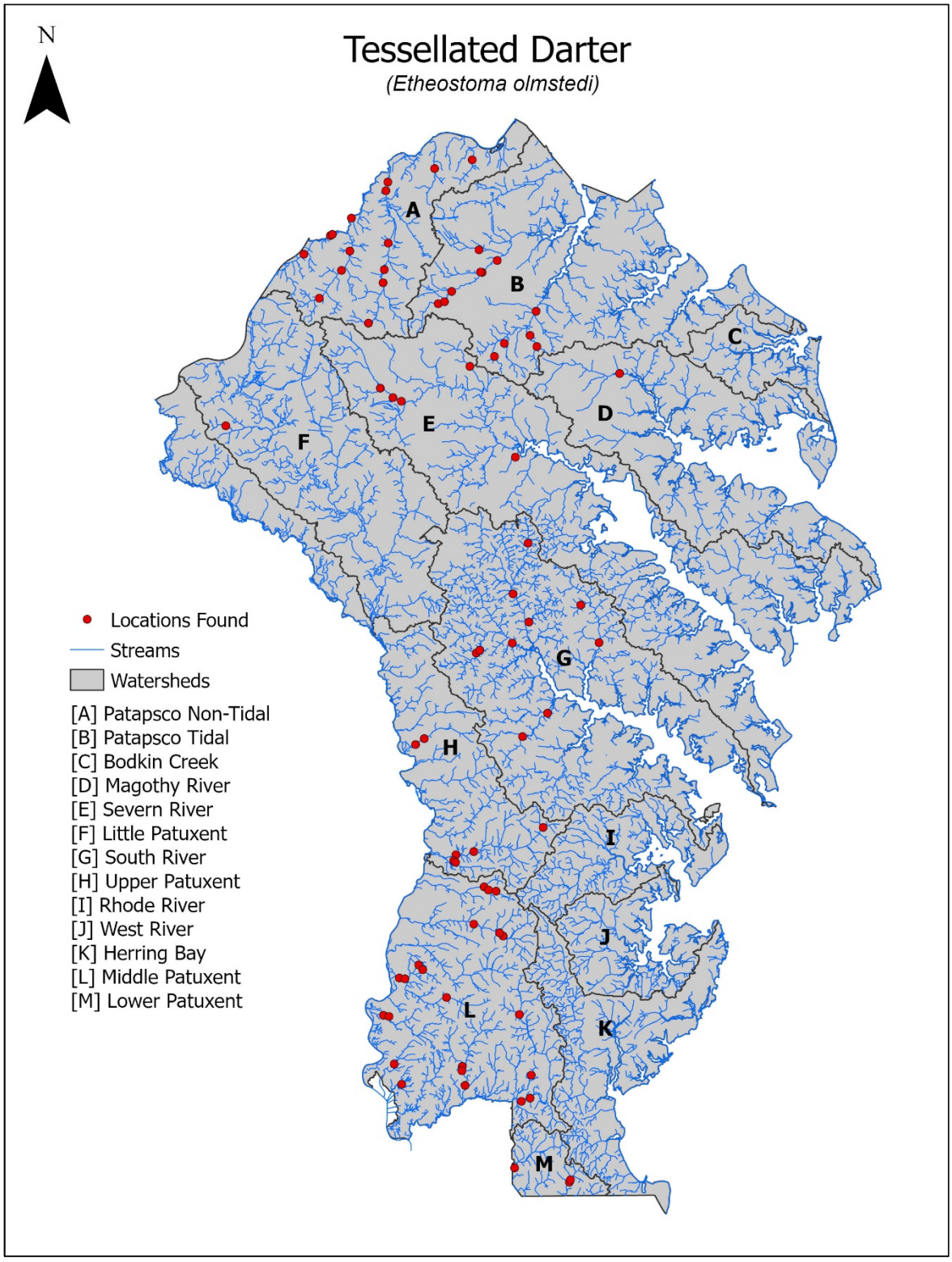
## Distribution:
Common in the County and frequent when found. Found in many County watersheds.

## Origin:
Native to Maryland.

## Conservation Status:
No special protections under state or federal law.

## Description:
A member of the perch family, the Tessellated Darter has a short, but somewhat pointed snout, is somewhat elongate, and has 9 to 11 “X” or “W” shaped marks along its midline (1, 2). Typical of darters, it has two separate dorsal fins and has its pectoral and pelvic fins in line with each other just after the gill covering (2). Sizes range between 2 to 4 inches (1).

## Life History and Habitat:
This is a somewhat pollutant-tolerant species that inhabits a variety of stream habitat with sand or mud bottoms (10). The Tessellated Darter is a general insect eater, with midges and small crustaceans making up most of its diet (1). Spawning takes place in spring and early summer with the male preparing a nest under a flat rock, stick, or other cover (1, 10). Males court females and when ready, they enter the nest, assume an upside down position, where female lays the eggs on the underside of the nest as they are fertilized by the male (1). The male may court several females in this way. Eggs hatch in about a week and no parental care is provided (1). Individuals live from 3 to 4 years (1, 10).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## Yellow Perch
*(Perca flavescens)*

Images: Duane Raver, USFWS (left) and Emilio Concari, MD Biodiversity Project (right).

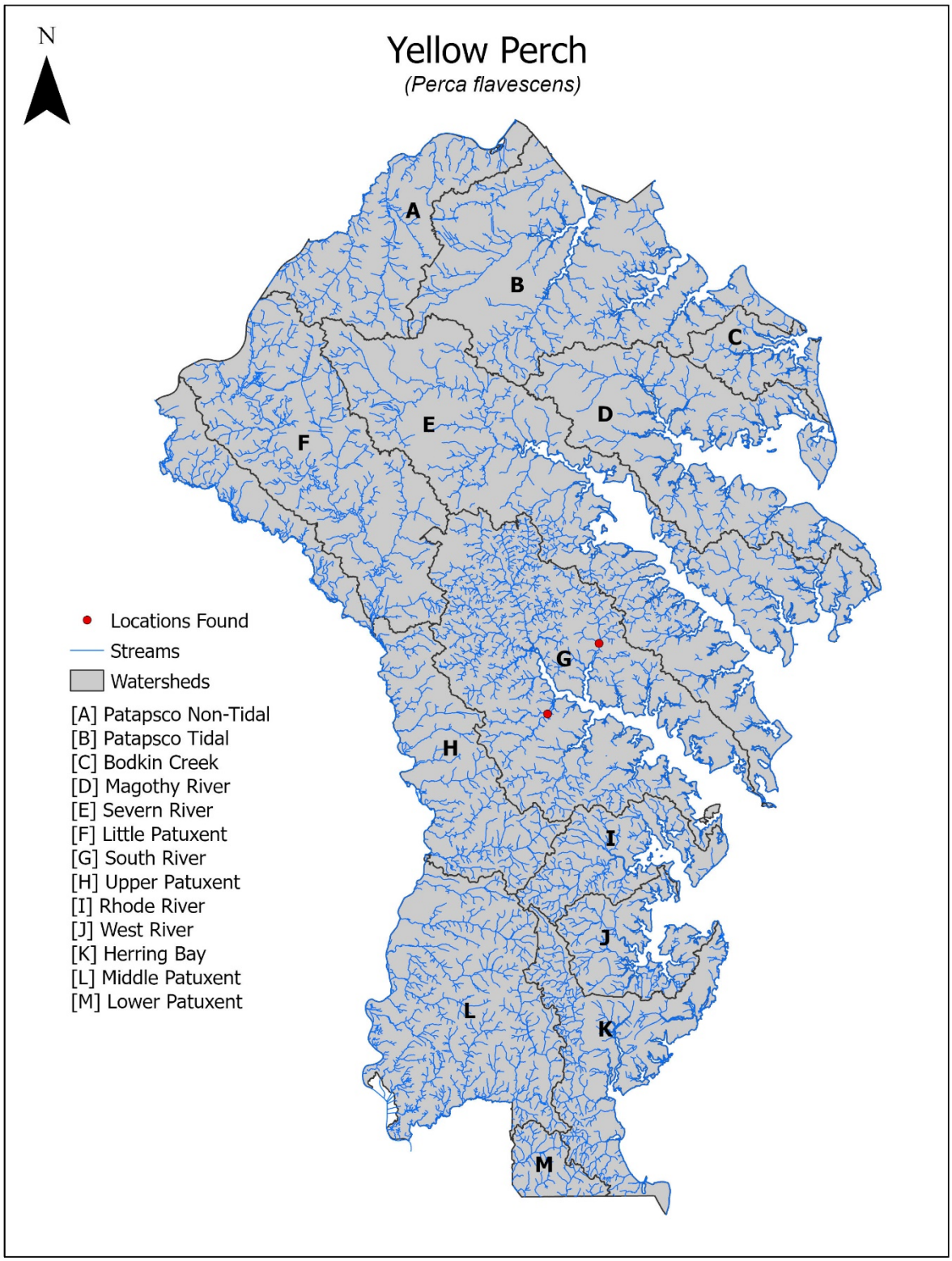
## Distribution:
Uncommon in the County and very infrequent when found. Observed only in the South River watershed.

## Origin:
Native to Maryland.

## Conservation Status:
No special protections under federal law. Considered a Species in Need of Conservation in Maryland by the Maryland Department of Natural Resources (67).

## Description:
The Yellow Perch is a somewhat long and compressed fish that has a greenish-yellow body with a series of six to eight dark vertical bands along its sides (1, 2) The pectoral, pelvic, and anal fins are tinted with yellow or orange (1, 2). Other identifying characteristics include a dorsal fin separated into a spiny-rayed forward fin followed by a soft-rayed fin (1). Individuals range from 6 to about 16 inches (1).

## Life History and Habitat:
The Yellow Perch is moderately sensitive to poor water quality (60). This species feeds mostly on small fish, aquatic insects, crayfish, and other invertebrates (1). In the Chesapeake Bay, adult Yellow Perch are semi-anadromous, meaning that they tend to live in low salinity estuary areas or tidal fresh streams and migrate up nontidal freshwater streams and rivers to spawn (60). The female lays a long gelatinous string of eggs on woody debris or some other structure in the stream which is then fertilized by the male and abandoned by both parents (1, 60). Yellow Perch can live up to 13 years (1).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[J] West River
[K] Herring Bay
[L] Middle Patuxent
[M] Lower Patuxent

## Glassy Darter
## *(Etheostoma vitreum)*

Images: Robert Aguilar, SERC / MD Biodiversity Project (left) and a 2018 voucher photo showing this species' pectoral fins and pointed spout (right).

## Distribution:

Seldom found in the County and very infrequent when found. Observed in the Upper Patuxent River watershed.

## Origin:

Native to Maryland.

## Conservation Status:

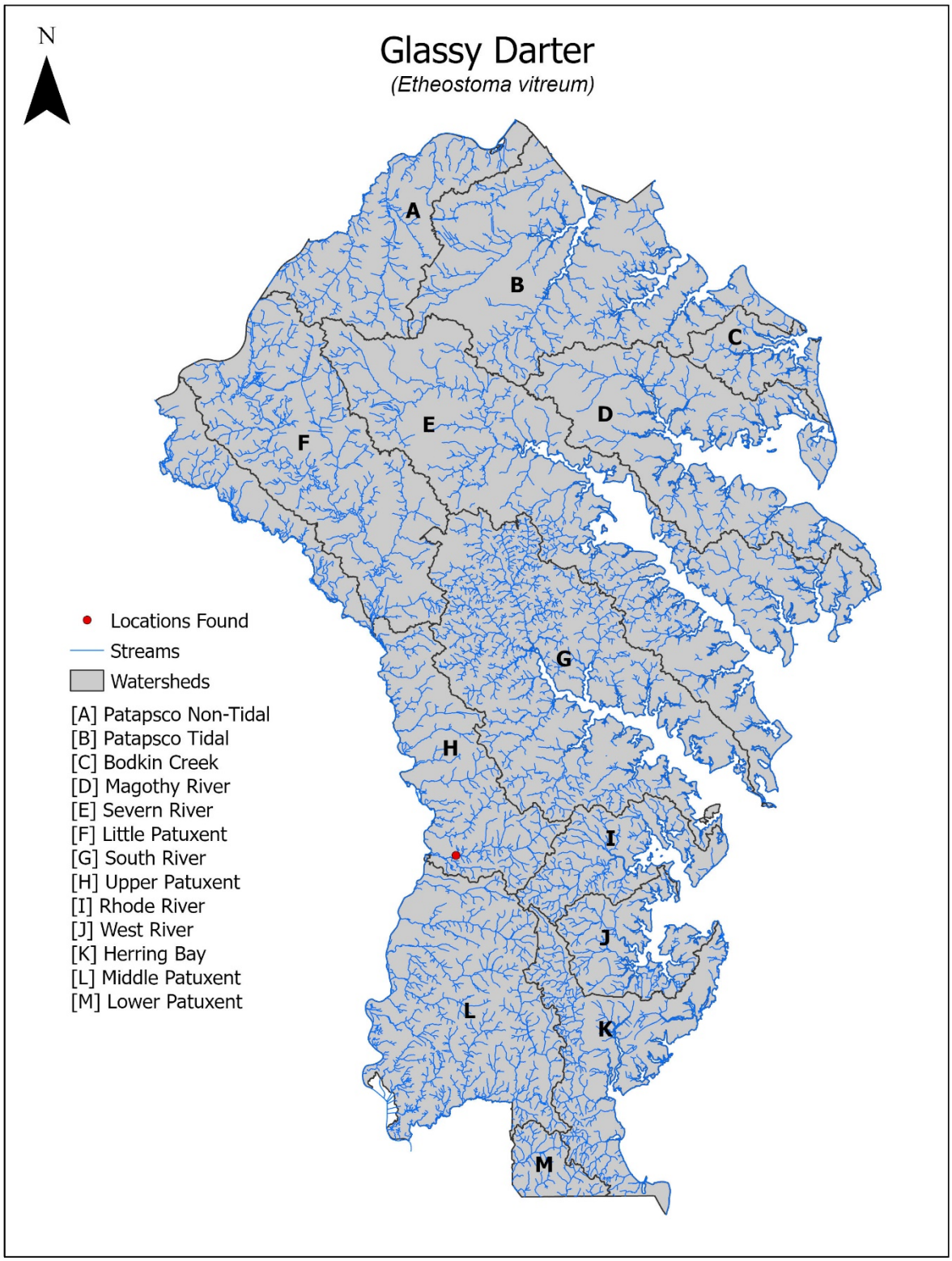
No special protections under federal law. Designated as a Threatened Fish Species in Maryland by the Maryland Department of Natural Resources (67).

## Description:

The Glassy Darter is more elongate and slender than its cousin, the Tessellated Darter, and is translucent (hence the species name—*vitreum* is a Latin word meaning glasslike) with scattered dark spots along the upper half of the body (1, 2). Its pectoral fins are also quite long compared to other darters found in Maryland and it has a pointed snout (1, 2). Individuals grow to between 1.8 and 2.6 inches (1).

## Life History and Habitat:

The Glassy Darter is a somewhat pollution-sensitive species (1, 60). It inhabits first to third order streams and prefers sand and gravel runs and moderately fast water areas (1, 60). Spawning occurs from mid-March to mid-April (62). Unique among darters, this is the only species that engages in communal spawning, where dozens of males and females will spawn upon a large object like a rock or log that is oriented into the current so that the eggs are exposed to the flow (61). Tens of thousands of eggs may be laid upon a preferred site during the season (61). No information was found regarding this species' life span.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[K] Herring Bay
[L] Middle Patuxent
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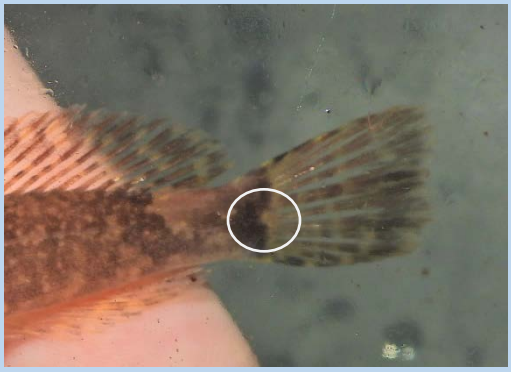
# SCULPINS
## (Family *Cottidae*)

Sculpins are stout bottom dwellers with large eyes and mouths and often have small, spiny bone growths on the head. Over 300 species are in this family, many of which are marine. Those that are freshwater or estuarine are distributed all over the Northern Hemisphere. There are eight species in the Mid-Atlantic area, four of which are found in Maryland. One species was observed in the County:

- Blue Ridge Sculpin (*Cottus caeruleomentum*) p. 90

## Blue Ridge Sculpin
## *(Cottus caeruleomentum)*



Images: Emilio Concari, MD Biodiversity Project. A Blue Ridge Sculpin on the left and a close up of a Mottled Sculpin's tail on the right, illustrating the notch found in its tail band (circled).

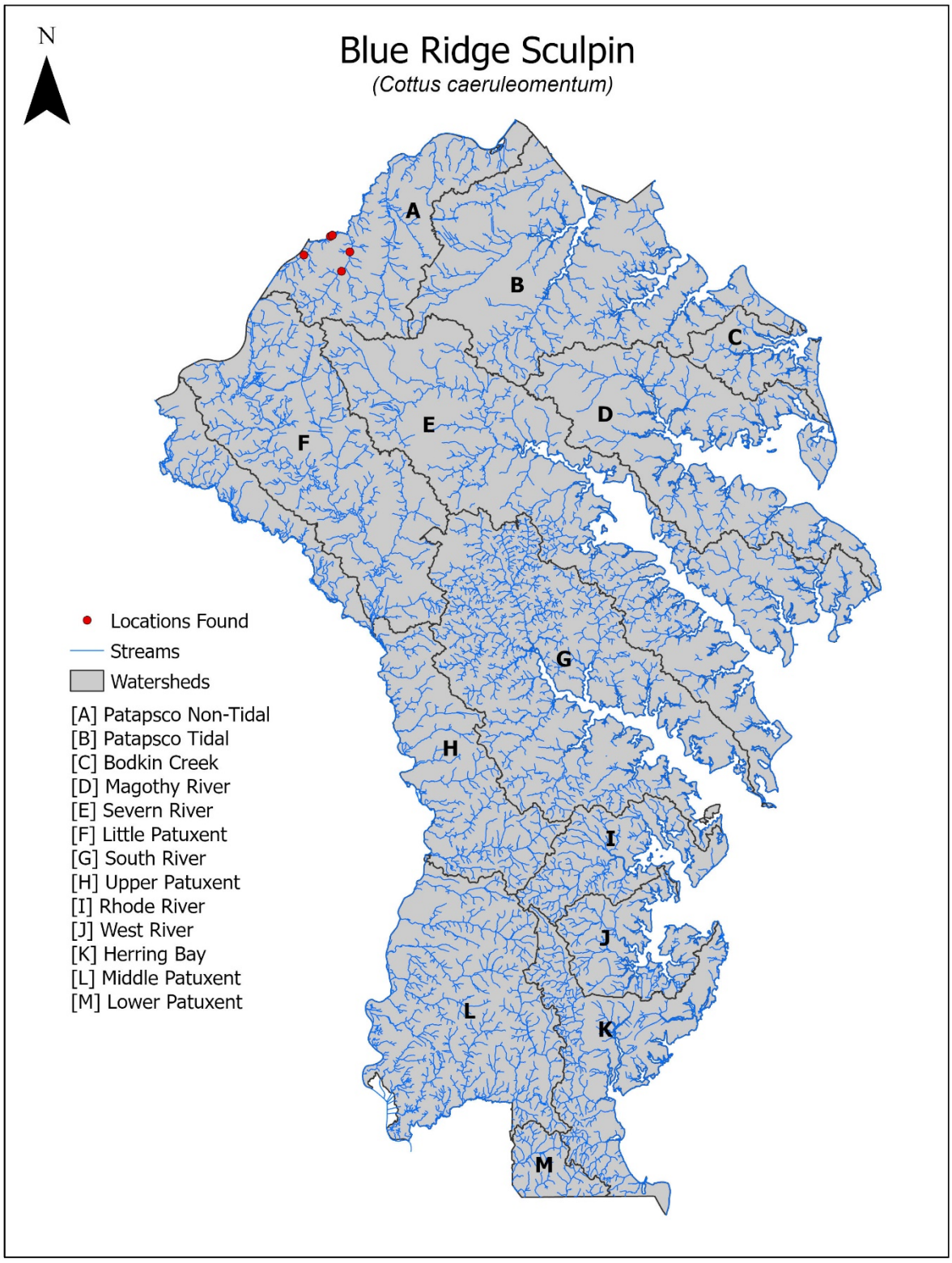
## Distribution:
Uncommon in the County and infrequent when found. Found in the Patapsco Nontidal River watershed.

## Origin:
Native to Maryland.

## Conservation Status:
No special protections under state or federal law.

## Description:
The Blue Ridge Sculpin has a large head and mouth, two dorsal fins and large, fan-shaped pectoral fins that have small prickly scales just behind the pectoral fins (1). Distinguishing it from its very close relative, the Mottled Sculpin, is difficult. A key difference, however, is that Blue Ridge Sculpin lacks a notch in the pigmented bar along the base of the tail that is found in both species (see the above, right image). Sizes range from 1.75 to about 3 inches (45).

## Life History and Habitat:
Relatively intolerant to poor water quality conditions, the Blue Ridge Sculpin is found in cool, clean, fast moving parts of streams and rivers that flow over a gravel or rock substrate (1). Little specific habitat and feeding information is available about this species, but it probably is very similar to its close relative, the Mottled Sculpin This species likely feeds on a variety of aquatic insects and insect larvae (1). Breeding likely occurs from March to May (46) during which males establish a territory around some physical structure in the stream like a log or a rock (1). The eggs are laid in the nest and guarded by the male (1). Blue Ridge Sculpins likely live less than three years (1), but a more precise estimate of life expectancy is currently not available.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[K] Herring Bay
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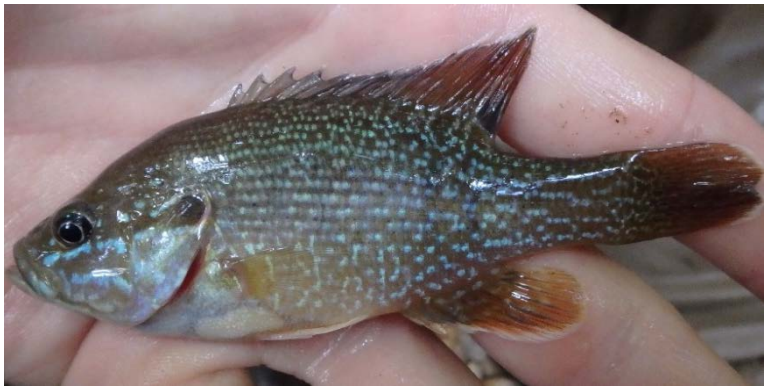
# SUNFISHES
## (Family *Centrarchidae*)

This family is native to warm water systems east of the Rocky Mountains, but many species have been extensively distributed all over the United States and beyond. This family contains some of the most popular game fish, making this an economically important fish group. Of the 17 species found in Maryland, 11 were observed in the County:

- Green Sunfish (*Lepomis cyanellus*) p. 93
- Bluegill (*Lepomis macrochirus*) p. 95
- Pumpkinseed (*Lepomis gibbosus*) p. 97
- Redbreast Sunfish (*Lepomis auritus*) p. 99
- Largemouth Bass (*Micropterus salmoides*) p. 101
- Bluespotted Sunfish (*Enneacanthus gloriosus*) p. 103
- Warmouth (*Lepomis gulosus*) p. 105
- Smallmouth Bass (*Micropterus dolomieu*) p. 107
- Black Crappie (*Nocomis micropogon*) p. 109
- Rock Bass (*Ambloplites rupestris*) p. 111
- White Crappie (*Pomoxis annularis*) p. 113



Green Sunfish

## Green Sunfish
## *(Lepomis cyanellus)*

Images: Duane Raver, USFWS (left); voucher specimen (2018) (right).

## Distribution:

Common in the County and frequent when observed. Found in many County watersheds.

## Origin:

Native only to western Maryland watersheds that are part of the Ohio River drainage, but introduced and naturalized in Chesapeake Bay watersheds throughout the state.

## Conservation Status:

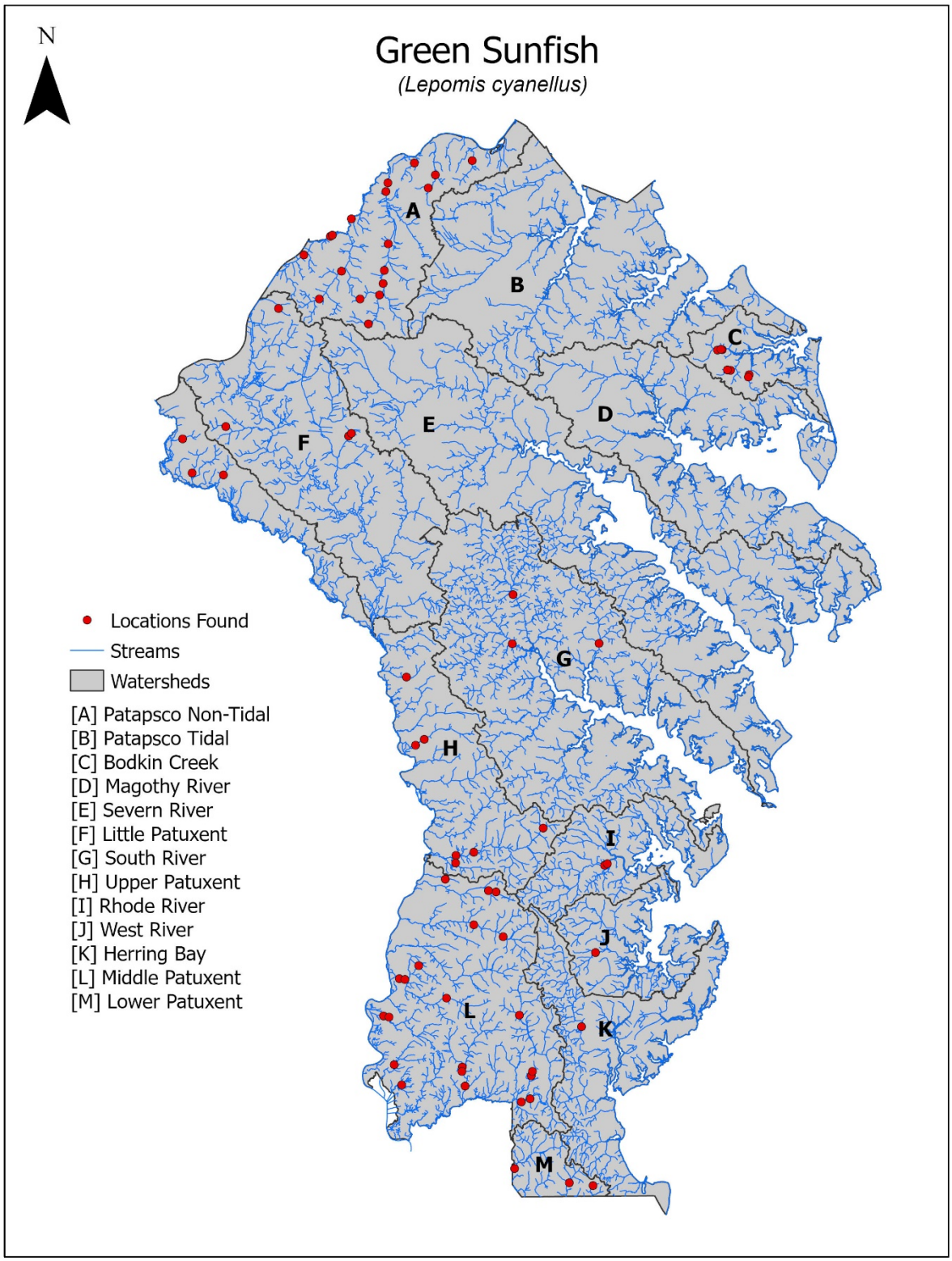
No special protections under state or federal law.

## Description:

The Green Sunfish has a green colored back and a yellow or orange belly. Its shape is more elongated and "bass-like" than other sunfishes (1). The large dark spot on the flap of the gill cover, or opercule, has a light colored margin around it and is stiff, not flexible (2). The mouth is considered large for sunfishes. It can reach a maximum length of approximately 12 inches (1).

## Life History and Habitat:

This species is a stream dweller that inhabits deep pool areas in meandering bends and undercut banks, but can also thrive in ponds (7). The diet consists mostly of aquatic insects, small fish, and terrestrial insects that fall into the stream. This species is considered reasonably tolerant to a wide variety of water quality conditions (1, 7). This species spawns in spring and summer. Males usually construct nests in shallow areas with sand or gravel bottoms. After courtship and mating, the male guards the eggs while the female lays and maintains them until they hatch, after which the male guards the fry until they leave the nest (1). Green Sunfish are thought to live a maximum of 10 years (7).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## Bluegill
*(Lepomis macrochirus)*

Images: Voucher specimen from 2017 (left) and Scott Harden, right.

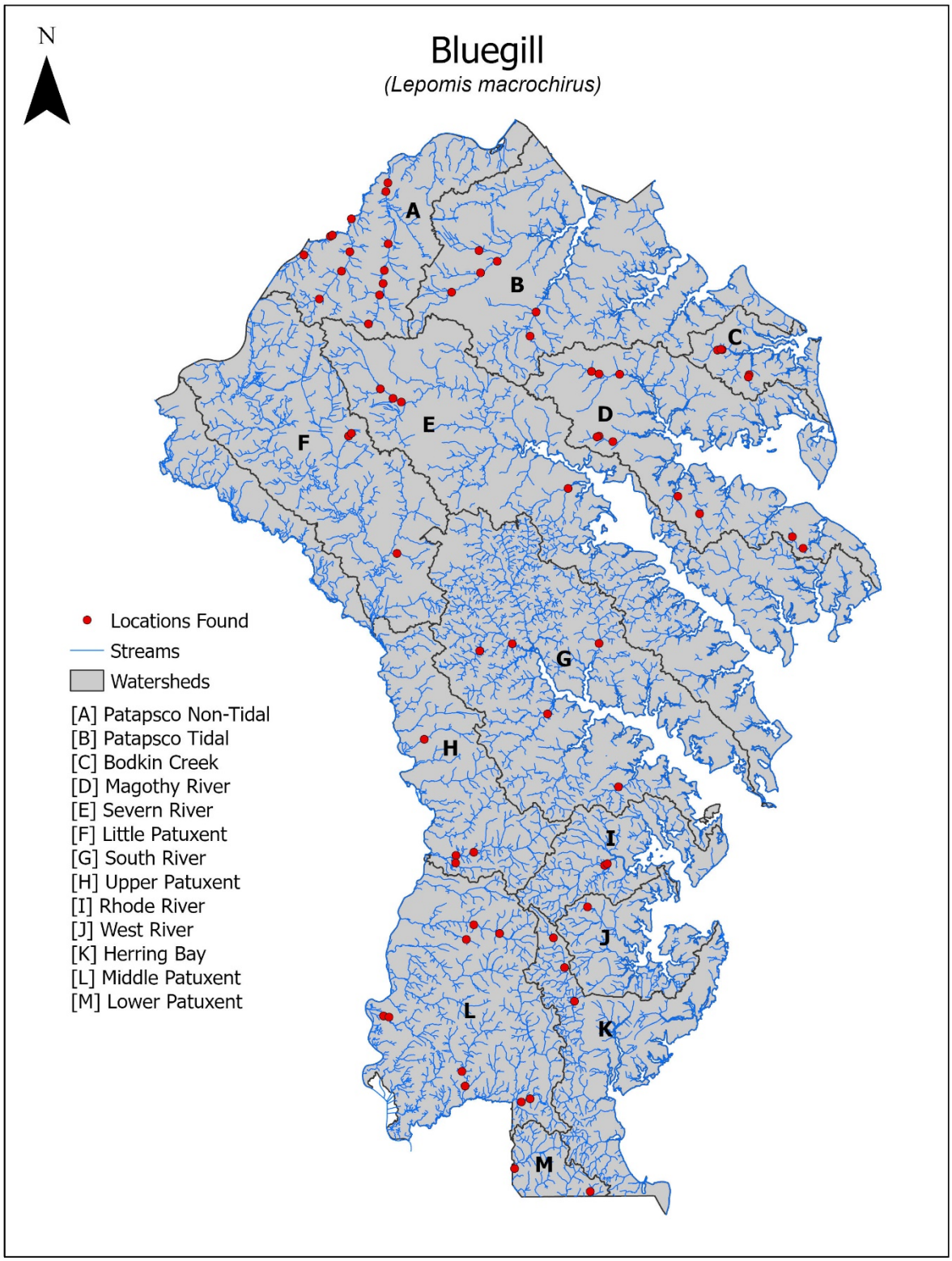
## Distribution:
Common in the County and somewhat frequent where found. Observed in nearly all County watersheds.

## Origin:
Native to Maryland.

## Conservation Status:
No special protections under state or federal law.

## Description:
The Bluegill is somewhat oval shaped and has a small mouth (1) and might be described as having a classic rounded and stout "sunfish" body shape. This species typically has blue or purple color along its upper back (although younger fish can be somewhat pale) with distinct vertical bars along the side, with a prominent spot at the bottom back of the dorsal fin (1, 2). Also, the small flap at the center back edge of the gill cover is black across its entire length, unlike other common sunfish in the County, where a clear band along the edge of this flap is present (2). This species reaches a length of up to 16 inches (1).

## Life History and Habitat:
This species lives in slow pool areas with undercut banks in streams and along the shallow, weedy, margins of lakes (1, 11). Bluegills eat a variety of insects, crustaceans, and worms (1, 11). Bluegills spawn in spring and early summer. Males make saucer shaped depressions as nests in sand or gravel substrate. After courtship, females may lay a few thousand to 60,000 eggs, which are fanned and protected by the male until a week after hatching (1). Bluegills are popular game fish and are often stocked in farm ponds and recreational areas (1, 11). The Bluegill lives up to 11 years (1).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[B] Patapsco Tidal
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[E] Severn River
[F] Little Patuxent
[G] South River
[H] Upper Patuxent
[I] Rhode River
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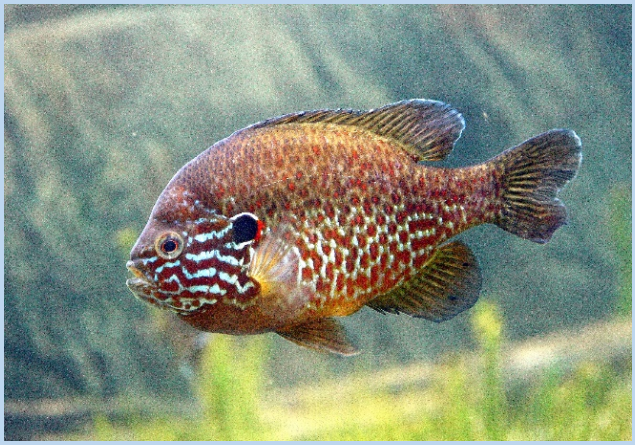
[K] Herring Bay
[L] Middle Patuxent
[M] Lower Patuxent

## Pumpkinseed
*(Lepomis gibbosus)*



Images: 2020 voucher specimen (left) and Simon Barrette (right).

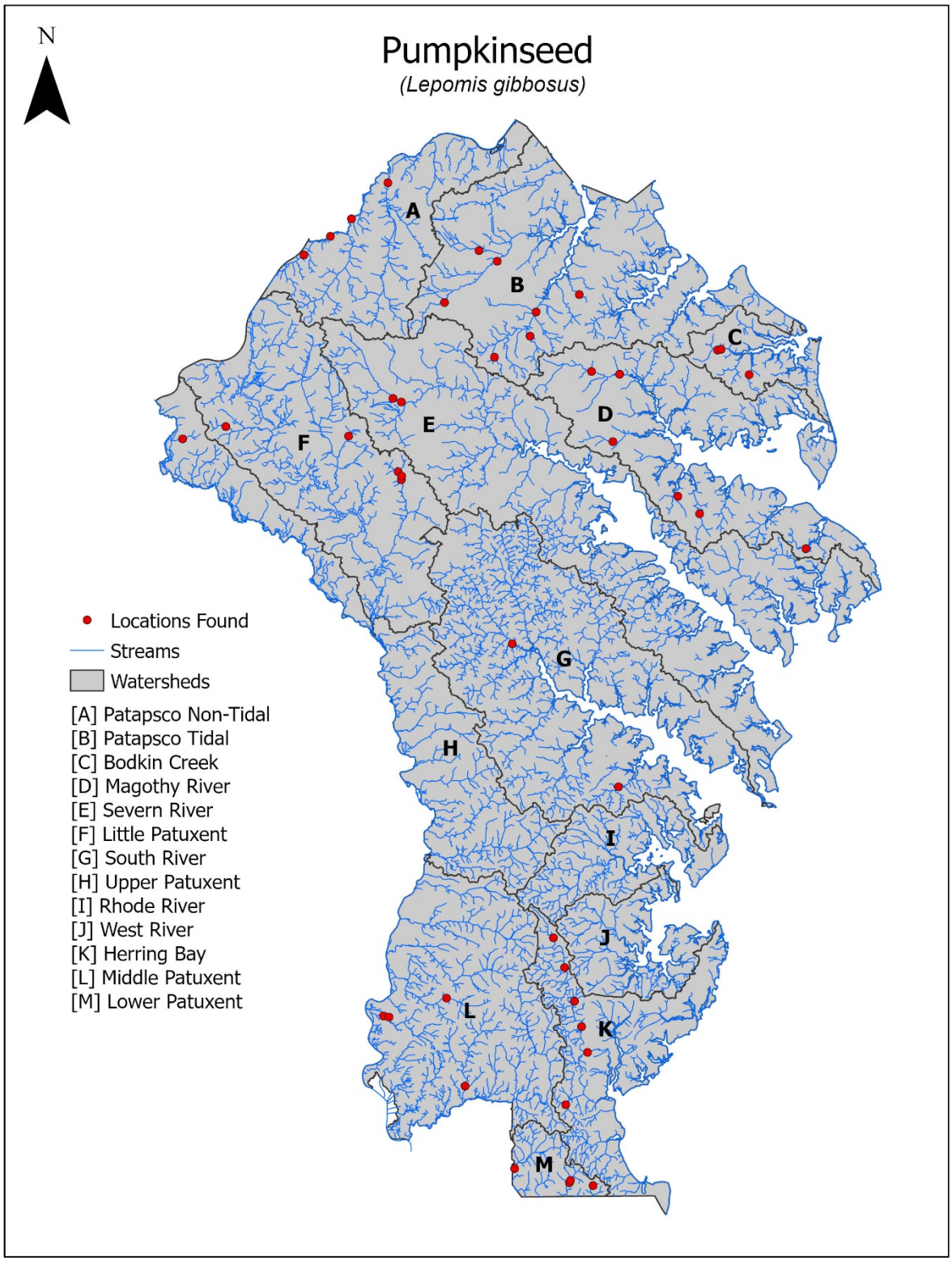
## Distribution:
Common in the County and somewhat frequent where collected. Found in many County watersheds.

## Origin:
Native to Maryland.

## Conservation Status:
No special protections under state or federal law.

## Description:
The Pumpkinseed is an olive green fish with side mottling that can be bluish or more orange, shifting to yellow or orange on the belly, with breeding males becoming quite orange in color (1, 2) Individuals range from 3 to 15 inches in length (1), with the characteristic rounded and stout "sunfish" shaped body. The mottling found at the base of the dorsal fin towards the rear of the fin (2) and the distinctive red-edged flap on the operculum (1,2) are other diagnostic characteristics of this fish.

## Life History and Habitat:
The Pumpkinseed is a somewhat pollution-tolerant fish found in a variety of different stream habitats, from clear, running waters to still pools (1, 19). This species feeds on an assortment of stream insects, mollusks, and small fishes (1, 19). Spawning occurs from spring to early summer, with males constructing nests that are vigorously defended (1). Nests will be constructed in shallow areas like those found at the edges of ponds and wetlands, preferring heavily vegetated areas (1). This species is known to reach an age of 12 years in captivity (19).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(Lepomis gibbosus)
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[B] Patapsco Tidal
[C] Bodkin Creek
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[E] Severn River
[F] Little Patuxent
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[H] Upper Patuxent
[I] Rhode River
[J] West River
[K] Herring Bay
[L] Middle Patuxent
[M] Lower Patuxent

## Redbreast Sunfish
*(Lepomis auritus)*

Images: Duane Raver, USFWS (left), and a 2018 voucher photo (right).

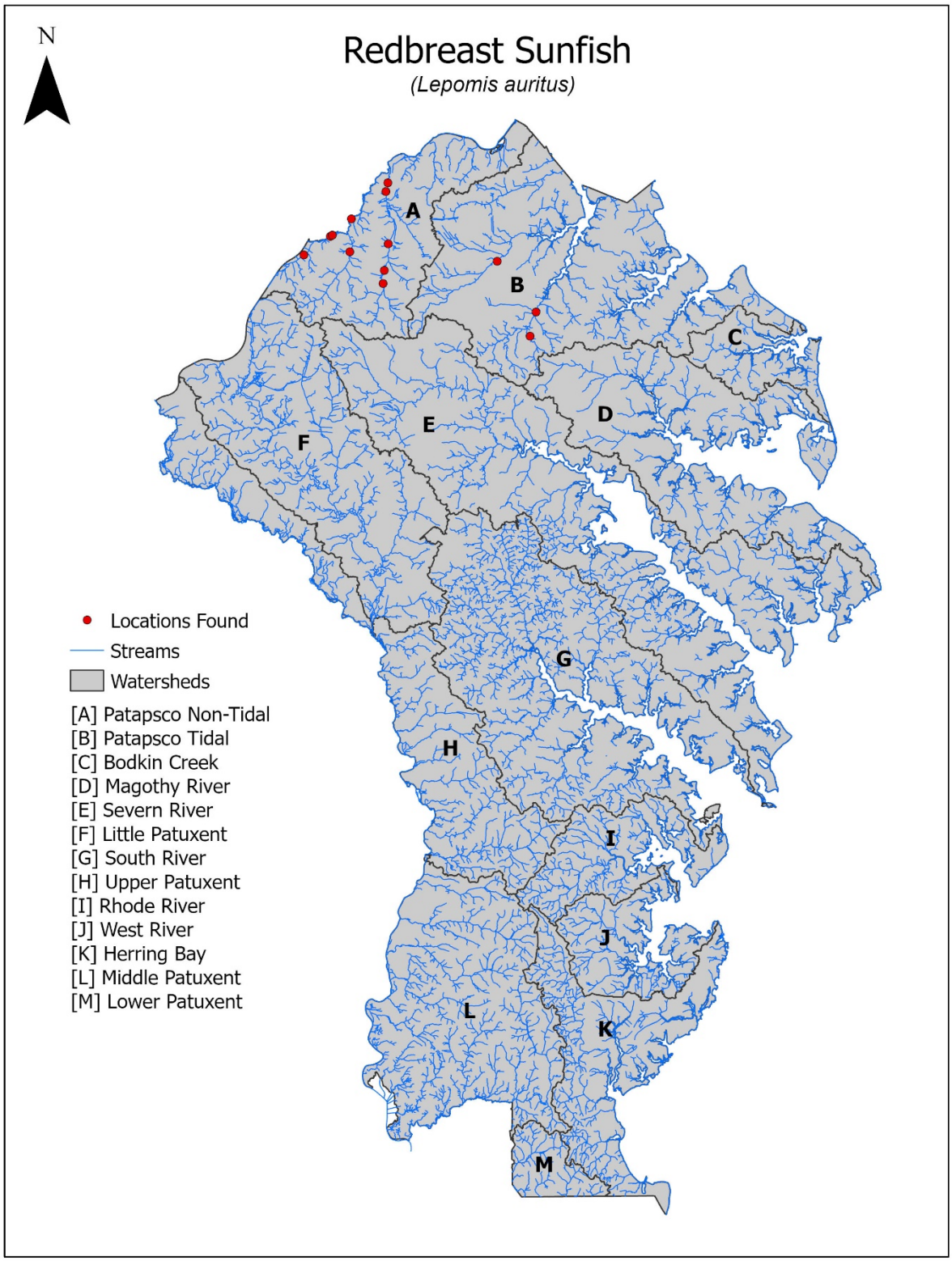
## Distribution:
Uncommon in the County, but somewhat frequent where found. Observed mostly Patapsco River watershed.

## Origin:
Native to Maryland.

## Conservation Status:
No special protections under state or federal law.

## Description:
The Redbreast Sunfish is somewhat more elongate compared to other sunfish (1), with a bright orange belly found in males and a yellow belly found in females (1). Blue streaks are often found on the cheeks and around the eyes in both sexes (29). The long flap that extends back from the gill cover, over an inch in some cases, is black in color all the way to its edge and has a width less than eye diameter (2, 29). Individuals can range from 2.5 to about 10 inches long (1).

## Life History and Habitat:
This species is found in large and small streams and exhibits no strong preferences for flow velocity as it is found in both slow and fast water areas (1, 31). Redbreast Sunfish eat a variety of insects, small clams, crayfish, and small fish (1, 30) and will also eat terrestrial insect species when available (31). Spawning takes place from April to June; new nests are made in sandy substrates or the abandoned nests of other sunfish are used (1). Individuals live up to nine years (1).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## Largemouth Bass
## *(Micropterus salmoides)*


Images: Duane Raver, USFWS (left), and a 2020 voucher photo (right).

## Distribution:

Somewhat common in the County, but infrequent where observed. Found mostly in the Patapsco River watershed, with some occurrences in the Magothy, South, and Patuxent River watersheds.

## Origin:

Native only to the Ohio River watershed areas in Western Maryland, but widely Introduced and naturalized throughout the state.

## Conservation Status:

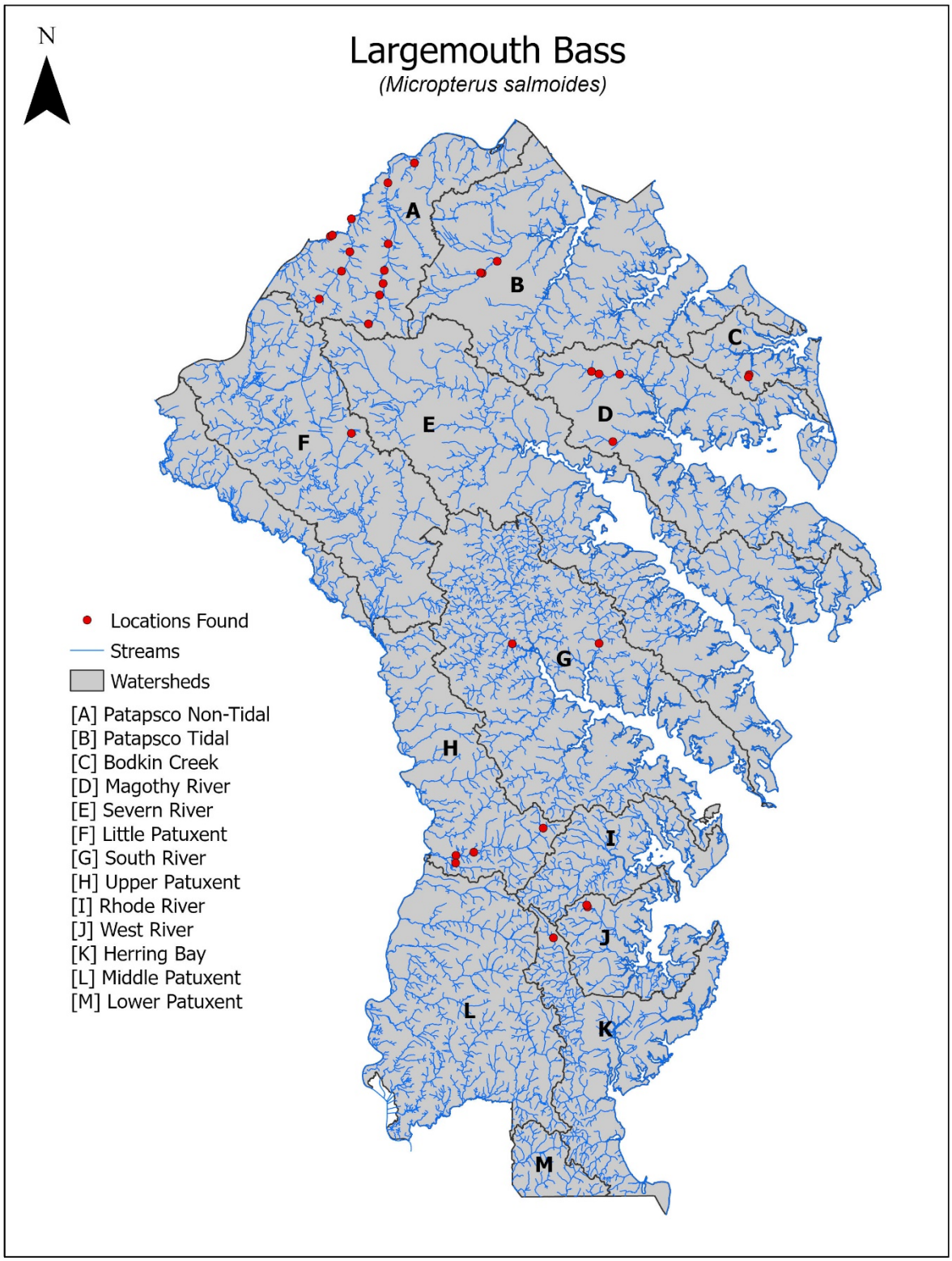
No special protections under state or federal law.

## Description:

The largest member of the sunfish family, the Largemouth Bass is more elongate than other sunfishes and is olive green in color with a prominent, but blotchy, longitudinal black stripe along its body (1, 2). In mature individuals, the lower jaw ends just past the back side of the eye while in juveniles, it ends just at or just before this point (1, 2). Also, dorsal fin is deeply notched, more so than its cousin, the Smallmouth Bass (1). This species can grow up to 30 inches in length in the Chesapeake Bay watershed (36).

## Life History and Habitat:

A very popular sport fish, Largemouth Bass are somewhat pollutant-tolerant, preferring warmer water and shallower, slower moving parts of streams and rivers (1, 36, 37). This species feeds on smaller aquatic insects when young but switches to a primarily fish-based diet as adults, although amphibians, crayfish, and other Largemouth Bass are enthusiastically consumed as well (1, 37). Breeding takes place in spring, when males establish and defend a territory up to 10 feet in diameter in a sandy area that is cleaned of organic debris (1). The female lays adhesive eggs, which stick to the sand and are fanned and guarded by the male until a few days after hatching, when the hatchlings move off as an independent school (1). Largemouth Bass are known to live between 13 and 15 years (1, 37).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[J] West River
[K] Herring Bay
[L] Middle Patuxent
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## Bluespotted Sunfish
## *(Enneacanthus gloriosus)*

Images: Hugh Chrisp, NYDEC (left) and 2017 voucher specimen (right).

## Distribution:

Uncommon in the County and infrequent when found. Found mostly in the South and Magothy River watersheds.

## Origin:

Native to Maryland.

## Conservation Status:

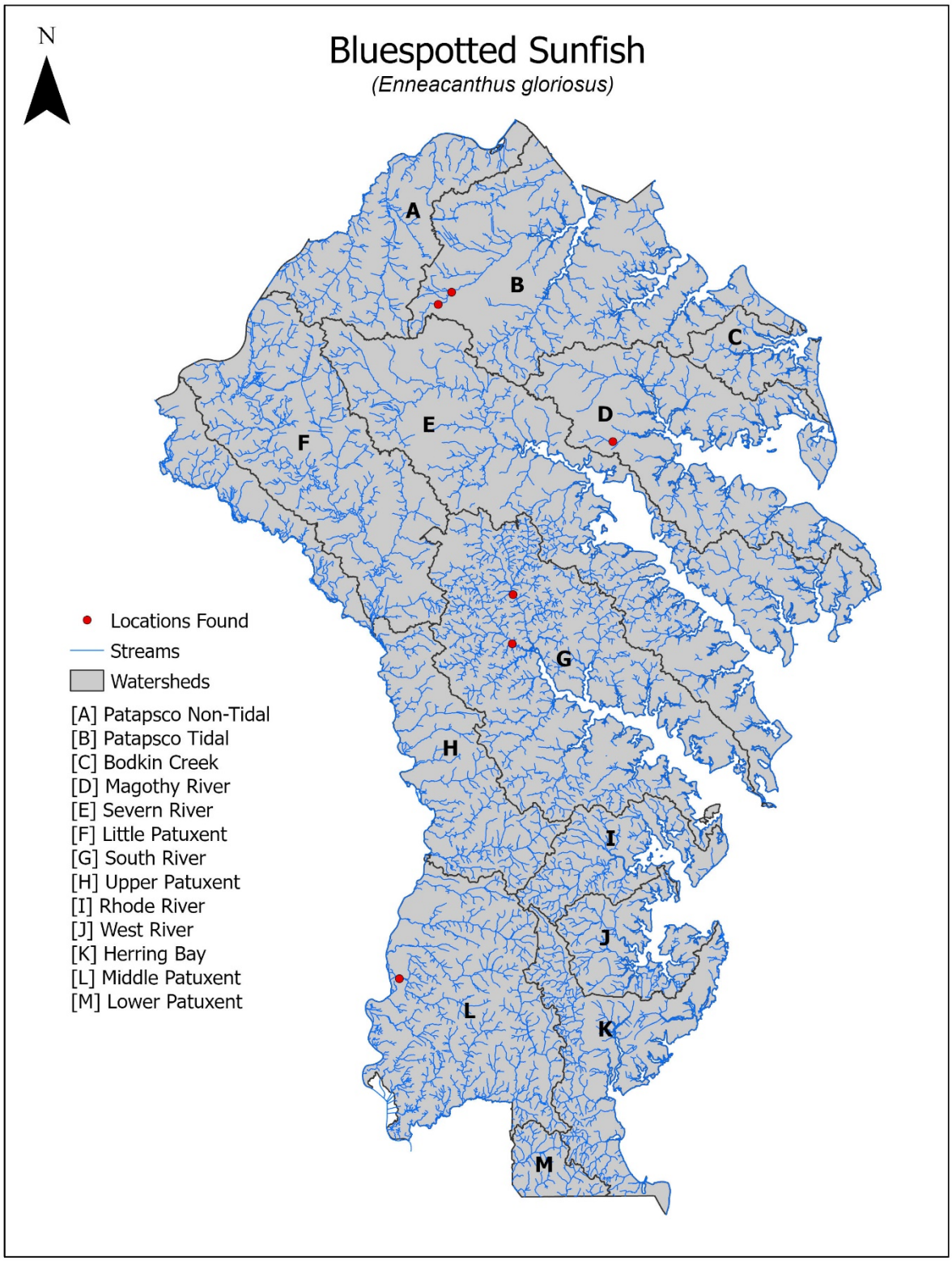
No special protections under state or federal law.

## Description:

The Bluespotted Sunfish is a small sunfish that has a rounded tail instead of a forked tail like all other sunfishes found in the County (1, 2). Colors vary, with reproductive age males having an almost black body with iridescent blue, green, silver, or gold spots along its body. Non-reproductive adults are usually colored dark green with indistinct vertical bands and less obvious spotting (1, 2), although the bands are more distinct in juvenile fish (2). Sizes range from 2 to 3 inches (1), making this species the smallest sunfish found in the County.

## Life History and Habitat:

Bluespotted Sunfish are likely somewhat tolerant to poor water quality conditions as they are described as found in a variety of slow and still water habitats, including drainage ditches, over sand or mud bottoms (1). Aquatic insects, copepods, scuds, and other crustaceans are this species' preferred food (44). Bluespotted Sunfish spawning occurs from early spring to summer (1, 44). Males construct a circular nest into which females lay adhesive eggs; more than one brood may be raised in a season (1). This species lives up to four years (1).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## Warmouth
*(Lepomis gulosus)*

Images: Duane Raver, USFWS (left), and Emilio Concari, MD Biodiversity Project (right).

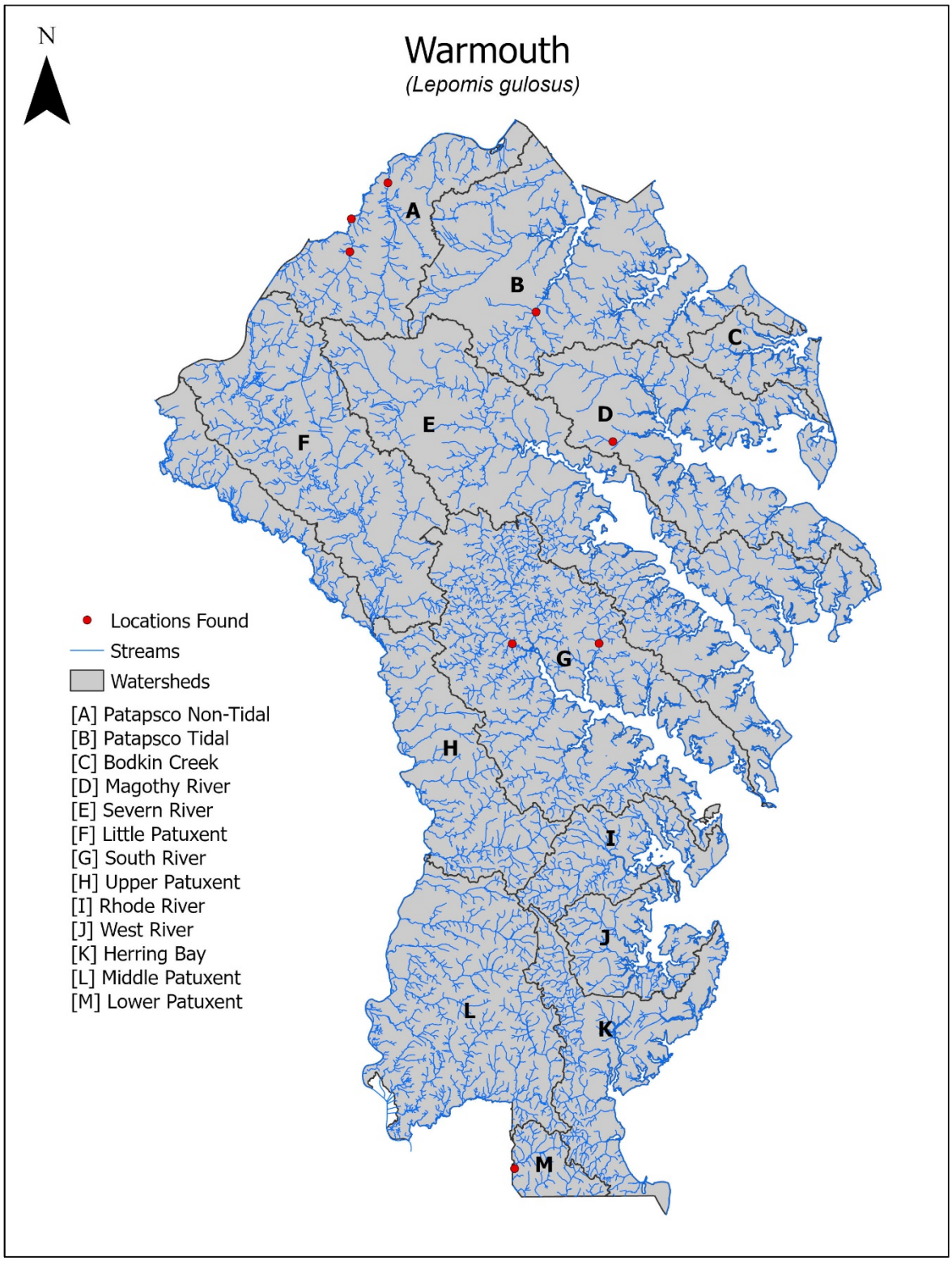
## Distribution:
Uncommon in the County and infrequent when found. Found primarily in the Patapsco, Magothy, and South River watersheds.

## Origin:
Native to Maryland.

## Conservation Status:
No special protections under state or federal law.

## Description:
The Warmouth is a mottled olive-green to brown color, often with an orange or yellow wash along the belly, with a more elongate body than other sunfish (1). The cheeks often have three to four distinct dark bands (1, 2) and a marbled pattern is often observed along the lower rear of the body (1, 2). Younger fish often have distinct vertical bars along the body (see photo, upper right) that become more mottled in older fish (1, 2). Individuals range from 3 to 12 inches long (1).

## Life History and Habitat:
The Warmouth is moderately tolerant to degraded water quality conditions (47) and is often found in slow-moving streams and rivers over a mud bottom with extensive submerged aquatic vegetation present (1, 47). Primarily a fish eater, the Warmouth also feeds on crayfish and insects (47). Spawning occurs from April to August (47). Males construct a nest, usually in protected areas near woody debris or vegetation, and the eggs are protected by the male until the fry leave the nest, usually five or six days after hatching (1). The maximum observed life span is eight years (1).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## Smallmouth Bass
*(Micropterus dolomieu)*

Images: Duane Raver, USFWS (left), and 2018 voucher photo (right).

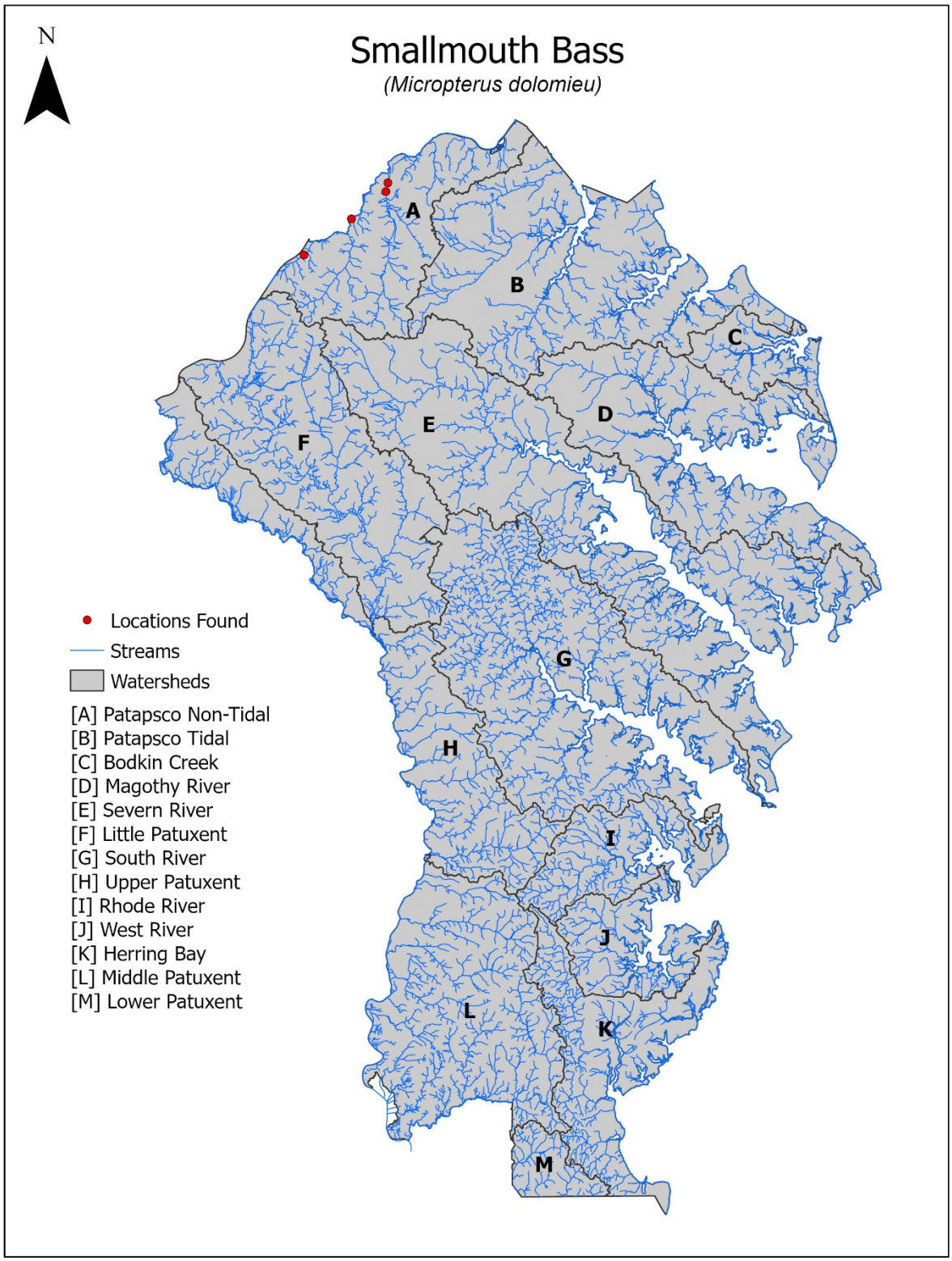
## Distribution:
Uncommon in the County and very infrequent when found. Found only in the Patapsco Nontidal River watershed.

## Origin:
Not native to Maryland, but widely introduced and naturalized across the state.

## Conservation Status:
No special protections under state or federal law.

## Description:
The Smallmouth Bass is green-yellow in color with an elongated body and a series of dark vertical bars that are often present along its sides (1). It is distinguished from its close relative, the Largemouth Bass, by having a shallow notch between its two dorsal fins (instead of a deep notch) and by the back of its mouth not extending past the middle of the eye (1, 2). Individuals range from 8 to 27 inches (1).

## Life History and Habitat:
The Smallmouth Bass is intolerant of turbidity and siltation, but can tolerate a range of temperatures; its presence is usually an indicator of good water quality conditions (1). Smallmouth Bass are often found in larger streams and rivers with deep pools and moderate cover present, over gravel or rubble bottoms (54). This species eats fish and crayfish when grown, but eats aquatic insects when younger (1, 54). From late spring to early summer, males construct large (~4 feet) nests in gravel areas with flowing water and may spawn with several females (1). The male guards the nest until the eggs hatch and the fry leave the nest (1). Individuals may live up to 15 years (54), but fish between three and seven years old are more typical (1, 54). The Smallmouth Bass is an important and widely sought after game fish (1, 54).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[J] West River
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[L] Middle Patuxent
[M] Lower Patuxent

## Black Crappie
*(Nocomis micropogon)*

Images: Duane Raver, USFWS (left), and Emilio Concari, MD Biodiversity Project (right).

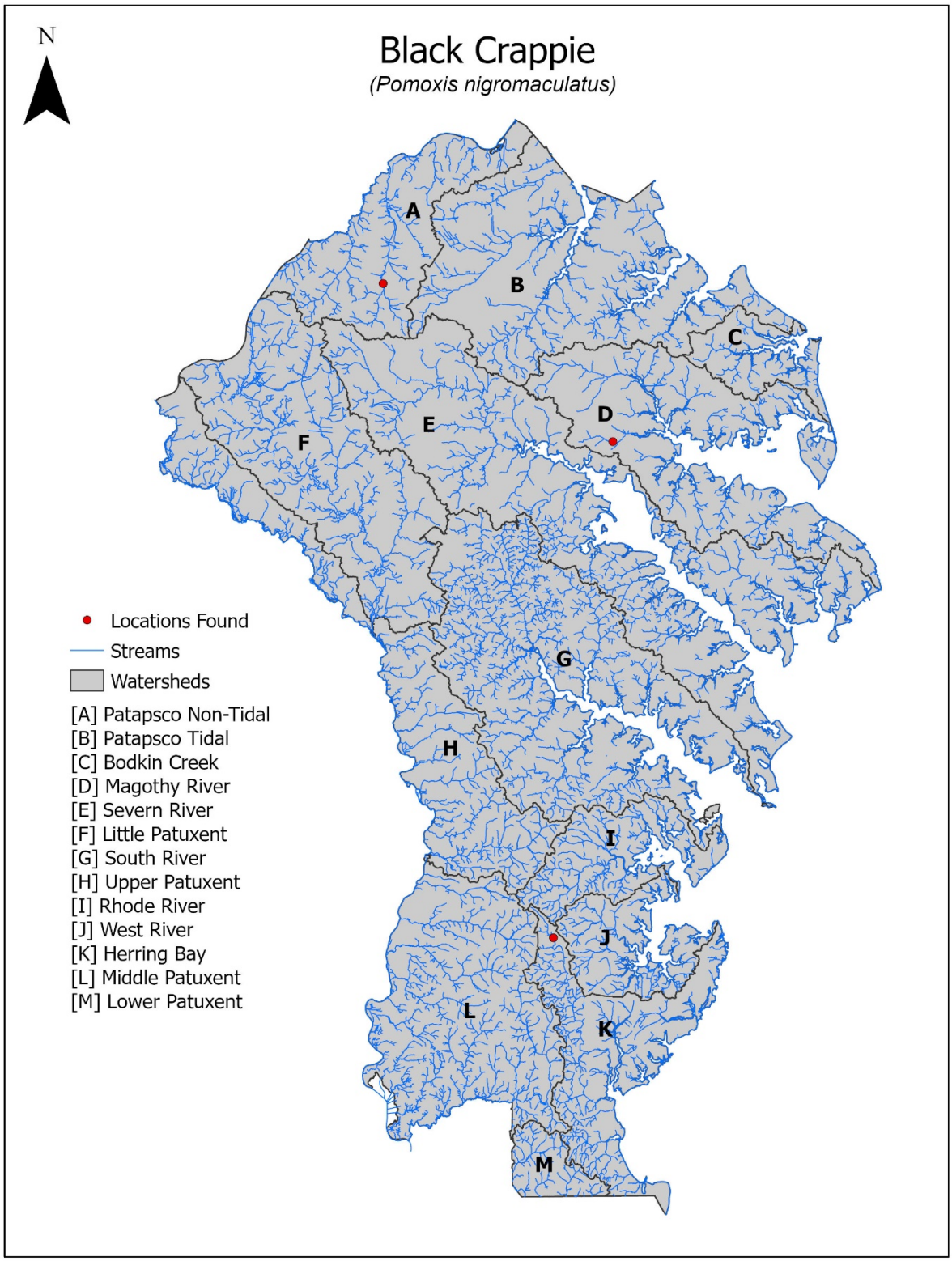
## Distribution:
Uncommon in the County and very infrequent when found. Observed in the Herring Bay, Magothy, and Patapsco Nontidal River watersheds.

## Origin:
Native to Western Maryland Ohio River drainage areas only, but introduced and naturalized all over the state, including Anne Arundel County.

## Conservation Status:
No special protections under state or federal law.

## Description:
The Black Crappie is a silver colored sunfish covered with many dark speckles or blotches (1). This species has a large mouth and 7 or 8 spines at the front of its dorsal fin (1, 2, 55). Individuals range from 5 to 20 inches (1).

## Life History and Habitat:
Moderately sensitive to pollution, the Black Crappie is found in slow moving parts of streams and blackwater creeks, often near submerged aquatic vegetation (SAV) or woody debris (1). Young fish feed on aquatic insects but transition to fish only when larger (1, 55). From spring to summer, males construct nests in shallow areas near woody cover or SAV and may mate with more than one female during the season (1). The male guards and maintains the nest until the eggs hatch and the fry leave (1). Black Crappie have been known to live up to 15 years (55).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## Rock Bass
## *(Ambloplites rupestris)*

Images: Duane Raver, USFWS (left), and Emilio Concari, MD Biodiversity Project (right).

## Distribution:

Seldom found and very infrequent when found. Observed in the Patapsco Nontidal River watershed.

## Origin:

Native only to the Ohio River drainage areas in Western Maryland; introduced and naturalized elsewhere in the state.

## Conservation Status:

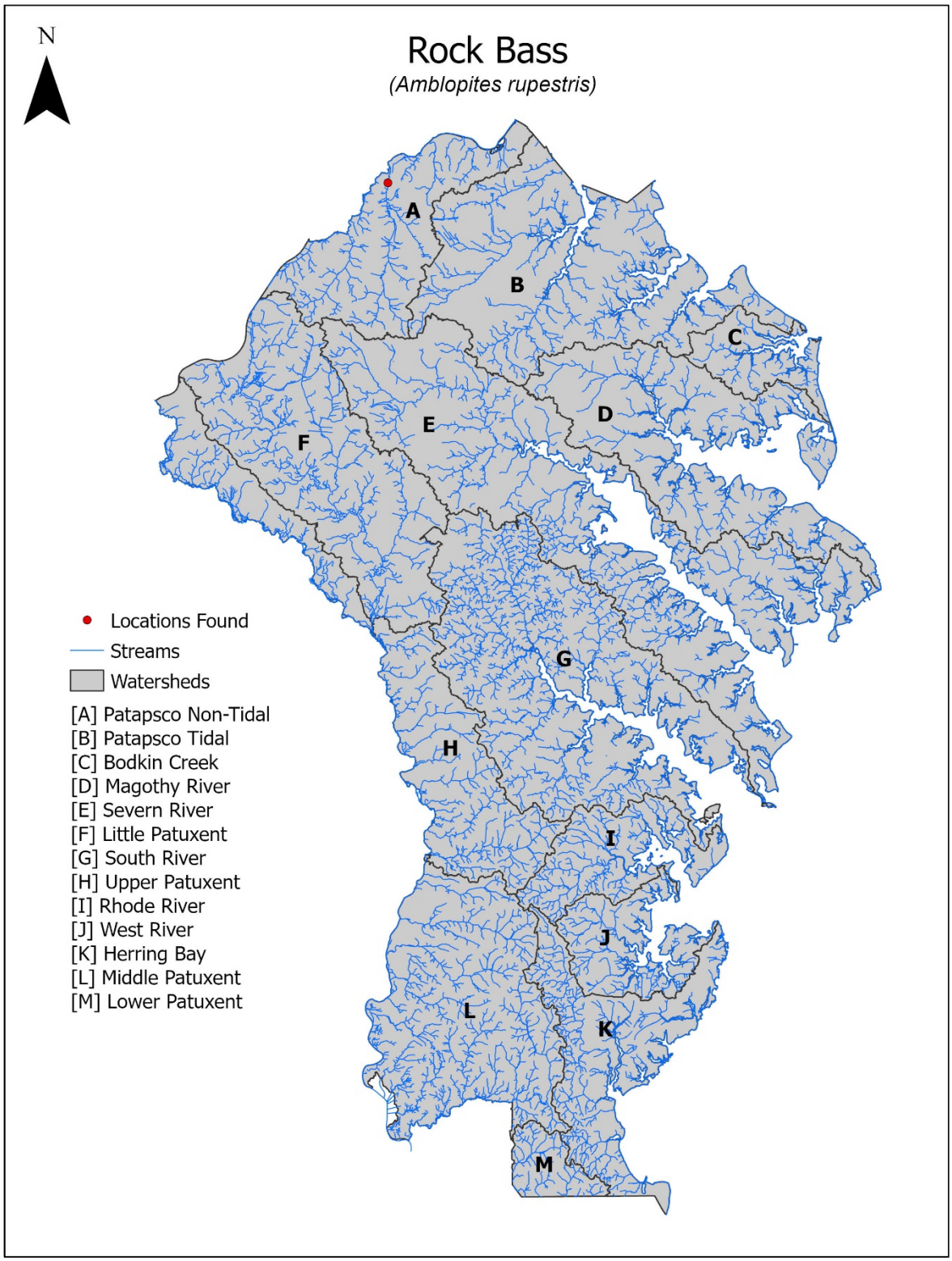
No special protections under state or federal law.

## Description:

The Rock Bass is a stout-bodied sunfish with red or reddish eyes and is dark green on top which fades to a lighter green towards the belly (1, 2, 65). It has four to five spines at the beginning of its anal fin and the scales on this fish have a rough, spikey feel when lightly rubbed from tail to head (1, 2, 65). Individuals range from 6 to 17 inches (1).

## Life History and Habitat:

This species prefers fast-moving parts of the streams and rivers in which they live, over sand, gravel, and rock bottoms (1, 65). Rock Bass have a broad temperature tolerance and inhabit cool and warm water systems (1). Small fish, crayfish and other crustaceans, and aquatic insect larvae are the preferred prey for this species (1, 65). Breeding occurs in the summer, where males make a circular nest in sand or gravel (1, 65). After the eggs are laid, the male protects the nest until the fry hatch (1, 65). Males and females may mate multiple times with different partners in a season (65). The typical age in the wild for this species is five to eight years (65).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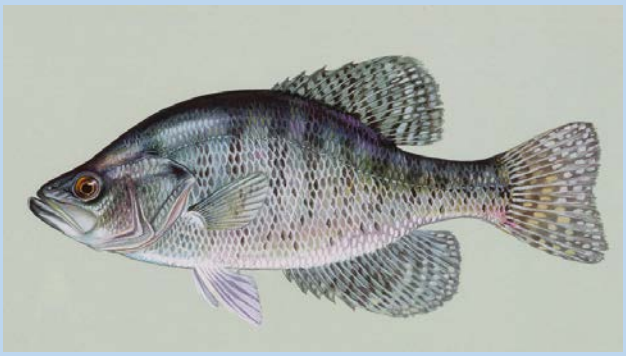
## White Crappie
*(Pomoxis annularis)*



Images: Duane Raver, USFWS (left), and the Idaho Department of Fish and Game (right).

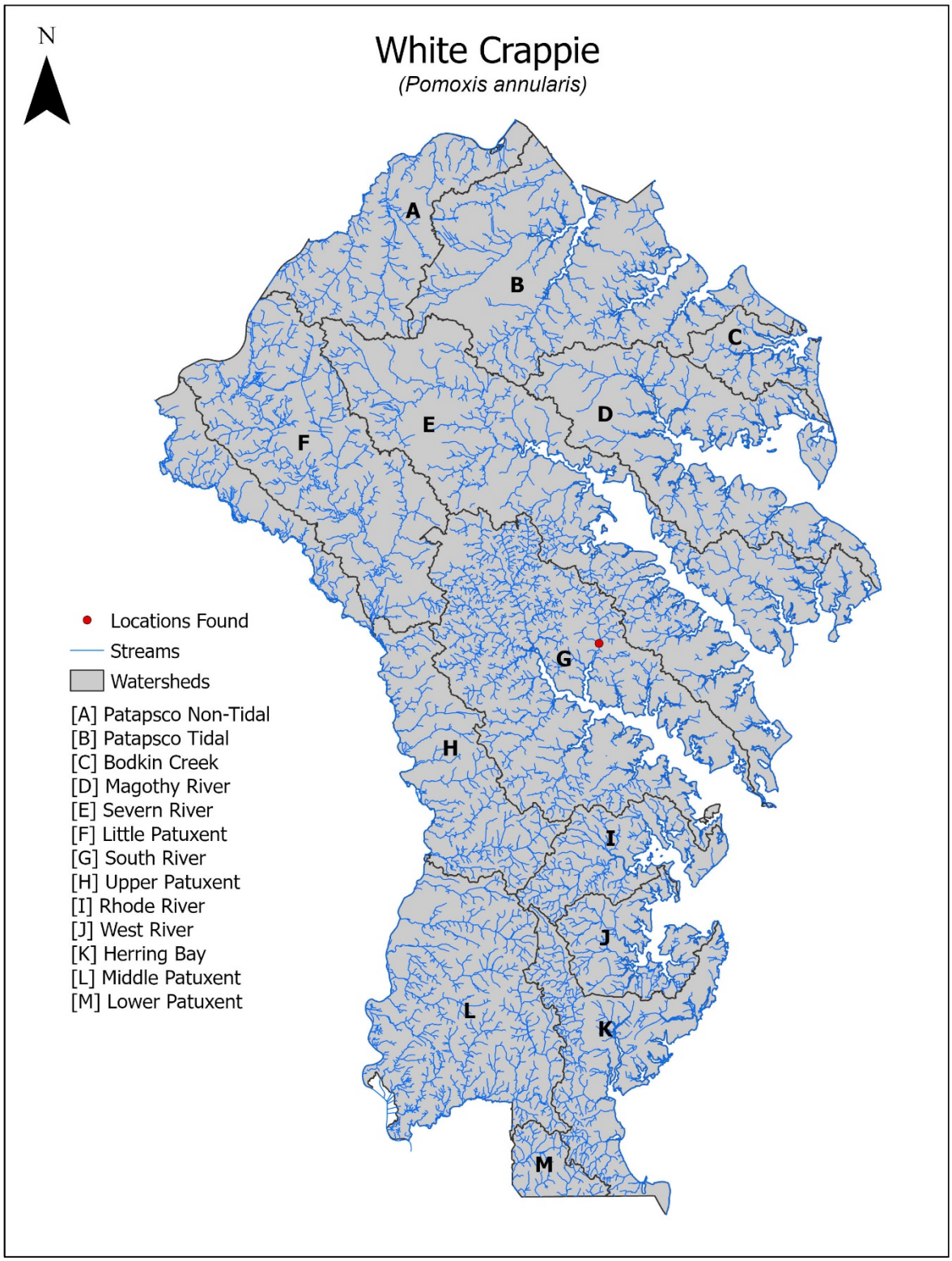
## Distribution:
Seldom found in the County and very infrequent when found. Observed in the South River watershed.

## Origin:
Native only to the Ohio River drainage areas in Western Maryland; introduced and naturalized elsewhere in the state.

## Conservation Status:
No special protections under state or federal law.

## Description:
The White Crappie is a sunfish with an elongate body and five or six spines at the front of the dorsal fin, a distinguishing characteristic from its relative, the Black Crappie, which will have seven or eight dorsal fin spines (1, 2). The White Crappie's body is an overall silver-green color with a series of poorly formed dark bands, while the Black Crappie is more mottled than banded (1). Individuals range from about 6.5 to 20 inches (1).

## Life History and Habitat:
The White Crappie is somewhat tolerant to poor water quality conditions and is found in slow-moving parts of streams and rivers—often near woody debris, aquatic vegetation, and other cover—over a variety of hard and soft bottom types (66). This species feeds on aquatic insect larvae, small fish, and crustaceans (1, 66). Spawning occurs from spring to mid-summer, where males make nests in moderately shallow water, near woody debris or aquatic vegetation (1, 66). Nests are often grouped together and the male provides all the protection and care of the nest until the fry leave (1). White Crappie can live up to nine years (1, 66).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# SNAKEHEADS
## (Family *Channidae*)

Fishes in this family are native to Asia and Africa, but have been introduced all over the world. In systems where they are not native, there are no natural predators to check their numbers so they can have a serious adverse impact on native fish populations. There are more than 50 species, but only one has been introduced to Maryland:

- Northern Snakehead (*Channa argus*) p. 116

## Northern Snakehead
*(Channa argus)*

Images: Oriolekce1 / MD Biodiversity Project (left) 2021 voucher photo (right).

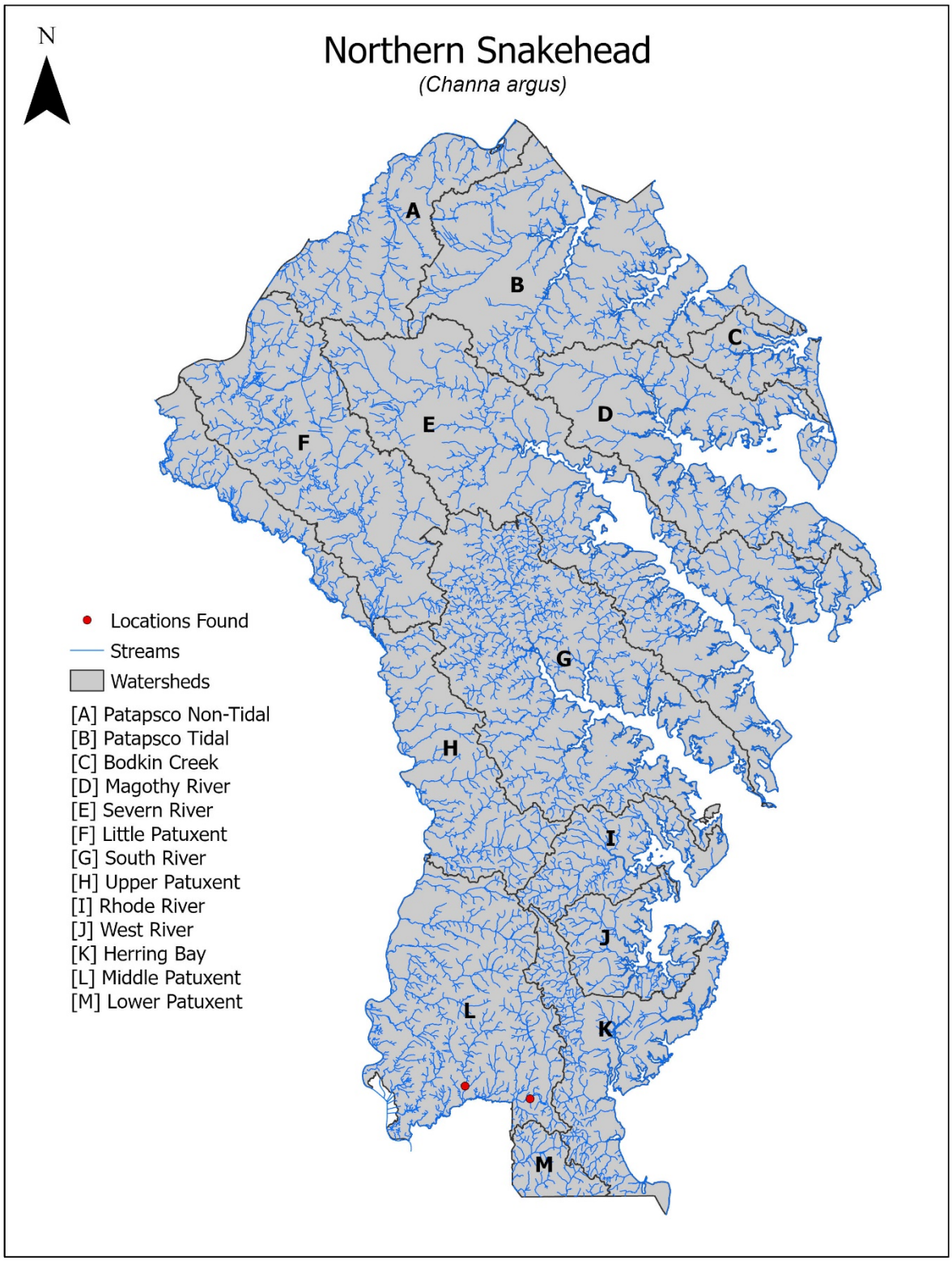
## Distribution:
Uncommon in the County and very infrequent when found. Observed in the Middle Patuxent River watershed.

## Origin:
Not native to Maryland.

## Conservation Status:
An invasive species that Mid Atlantic wildlife authorities are attempting to control. State regulations prevent the retention of live snakeheads (59). It is strongly recommended that, if caught, individuals are not returned to the waters of the County and instead are humanely destroyed.

## Description:
The Northern Snakehead is a long, torpedo shaped fish that is dark yellow or brown with a bold pattern of dark vertical blotches (2). It has a large, flattened head with a large mouth full of teeth and it is distinguished from the native lookalike, the Bowfin, by having a rounded tail, an anal fin that starts at the body midpoint and continues to the base of the tail, and lacking a bony plate on the underside of the head in the middle of the lower jaw (2). Individuals grow up to 33 inches in length (59).

## Life History and Habitat:
First discovered in the Bay watershed in a pond in Crofton in 2002, the Northern Snakehead is now found in the Potomac River and several Bay tributaries in Maryland and Virginia (59). This species is likely tolerant of degraded water quality conditions as it is often found in slow, stagnant water over mud substrate with submerged aquatic vegetation present (60). This species is also an air breather and can use this ability to move short distances over land to colonize new waterbodies (59). Primarily a fish eater, it has been known to also eat crustaceans, amphibians, and mammals (59, 60). Spawning occurs in nests made in SAV and both parents protect the nest and the larva after hatching (59). Snakeheads are believed to live up to eight years (59).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[G] South River
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[I] Rhode River
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| Figure 1. Fish anatomy diagram | SCDNR: https://www.dnr.sc.gov/fish/anatomy.html | public domain assumed since produced by a state agency |

Appendix A: Definition of the Abundance and Density Categories Used to Characterize Fish Distributions

An attempt was made to standardize the descriptions of how often a particular fish species occurred during the sampling work and how widespread a particular species was across different watershed areas. These categories are used in the individual species descriptions.

**ABUNDANCE:** A measure of how often a species occurred in the sampling. Expressed as the percentage a particular species comprises of the total number of fish observed during the assessment (% abundance = species total number/total R3 fish collected *100), using the following categories:

- **Frequent**: >= 5% of all fish captured.
- **Somewhat Frequent**: Between >=1% and <5% of all fish captured.
- **Infrequent**: Between 0.1 and <1% of all fish captured.
- **Very infrequent**: <0.1% of all fish captured.

**DENSITY:** A measure of a species' distribution across the County, irrespective of abundance. Expressed as the percentage of sites where an individual of a particular species occurred at least once (% density = no. sites where species found at least once/total R3 sites sampled*100), using the following categories:

- **Widespread**. Found at least once in more than 50% of sites sampled.
- **Common**. Found at least once in between 21 and up to 50% of sites sampled.
- **Somewhat common**. Found at least once in between 11 and up to 20% of sites sampled.
- **Uncommon**. Found at least once in between 1 and up to 10% of sites sampled.
- **Seldom found**. Found at least once in less than 1% of sites sampled.

Appendix B:  Total Count of Each Species Observed in this Assessment

| Species | Total Observed |
|---|---|
| Blacknose Dace | 7933 |
| Eastern Mudminnow | 3550 |
| Eastern Mosquitofish | 2573 |
| Green Sunfish | 1833 |
| Tessellated Darter | 1633 |
| American Eel | 1346 |
| Creek Chub | 1199 |
| Bluegill | 1102 |
| Fallfish | 730 |
| Least Brook Lamprey | 656 |
| Rosyside Dace | 638 |
| Swallowtail Shiner | 622 |
| Pumpkinseed | 534 |
| White Sucker | 407 |
| Creek Chubsucker | 407 |
| Golden Shiner | 386 |
| Brown Bullhead | 314 |
| Fathead Minnow | 308 |
| Satinfin Shiner | 305 |
| Mummichog | 227 |
| Redbreast Sunfish | 176 |
| Central Stoneroller | 134 |
| Longnose Dace | 132 |
| Sea Lamprey | 130 |
| Yellow Bullhead | 107 |
| Largemouth Bass | 104 |
| Bluntnose Minnow | 97 |
| Redfin Pickerel | 79 |
| Banded Killifish | 60 |
| Bluespotted Sunfish | 46 |
| Blue Ridge Sculpin | 29 |
| Warmouth | 26 |
| Spottail Shiner | 22 |
| Margined Madtom | 21 |
| Northern Hogsucker | 18 |
| Common Shiner | 17 |
| Cutlip Minnow | 11 |
| Chain Pickerel | 8 |
| River Chub | 6 |
| Smallmouth Bass | 6 |

| Species | Total Observed |
|---|---|
| Black Crappie | 6 |
| Tadpole Madtom | 4 |
| Goldfish | 3 |
| Northern Snakehead | 3 |
| Yellow Perch | 2 |
| Glassy Darter | 2 |
| Rock Bass | 1 |
| White Crappie | 1 |
| Brook Trout | 1 |
| **Total Fish Observed** | **27955** |