

Habitat Assessment Manual (HAM) – Introduction

This Habitat Assessment Manual was created as a reference tool for KYTC Environmental Coordinators (ECs) to facilitate timely and efficient documentation of compliance with Section 7 of the Endangered Species Act (ESA). The document is intended to empower ECs, who may not have a background in biology, to assess and document lack of habitat for species that may be considered potentially present within a proposed project area. In conformance with the HAM, such determinations may be made without the involvement of a biology Subject Matter Expert (SME) from the Division of Environmental Analysis (DEA). Making these decisions at the District level promotes more efficient use of limited biology SME resources and more timely completion of required project documentation.

This document provides guidelines for the initial assessment to consider impacts of KYTC projects on federally-listed species or their habitat which is required for compliance with NEPA and Section 7 of the Endangered Species Act (ESA). The assessment may conclude that the project is one that by definition will have No Effect on federally protected species and requires no project-specific documentation (see KYTC/FHWA Determinations of No Effect Memorandum of Understanding, 2005). For other projects, the process will conclude with preparation of a No Effect document or coordination with a DEA SME for further review and analysis. These decisions should be made based on information provided in the HAM, including: photos, Species Description, Habitat Description, Life History Information, Critical Habitat Units, Species Range, Location Maps, and Decision Key. Although the species information provided is not all inclusive, it should be sufficient for determining further actions required in most KYTC project circumstances.

Organization of HAM

The HAM is divided into groupings which separate organisms (e.g. – birds, crustaceans, fishes, mammals, etc.). A ‘Notable Species’ section also details species with ESA history, but which are not currently provided any federal protections (e.g. delisted, not warranted, etc.) and thus formal review or actions are not required. Within each grouping, species are arranged in alphabetical order by common name. In most cases, each species section can be considered a standalone document; however, further useful general information may also be provided in grouping level documents such as the introduction, glossary, figures (e.g. fish, bats, mussels). Bibliography not included for organizational purposes.

Species Information

Information presented for individual species will typically include photos, Species Description, Habitat Description, Life History Information, Critical Habitat Units, Species Range, Location Maps, and Decision Key. For species with designated critical habitat units, the primary constituent elements that were listed in the Federal Register by the US Fish and Wildlife Service (USFWS) are provided. Other critical habitat information may include a table of listed units, unit descriptions, and/or maps of each unit location.

USFWS has a new record sharing method via their online IPaC (Information for Planning and Conservation) tool. ***IPaC is now the required method for securing an official species list from our USFWS-Kentucky Field Office.*** IPaC can be accessed at the following interactive website: <https://ecos.fws.gov/ipac/>. See further guidance detail in No Effects Determination Step 1 below, or assistance in use of this website can be provided by contacting your DEA SME Biologist.

Kentucky State Nature Preserves Commission (KSNPC), and Kentucky Department of Fish and Wildlife Resources (KDFWR) also keep and maintain records for federally listed species and other species of concern (e.g. state listed). KSNPC and KDFWR records are available via formal consultation request (email or letter) and may require a small fee. Dependent on level of review, coordination with these agencies is highly suggested for obtaining useful, detailed species records at/near your project area. KSNPC records are often detailed beyond the USFWS official species list generated.

How to Use the HAM

To address Section 7 of the Endangered Species Act, start with identifying which species are listed for the project's area or at the county level (refer to Species Information section above), and then perform a Habitat Assessment (HA) using the information in this HAM. Conditions in the project vicinity should be compared to the habitat requirements described in the HAM for each listed species with potential to occur within that particular area or county. Based on this comparison and working through the questions in the provided Decision Key, you will make a determination on how to address each listed species or whether you need to contact your SME for additional review. The assessment may conclude that the project is one that by definition will have No Effect on federally protected species and requires no project-specific documentation (see KYTC/FHWA Determinations of No Effect Memorandum of Understanding, 2005). For other projects, the process will conclude with preparation of a No Effect document or coordination with a DEA SME for further review and analysis. The SME may determine that there is No Effect or require a Biological Assessment for certain listed species (this may require seasonal survey efforts). Each of these options are discussed in further detail below.

Project Types Defined as Having No Effect

The following fifteen categories are considered to have *No Effect by Definition* (see KYTC/FHWA Determinations of No Effect Memorandum of Understanding, 2005) to federally listed species. The list closely aligns with the Categorical Exclusion (CE) list for undocumented CEs (the "C" list") that was in FHWA regulation in 2005. Though the "C" list has been significantly expanded in recent years, the projects defined as having No Effect by definition has not changed. Regardless of whether listed species may be present within the vicinity of these project areas, it is highly unlikely that the species, habitat, or critical habitat as defined in the HAM would be affected due to the location and nature of these project types. If your project fits into one or more of the fifteen categories listed below, no project-specific documentation is required.

If a project included in the list below involves removal or impact to suitable listed species habitat as defined in the HAM (e.g. tree removal) or if the project includes any additional activities that do not fully fit into any of the fifteen categories described below, then you must continue with a No Effect finding or consult your SME.

No Effect Projects by Definition*:

- 1) General highway maintenance, including filling potholes, crack sealing, mill and resurfacing, joint grinding/milling, etc.
- 2) Guardrail replacement where no new bank stabilization is required.
- 3) The replacement of traffic signals within existing ROW.
- 4) The installation or maintenance of signs or pavement markings within the existing ROW.
- 5) General pavement marking or “line painting” projects.
- 6) The installation of raised pavement markers.
- 7) Mowing or brush removal/trimming projects within existing ROW.
- 8) Improvements to existing KYTC/County maintenance facilities.
- 9) Study-type projects (e.g. feasibility studies, etc.).
- 10) Installation of new fencing, signs, small passenger shelters, traffic signals, or railroad warning devices where no habitat, as defined in the HAM, occurs.
- 11) Acquisition of scenic easements.
- 12) Transfer of federal lands pursuant to USC 317 when the subsequent action is not an FHWA action.
- 13) Track and rail-bed improvements, maintenance activities, or acquisition.
- 14) Bridge deck overlays, bridge deck replacements and other maintenance activities, including painting projects provided the project does not involve any work within or involve impacts to streams, rivers, scenic river corridors, or other habitat as defined in the HAM.
- 15) Disposal of excess ROW parcels wholly contained in recent Major Project Acquisitions.

*List is derived from KYTC/FHWA Determinations of No Effect Memorandum of Understanding, 2005. Contact your SME Biologist if you would like a copy of the full MOU document.

No Effect Determination

Projects not ‘defined’ as having No Effect, as described in the previous section will instead need to be evaluated on a project-by-project basis. A No Effect determination can be reached if (1) the habitat requirements of a potentially occurring listed species are not present in the project’s impacts area, or (2) if listed species potential habitat is in the project vicinity but that habitat will not be impacted by the proposed actions.

Note: Always consult with SME Biologist for work in or adjacent to critical habitat units.

Below are steps that are appropriate steps to be followed to reach a No Effect determination.

Step 1. Identify which species are federally listed for either the specific area or the entire county where the KYTC project is located by using USFWS’s IPaC interactive website (<https://ecos.fws.gov/ipac/>). Drawing your specific project area within IPaC can aid in pinpointing your project area’s potential for containing habitat for federally listed species. Obtaining your species list at the county level is also still accurate; however, may include a large list of species, all of which must then be discussed and evaluated in your documentation. If there is any uncertainty regarding this list, please consult with your DEA SME Biologist.

Step 2. Once all listed species have been identified for a project area (including excess material sites), review each species’ section in the HAM for further evaluation. Identify the types of habitat used by the various species in question and assess, by gathering appropriate office or field data, whether a species’ habitat may or may not be present within the project area. Where a project area coincides or is in proximity to areas of designated critical habitat, the EC must coordinate with the DEA SME Biologist.

Step 3. Answer the questions of each Decision Key to identify steps necessary for determining and documenting the environmental habitat assessment for each listed species. Some species may have a longer Decision Key than others and require multiple

steps. Recognize that some questions may be answered based on office review alone, while other instances may require a site visit for field assessment.

Most Decision Keys begin with an office assessment component that requires either a ‘yes’ or ‘no’ answer. These office assessments may include identifying presence/absence of features such as perennial streams, trees, sinkhole/karst potential, etc. Review of area conditions such as stream order, topographical features, soil type, and/or other physical or geologic features may also be pertinent.

Step 4. If no habitat is present for listed species, or suitable habitat will not be impacted by the project, then complete a No Effect document. The No Effect document must include species habitat descriptions (provided within the HAM) to compare habitat present at the project site and habitat characteristics required for the listed species. This results section should clearly describe why or how it was determined that the required species’ habitat was unsuitable or absent from the project area or how suitable habitat will not be impacted.

If a project cannot be fully reported via No Effect finding, you must consult your SME.

Contact DEA SME Biologist

For projects that are not ‘defined’ as having No Effect and where a determination of No Effect cannot be reached through the Decision Key (see Step 3 above), the project must be reviewed by a DEA SME Biologist. After working through Steps 1-3 above, if it is found that suitable listed species habitat may be present and is likely to be impacted, then **Step 4** (instead of a No Effect document) will be to contact the DEA SME Biologist. This will be determined when a species’ Decision Key concludes SME review as the necessary action. Inevitably, some projects will require further assessment by the SME Biologist such as a site visit or seasonal field survey. The first step in this further assessment is for the EC to provide the SME with a Request for Assistance, including the project location (including excess material sites), description (i.e. proposed action, purpose and need), plan set (PDF/DGN), maps, photos, desired schedule for completion of work and any other pertinent information available.

The SME will usually conduct an on-site habitat assessment after their initial office review. Once their review is complete, the SME will determine how best to proceed to provide compliance with Section 7 of the ESA. These actions may include use of Programmatic Agreements, field surveys, Biological Assessment reports, Biological Opinions, etc. When the EC sends a Request for Assistance to their SME Biologist, they should also consider the seasonal requirements for identification of many species and afford sufficient time for the SME to complete any necessary review or actions (e.g. surveys) prior to a project's letting date or upcoming action (ROW authorization, utility relocation, etc.). See project example below:

Example: A proposed project is located on the western edge of Morgan County. The project is a reconstruction of an existing state road. According to the project-specific official species list generated via IPaC, it is determined that snuffbox mussel, Indiana bat, gray bat, northern long-eared bat, and Virginia big-eared bat are currently listed for Morgan County. After reviewing the HAM species information for snuffbox mussel, it is determined that there are no “perennial streams or their nearby tributaries” located within the project area. By following the Decision Key, due to this lack of habitat, the snuffbox mussel would qualify for inclusion within a KYTC ‘No Effect’ document. It is determined that tree take will occur for the project, and that blasting impacts are expected. Some karst areas are nearby, and the project is in known bat swarming habitat (which would indicate known caves in the project's vicinity). Based on the potential for cave/portal habitat surrounding the project, and the known take of summer roosting habitat (trees), the EC would then contact DEA SME Biologist to provide advanced project review and assessment.

Migratory Bird Treaty Act (1918)

The Migratory Bird Treaty Act (MBTA) is a Federal law that prohibits (individual, entity, or agency) the taking of any kind (killing, capturing, nest removal, egg collection, possess, sell, trade, purchase, deliver, import, export, transport, etc) of any migratory bird. The latest list of over 2100 species, roughly 800 occurring in North America, can be found at the USFWS webpage: <https://www.fws.gov/migratorybirds/RegulationsPolicies/mbta/mbtandx.html>.

Instances in which the MBTA does not apply occur under special circumstances approved by the MBTA: specific species hunting seasons for specific regions, nuisance/non-native exotic species, and other special circumstances. In short, it is unlawful to take, all inclusive definition, any protected migratory bird from the above referenced list.

How does this apply to KYTC? Most of our actions do not include what KYTC considers take. It is becoming increasingly common where eagles, hawks (osprey), owls, or other large birds actively nest on bridges or within the project zone, have we been required to coordinate with USFWS (via KDFWR) to comply with the MBTA. If you suspect concerns with take or harassment of any bird species protected under the MBTA, **please contact your SME for further investigation. The information presented below is for your reference only, but still requires consultation with your SME to ensure compliance with the MBTA.**

Fixing America's Surface Transportation Act (FAST Act)

Under the FAST Act, the take of active swallow nests on qualifying bridges [with any component condition rating of 3 or less (as defined by the National Bridge Inventory General Condition Guidance issued by the Federal Highway Administration)] is authorized during the typical breeding season of April 1 through August 31. This is due to the frequency in which bridges provide ideal artificial nesting habitat for some swallow species and to ensure public transportation safety. This Act permits take for nests of all swallow species (Table 1); however, the majority of those found on bridges are utilized by cliff swallows and barn swallows (Images 1 and 2). The following excerpt from the FAST Act explains protocol and requirements for breeding season take of active swallow nests. All inactive nests may be removed after verification of inactivity during the breeding season. Coordination is not required for bridge activities scheduled during the non-breeding season of September 1 through March 31. All coordination for the FAST Act will be completed via assistance from a DEA SME Biologist. Link to full FAST Act: <https://www.gpo.gov/fdsys/pkg/PLAW-114publ94/pdf/PLAW-114publ94.pdf>

Image 1: Cliff swallow and typical nests



Image 2: Barn swallow and typical nest



Table 1: Breeding swallow species of Kentucky.

Common Name	Scientific Name	Nesting Habitat
Tree Swallow	<i>Tachycineta bicolor</i>	Tree cavities/bird houses in open fields or over water
Bank Swallow	<i>Riparia riparia</i>	-Colonial Excavates tunnels into vertical sandbanks
Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>	Holes in sandbanks, crevices, pipes in cliffs/walls
Cliff Swallow	<i>Petrochelidon pyrrhonota</i>	-Colonial Overhanging ledges of rocky cliffs, building eaves, bridges
Barn Swallow	<i>Hirundo rustica</i>	Cliff ledges, house eaves, bridges
Purple Martin	<i>Progne subis</i>	Tree cavities/martin houses in open fields or over water

*If ring-neck doves or pigeons are nesting, there is no need to contact SMEs unless you are unsure of bird identification as these nests can be removed at any time.

Decision Key

- 1) Does the project have swallow nests present? The nest will frequently be on the underside of bridges on vertical surfaces.
 - a. Yes: Look for birds flying to the nests or under the structure. Look into nests and determine if eggs are present. If no eggs are present, then nests can be removed. If eggs are present within nests or it cannot be clearly determined if eggs are present, **contact your SME**.
 - b. No: Proceed with work even if birds are present.

Golden and Bald Eagle Protection Act (1940)

The Bald and Golden Eagle Protection Act prohibits anyone, without a permit issued by the Secretary of the Interior, from taking bald eagles (or golden eagles), including their parts, nests, or eggs. The Act provides criminal penalties for persons who "take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald eagle ... alive or dead, or any part, nest, or egg thereof." The Act defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb."

"Disturb" means: "to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior."

In addition to immediate impacts, this definition also covers impacts that result from human-induced alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagle's return, such alterations agitate or bother an eagle to a degree that interferes with or interrupts normal breeding, feeding, or sheltering habits, and causes injury, death or nest abandonment.

A violation of the Act can result in a fine of \$100,000 (\$200,000 for organizations), imprisonment for one year, or both, for a first offense. Penalties increase substantially for additional offenses, and a second violation of this Act is a felony.

Link to full Bald and Golden Eagle Protection Act: <http://www.fws.gov/permits/ltr/ltr.html>.
Bald and Golden Eagle Act Permit Regulations: Code of the Federal Register 50 Part 22

Literature Cited:

USFWS Website <http://www.fws.gov/midwest/midwestbird/eaglepermits/bagepa.html>).

Bald Eagle (*Haliaeetus leucocephalus*)

Species Description

This state and national iconic symbol has become a champion of the Endangered Species Act because it was **delisted** due to recovery. This raptor is characterized with seven foot wingspans, with mature adults possessing “bald” white heads and tails. Juveniles and immatures, although overall dark or black, have some variation or mottling of white and black among the plumage. In the field they can typically be distinguished by their size and flight pattern (straight to slightly over-arched wingspan in comparison to a turkey vultures dihedral shape or the stout wings and short tail of black vultures).

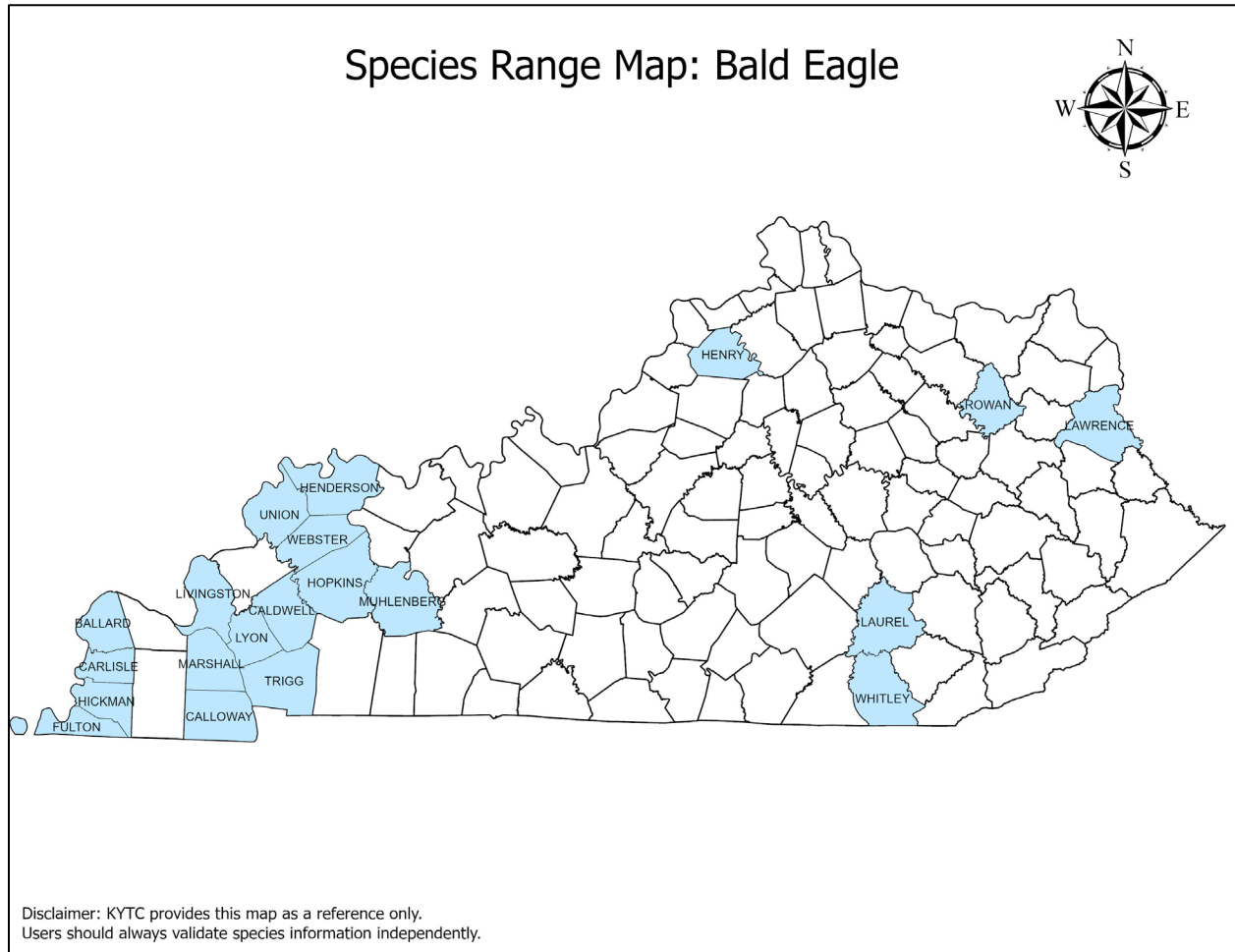


Figure 1 Photograph by: Steve Maslowski – USFWS.

This bird is no longer federally-listed, but it is covered by the MBTA and the Bald and Golden Eagle Act.

Habitat and Range

Typically bald eagles are associated with large bodies of water. Kentucky has several lakes and large rivers that potentially provide habitat for these birds. Although adept at hunting and fishing, Bald Eagles are also skilled thieves of other birds of prey, and can often be observed stealing food from Osprey and other raptors. The map provided shows where agencies (KDWFR, USFWS) currently list Bald Eagles. However, if a project is near a large body of water like a lake, the Ohio River, Mississippi River, and other large rivers, then attention to potential presence detection is warranted.



KYTC Special Considerations

National efforts monitoring the bald eagle populations have ceased in Kentucky, but KDFWR still continues monitoring winter populations in the state. As of the 2025 Eagle Survey Report provided by KDFWR, known nesting pairs are located around Ballard Wildlife Management Area, Lake Cumberland, and Land Between the Lakes. Additional surveys have documented bald eagles at Bernheim Forest, Cave Run Lake, Green River Lake, Laurel River Lake, Mississippi River, Ohio River - Carrsville-Henderson, Covington-Ashland, Henderson-Brandenburg, Wickliffe-Carrsville, Rough River Lake, and Taylorsville Lake.

Canada Goose (*Branta canadensis*)

Species Description

Canada geese can be identified by their long black head and neck, and their bill, which has a distinctive white mark near their chin. Their plumage has varying shades of brown-grey feathers on their dorsal region, and typically a cream or white color on their belly and rump. This species experiences a small degree of sexual dimorphism, where males are slightly larger than their female counterpart, but both



Figure 2 Photo Credit:
https://animaldiversity.org/collections/contributors/h_c_kvillingstad/CanadaGooseonnest_a/

weigh between 3 to 10.9 kg. Canada geese have a height of 76 to 110 cm and a wingspan of 1.3 to 1.7 m. Despite small size differences between the sexes, they appear similar. Goslings are yellow with grey-green feathers on their dorsal region and sometimes head, depending on the subspecies. They are born with black bills and feet. Their bill has lamella (comb-like ridges) around the outside edge, to aid feeding. There are seven subspecies, which are distinguished by size, plumage color, white cheek marks, or the presence of a white collar (Yarza 2014, ADW: *Branta canadensis*). Canada geese generally lay their eggs between March and June in Kentucky.

This bird is not federally-listed, but it is covered by the MBTA.

Habitat

Canada geese prefer open, grassy habitats. Areas with obstructions such as tall grass and shrubs are generally avoided because they may disguise predators. This species prefers to live near water including ponds, marshes, rivers, or coastlines. Canada geese can be successful at nearly all elevations, from coastal to alpine regions. Populations of these birds have become well established in urban and suburban areas where grassy lawns are maintained. They are also often seen grazing in agricultural land (Yarza 2014, ADW: *Branta canadensis*).

KYTC Special Considerations

Occasionally Canada geese will nest on KYTC bridges and bridge piers over large bodies of water. Should KYTC or a contractor need to destroy a nest for any reason, **reach out to your SME** to determine if a Goose Depredation Permit is required.

Osprey (*Pandion haliaetus*)

Species Description

Ospreys are large birds of prey (55 to 58 cm long), with a wingspan ranging from 145 to 170 cm. Their long wings have a characteristic bend at the carpal ("wrist") joints. They are bright white underneath, with dark brown patches at the carpal joints and a mottled dark brown necklace. Other identifying markings include a dark stripe through each eye, and a dark brown back. The feet of this species are pale blue-gray, and the beak is black (Watkins Kirschbaum 2000; ADW: *Pandion haliaetus*). Osprey generally lay eggs from March to early May in Kentucky.



Figure 3 <https://ebird.org/species/osprey>

This bird is not federally-listed, but it is covered by the MBTA.

Habitat

Ospreys have a wide distribution because they are able to live almost anywhere where there are safe nest sites and shallow water with abundant fish. Nests are generally found within 3 to 5 km of a water body such as a salt marsh, mangrove swamp, cypress swamp, lake, bog, reservoir or river. The frequency with which each of these habitat types is used varies by geographic region.

Ospreys choose structures that can support a bulky nest, and that are safe from ground-based predators. Nest sites can be safe from predators either by being difficult for a predator to climb (e.g. on a cliff) or by being over water or on a small island. Over-water nest sites that are often used by ospreys include buoys and channel markers, dead trees and artificial nest platforms. Ospreys have also been known to nest on various man-made structures, such as power poles, duck blinds, communication towers, buildings and even billboards (Watkins Kirschbaum 2000; ADW: *Pandion haliaetus*).

KYTC Special Considerations

Occasionally osprey will nest on KYTC truss bridges over large bodies of water. Should KYTC or a contractor notice nest material and/or individuals under bridges, **please consult with your SME.**

Peregrine Falcon (*Falco peregrinus anatum*)

Species Description

The peregrine falcon was previously federally-listed, but has been delisted due to **recovery**.

Peregrine falcons have slate and blue-gray wings, black bars on their backs and pale underbellies. They have white faces with a black stripe on each cheek and large, dark eyes.

Young birds tend to be darker and browner, with streaked, rather than barred, underparts. Plumage doesn't vary seasonally (Potter 2002; ADW: *Falco peregrinus anatum*).

Peregrines generally lay eggs from late February to early April, and special considerations are given for fledging chicks until June in Kentucky.



Figure 4
https://animaldiversity.org/collections/contributors/kevin_cole/Fperegrinus4/

This bird is now longer federally-listed, but is covered by the MBTA.

Habitat Description

Peregrine falcons prefer open habitats, such as grasslands, tundra, and meadows. They are most common in tundra and coastal areas and rare in sub-tropical and tropical habitats. They nest on cliff faces and crevices. They have recently begun to colonize urban areas because tall buildings and bridges are suitable for nesting in this species (Potter 2002; ADW: *Falco peregrinus anatum*).

KYTC Special Considerations

As of the 2025 Falcon Survey Report, falcons have been documented using the following structures:

Bridge	Locality	Result as of 2025
Simon Kenton Memorial Bridge	Mason County, KY	Nest couldn't be located, but had parental nesting behavior.
East South Shore Railroad Bridge	Scioto, OH	Nesting confirmed, fledging unconfirmed.
US-42 Carrollton Bridge	Carroll County, KY	Successful nesting and fledging. Nest Box.
Glover Cary Bridge	Daviess County, KY	Nest couldn't be located, but had parental nesting behavior.
I-275 Combs-Hehl Bridge	Campbell County, KY	Nest couldn't be located, but had parental nesting behavior.
Milton Madison Bridge	Trimble County, KY	Nesting confirmed, eggs failed to hatch.
I-275 Carroll Lee Cropper Bridge	Boone County, KY	Nest located, but no eggs.

Occasionally peregrine falcons will nest on KYTC truss bridges over large bodies of water. Should KYTC or a contractor notice nest material and/or individuals under bridges, **please consult with your SME.**

Big Sandy Crayfish (*Cambarus callainus*)

Species Description

Big Sandy crayfish was listed as **threatened** on April 7th, 2016.

The Big Sandy crayfish is a freshwater, tertiary burrowing crustacean of the Cambaridae family. Tertiary burrowing



crayfish do not exhibit complex burrowing behavior; instead, they shelter in shallow excavations under loose cobbles and boulders on the stream bottom. The Big Sandy crayfish is closely related to the Guyandotte River (*C. veteranus*) crayfish and both species share many basic physical characteristics. Adult body lengths range from 3.0 to 4.0 inches, and the cephalothorax (main body section) is streamlined and elongate, and has two well-defined cervical spines. The elongate convergent rostrum (the beak-like shell extension located between the crayfish's eyes) lacks spines or tubercles (bumps). The gonopods (modified legs used for reproductive purposes) of Form I males (those in the breeding stage) are bent 90 degrees to the gonopod shaft. Diagnostic characteristics that distinguish the Big Sandy crayfish from the Guyandotte River crayfish include the former's narrower, more elongate rostrum; narrower, more elongate chelea (claw); and lack of a well-pronounced lateral impression at the base of the claw's immovable finger. Carapace (shell) coloration ranges from olive brown to light green, and the cervical groove is outlined in light blue, aqua, or turquoise. The rostral margins and post orbital (behind the eye) ridges are crimson red. The abdominal terga (dorsal plates covering the crayfish's abdomen) range from olive brown to light brown to light green and are outlined in red. The walking legs of the Big Sandy crayfish range from light green to green blue to green, and the chelae are usually aqua but sometimes green blue to blue. This species likely functions as an opportunistic omnivore, with seasonal-mediated tendencies for animal or plant material.

The general life cycle pattern of the species is 2 to 3 years of growth, maturation in the third year, and first mating in midsummer of the third or fourth year. Following midsummer mating, the annual cycle involves egg laying in late summer or fall, spring release of young, and late spring/early summer molting. The likely lifespan is thought to be 5 to 7 years, with the possibility of some individuals reaching 10 years of age.

Habitat Description

Suitable instream habitat is generally described as clean, third order or larger (width of 4 to 20 meters), fast-flowing, permanent streams and rivers with unembedded slab boulders on bedrock, cobble, or sand substrate.

Under natural (i.e., undegraded) conditions, this habitat was common in streams throughout the entire upper Big Sandy watershed, and historically this species likely occurred throughout the range where this undegraded habitat existed. However, by the late 1800s, commercial logging and coal mining coupled with rapid human population growth and increased development in the narrow valley riparian zones, began to severely degrade the aquatic habitat throughout the river basin. Based on the best available data, it is assumed that the widespread habitat degradation, most visible as stream bottom embeddedness, likely led to this species' decline and the eventual extirpation of the Big Sandy crayfish from many streams within their historical range. Big Sandy crayfish appears to be intolerant of excessive sedimentation and embeddedness of the stream bottom substrate. This statement is based on observed habitat characteristics from sites that either formerly supported the Big Sandy crayfish or from sites within the species' historical range that were predicted to be suitable for the species, but where neither of the species (and in some cases no crayfish from any species) were observed.

Critical Habitat

Yes – (*see additional maps and detailed descriptions provided after the decision key*)

Critical habitat for the Big Sandy crayfish was designated on January 28th, 2020.

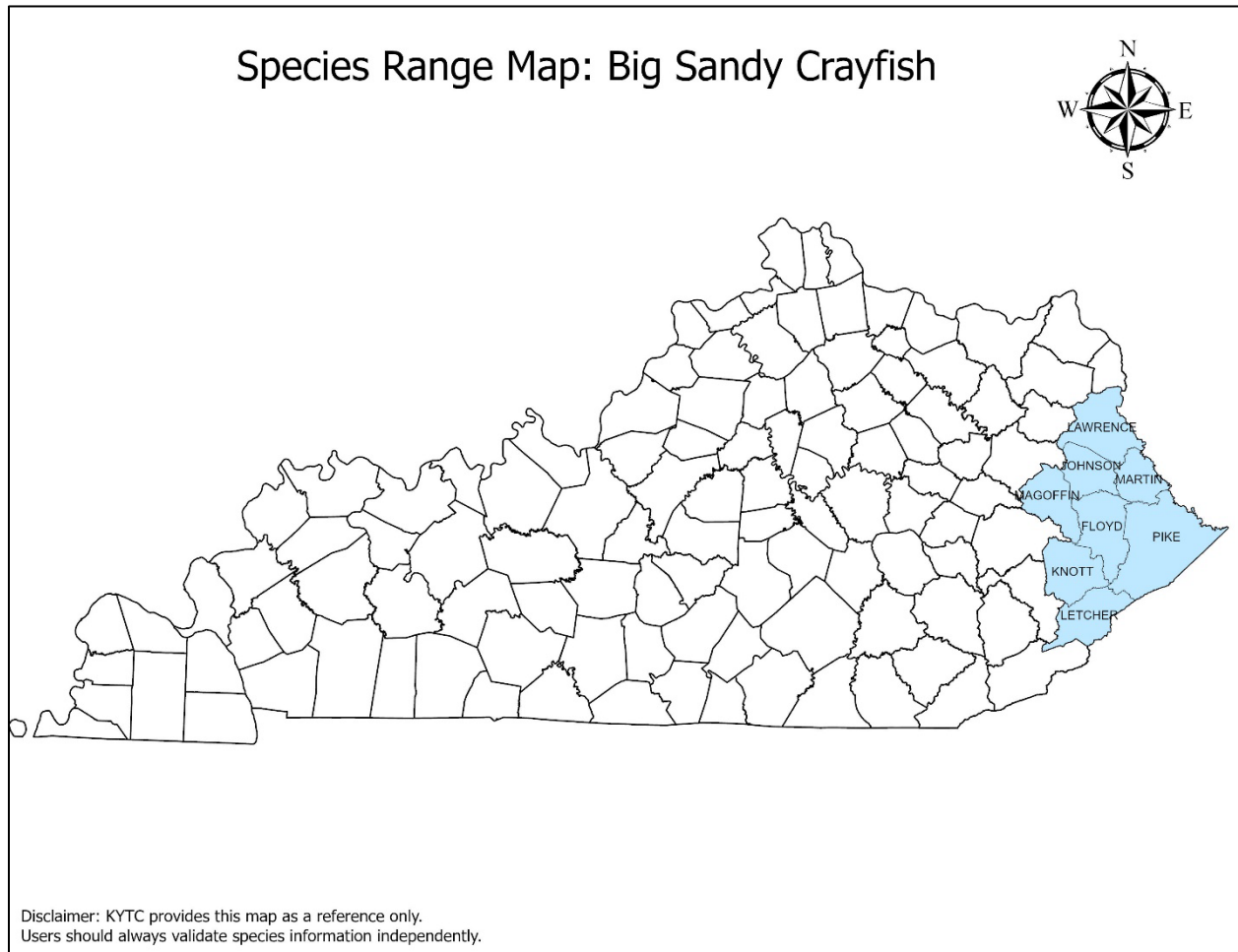
Primary constituent elements of critical habitat for this species include:

1. Fast-flowing stream reaches with unembedded slab boulders, cobbles, or isolated boulder clusters within an unobstructed stream continuum (i.e., riffle, run, pool complexes) of permanent, moderate- to large-sized (generally third order and larger) streams and rivers (up to the ordinary high water mark as defined at 33 CFR 329.11).
2. Streams and rivers with natural variations in flow and seasonal flooding sufficient to effectively transport sediment and prevent substrate embeddedness.
3. Water quality characterized by seasonally moderated temperatures and physical and chemical parameters (e.g., pH, conductivity, dissolved oxygen) sufficient for the normal behavior, growth, reproduction, and viability of all life stages of the species.
4. An adequate food base, indicated by a healthy aquatic community structure including native benthic macroinvertebrates, fishes, and plant matter (e.g., leaf litter, algae, detritus).
5. Aquatic habitats protected from riparian and instream activities that degrade the physical and biological features described in (1) through (4), above, or cause physical (e.g., crushing) injury or death to individual Big Sandy crayfish.
6. An interconnected network of streams and rivers that have the physical and biological features described in (1) through (4), above, that allow for the movement of individual crayfish in response to environmental, physiological, or behavioral drivers. The scale of the interconnected stream network should be sufficient to allow for gene flow within and among watersheds.

Species, Stream (unit), and State	Currently Occupied Stream Miles
Big Sandy Crayfish	
Russell Fork (2a), KY	52.1
Elkhorn Creek (2h), KY	5.3
Levisa Fork (upstream, 3a), KY	9.9
Levisa Fork (downstream, 3a), KY	10.9
Shelby Creek (3b), KY	20
Long Fork (3b), KY	8
Tug Fork (upstream, 4a), KY	65.9
Tug Fork (downstream, 4a), KY	7.3
Knox Creek (4d), KY	10.3
Peter Creek (4e), KY	6.3
Blackberry Creek (4f), KY	5.7

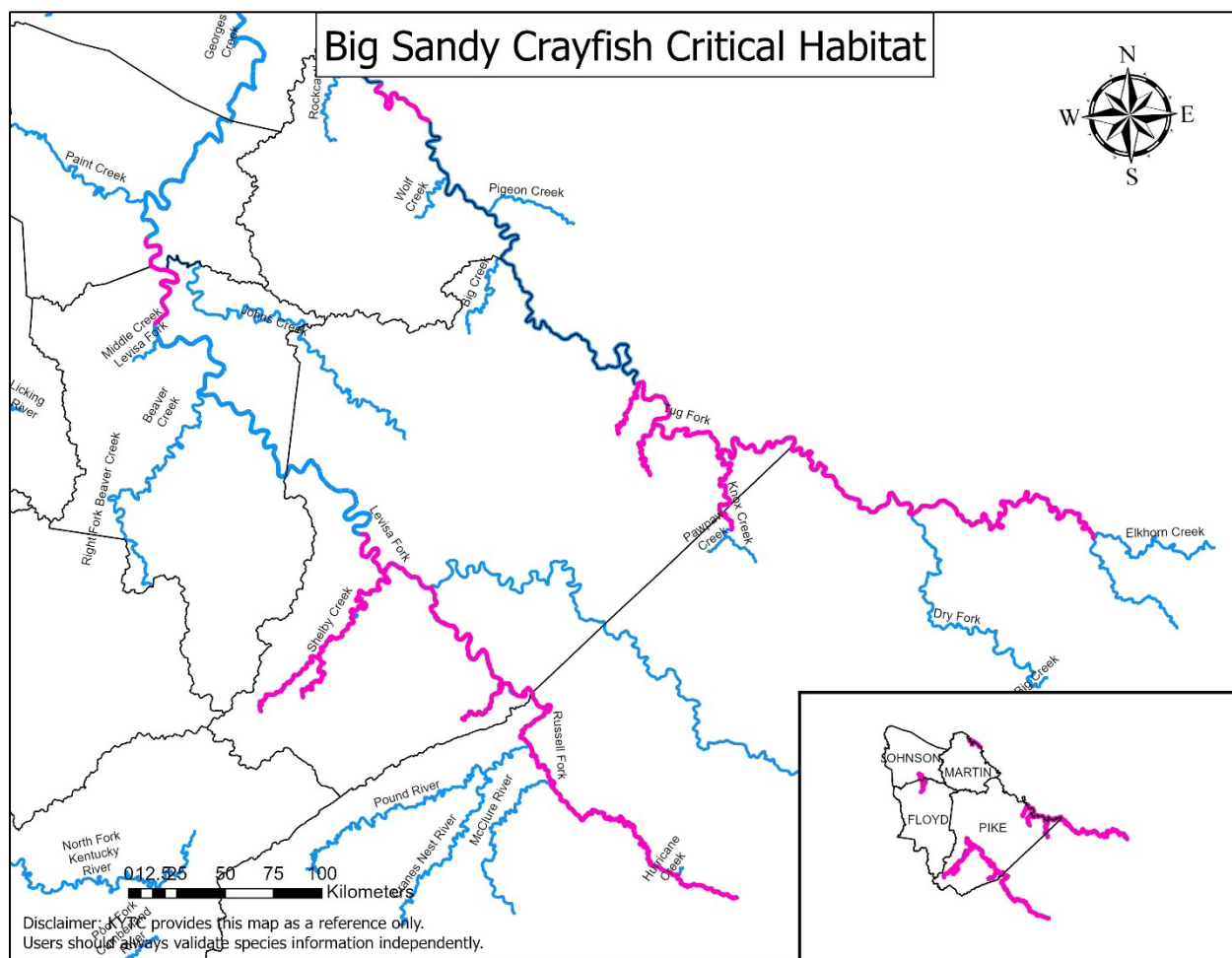
Range

Big Sandy crayfish is endemic to Kentucky and is known within the Big Sandy River watershed. Based on direct coordination with the USFWS Kentucky Field Office, our assessments will focus on the following 8 counties; Lawrence, Johnson, Magoffin, Floyd, Pike, Knott, and Letcher.



Decision Key

- 1) Does the project area lie within the Big Sandy river watershed within Lawrence, Johnson, Magoffin, Floyd, Pike, Knott, or Letcher Counties?
 - a. Yes: Go to #2
 - b. No: Prepare NE finding.
- 2) Will the project be directly or indirectly impacting a 3rd order or larger stream?
 - a. Yes: Go to #3
 - b. No: Prepare NE finding
- 3) Does the project directly or indirectly affect the Russell Fork?
 - a. Yes: Contact SME.
 - b. No: Go to #4
- 4) Does the stream being impacted have a substrate that includes unembedded large rock/slab boulders?
 - a. Yes: Contact SME
 - b. No: Prepare NE finding.



Subunit 2a: Russell Fork – Pike County, KY.

Subunit 2a includes approximately 83.8 skm (52.1 smi) of the Russell Fork mainstem from the confluence of Russell Fork and Ball Creek at Council, Virginia, downstream to the confluence of Russell Fork and Levisa Fork at Levisa Junction, Kentucky. Recent surveys of the Russell Fork indicated an abundance of unembedded slab boulders, boulder clusters, isolated boulders, and large cobbles, and live Big Sandy crayfish have been captured at numerous locations within this subunit (Thoma 2009b, p. 10; Loughman 2015a, p. 23). The Russell Fork watershed is mostly forested; however, USGS topographic maps and aerial imagery (ESRI) provide evidence of legacy and ongoing coal mining throughout the watershed. In the upper portion of the watershed, the narrow stream valley contains scattered residences and roads, but human development increases farther downstream in the form of small communities and towns, commercial facilities, and transportation infrastructure (i.e., roads and rail lines). Approximately 12 skm (7.4 smi) of Subunit 2a is within the Jefferson National Forest and Breaks Interstate Park. The remainder of the subunit is located almost entirely on private land, except for any small amount that is publicly owned in the form of bridge crossings or road easements. The Big Sandy crayfish population in Subunit 2a appears to be relatively robust and provides important connectivity

between crayfish populations in several tributary streams and rivers, contributing to their resiliency. Additionally, some Big Sandy crayfish from Subunit 2a likely disperse to areas downstream in the Levisa Fork basin, contributing to the species' representation and redundancy.

Subunit 2h: Elkhorn Creek – Pike County, KY.

Subunit 2h includes approximately 8.5 skm (5.3 smi) of Elkhorn Creek, a tributary to Russell Fork. This subunit extends from the confluence of Elkhorn Creek and Mountain Branch downstream to the confluence of Elkhorn Creek and Russell Fork at Elkhorn City, Kentucky. Recent surveys indicated unembedded slab boulders and boulders in Elkhorn Creek with “extensive bedrock glides” in the lower reaches of the creek. Live Big Sandy crayfish were collected from under slab boulders in lower Elkhorn Creek (Loughman 2015a, pp. 18–19). The USGS topographic maps and aerial imagery (ESRI) indicate the watershed is mostly forested; however, significant legacy and active coal mining and other mining and quarrying occurs in the watershed. Human development, in the form of small communities, residences, small agricultural fields, and commercial and industrial facilities, as well as roads, railroads, and other infrastructure, occurs almost continually in the riparian zone along Elkhorn Creek. The watershed to the south of Elkhorn Creek is a unit of the Jefferson National Forest; however, Subunit 2h is located almost entirely on private land, except for any small amount that is publicly owned in the form of bridge crossings or road easements. This subunit contributes to the redundancy of the species.

Subunit 3a: Levisa Fork – Pike, Floyd, and Johnson Counties, KY.

Subunit 3a includes approximately 33.4 skm (20.8 smi) of the mainstem Levisa Fork in two disjunct segments. The upstream segment includes approximately 15.9 skm (9.9 smi) of the Levisa Fork from its confluence with the Russell Fork at Levisa Junction, Kentucky, downstream to the confluence of Levisa Fork and Island Creek at Pikeville, Kentucky. Surveys indicate that suitable unembedded boulder habitat is present in the Levisa Fork, and live Big Sandy crayfish have been recently collected both upstream of Subunit 3a in the Russell Fork and at one location near Pikeville, Kentucky (Thoma 2010, pp. 5–6; Loughman 2015a, pp. 5–10). The downstream segment of Subunit 3a includes approximately 17.5 skm (10.9 smi) of the Levisa Fork near Auxier, Kentucky, from the confluence of Levisa Fork and Abbott Creek downstream to the confluence of Levisa Fork and Miller Creek. Recent surveys indicate isolated boulder clusters in this segment, with live Big Sandy crayfish collected from two locations (Thoma 2009b, entire; Loughman 2014, pp. 12–13). The USGS topographic maps and aerial imagery (ESRI) indicate the Subunit 3a watershed is mostly forested; however, legacy and ongoing coal mining is evident in several locations. Human development, in the form of towns, small communities, residences, small agricultural fields, commercial and industrial development, roads, railroads, and other infrastructure, occurs nearly continuously in the riparian zone of these segments of the Levisa Fork. Subunit 3a is located almost entirely on private land, except for any small amount that is

publicly owned in the form of bridge crossings or road easements. The upper segment of the subunit provides connectivity between the Russell Fork and Shelby Creek populations (discussed below), and the lower segment supports the most downstream population of Big Sandy crayfish in the Levisa Fork basin. Because the natural habitat characteristics (e.g., size, gradient, bottom substrate) in the Levisa Fork differ from those in the upper tributaries, this subunit increases Big Sandy crayfish representation as well as the species' redundancy.

Subunit 3b: Shelby Creek and Long Fork – Pike County, KY.

This subunit includes approximately 32.2 skm (20.0 smi) of Shelby Creek, a tributary to Levisa Fork, and approximately 12.9 skm (8.0 smi) of Long Fork, a tributary to Shelby Creek. The Shelby Creek portion of this subunit extends from the confluence of Shelby Creek and Burk Branch downstream to the confluence of Shelby Creek and Levisa Fork at Shelbiana, Kentucky. The Long Fork portion of Subunit 3b extends from the confluence of Right Fork Long Fork and Left Fork Long Fork downstream to the confluence of Long Fork and Shelby Creek at Virgie, Kentucky. Recent surveys of this subunit indicated an abundance of unembedded slab boulders, boulder clusters, and anthropogenic structures such as concrete slabs and blocks in Shelby Creek and Long Fork, and live Big Sandy crayfish have been collected at multiple locations within this subunit (Thoma 2010, pp. 5–6; Loughman 2015a, p. 18). The USGS topographic maps and aerial imagery (ESRI) indicate the Shelby Creek watershed is mostly forested; however, several large surface coal mines are evident west of the creek. The Long Fork watershed is also mostly forested; however, legacy and active coal mining is evident in the upper portion of this watershed. Human development, in the form of towns, small communities, residences, small agricultural fields, commercial and industrial development, roads, railroads, and other infrastructure, occurs nearly continuously in the riparian zone of Shelby Creek. In the riparian zone of Long Fork, residences, small agricultural fields, roads, and other infrastructure occur nearly continuously. Subunit 3b is located almost entirely on private land, except for any small amount that is publicly owned in the form of bridge crossings or road easements. This subunit maintains the most robust population of Big Sandy crayfish in the lower Levisa Fork (as indicated by recent survey capture rates) and increases the representation and redundancy of the species.

Subunit 4a: Tug Fork – Pike County, KY.

Subunit 4a includes approximately 117.8 skm (73.2 smi) of the Tug Fork mainstem in two disjunct segments. The upstream segment includes approximately 106.1 skm (65.9 smi) of the Tug Fork from the confluence of Tug Fork and Elkhorn Creek at Welch, West Virginia, downstream to the confluence of Tug Fork and Blackberry Creek in Pike County, Kentucky. Surveys indicate that suitable unembedded boulder habitat is sparse and discontinuous in this segment of the Tug Fork; however, live Big Sandy crayfish have been collected at four locations within this subunit (Loughman 2015a, p. 16). The downstream segment includes approximately

11.7 skm (7.3 smi) of the Tug Fork near Crum, West Virginia, from the confluence of Tug Fork and Bull Creek downstream to the confluence of Tug Fork and Little Elk Creek. The USGS topographic maps and aerial imagery (ESRI) indicate the Subunit 4a watershed is mostly forested; however, there is evidence of legacy and ongoing coal mining throughout the subunit. The riparian zone in the upper segment of Subunit 4a is relatively intact, with human development consisting primarily of road and railroad corridors. In the lower segment of the subunit, towns, small communities, residences, small agricultural fields, commercial and industrial development, roads, railroads, and other infrastructure become prevalent. Subunit 4a is located almost entirely on private land, except for any small amount that is publicly owned in the form of bridge crossings or road easements. Because of the diversity of natural habitat characteristics (e.g., size, gradient, bottom substrate) in this subunit, it contributes to Big Sandy crayfish representation and redundancy. This subunit provides habitat for the Big Sandy crayfish, as well as providing potential connectivity between the Dry Fork, Panther Creek, Knox Creek, Peter Creek, Blackberry Creek, and Pigeon Creek populations (discussed below).

Subunit 4d: Knox Creek – Pike County, KY.

Subunit 4d includes approximately 16.6 skm (10.3 smi) of Knox Creek, a tributary to Tug Fork. This subunit extends from the confluence of Knox Creek and Cedar Branch downstream to the confluence of Knox Creek and Tug Fork in Pike County, Kentucky. Recent surveys indicated abundant unembedded slab boulders, boulders, and boulder clusters, with live Big Sandy crayfish collected at four sites in the Kentucky portion of the creek (Thoma 2010, p. 5; Loughman 2015a, p. 12). The USGS topographic maps and aerial imagery (ESRI) indicate the Knox Creek watershed is mostly forested, with evidence of significant legacy, recent, and ongoing coal mining in the watershed. In the upper portion of this subunit, human development in the form of small communities, residences, roads, railroads, and other infrastructure is common. In the middle and lower sections, the riparian zone is relatively intact, except for scattered residences and a road and railroad line. Subunit 4d is located almost entirely on private land, except for any small amount that is publicly owned in the form of bridge crossings or road easements. This subunit contributes to the redundancy of the species.

Subunit 4e: Peter Creek – Pike County, KY.

Subunit 4e includes approximately 10.1 skm (6.3 smi) of Peter Creek, a tributary to Tug Fork. This subunit extends from the confluence of Left Fork Peter Creek and Right Fork Peter Creek at Phelps, Kentucky, downstream to the confluence of Peter Creek and Tug Fork at Freeburn, Kentucky. Recent surveys indicate moderate sedimentation issues in Peter Creek, but some unembedded bottom substrates continue to be present (Loughman 2015a, p. 12). Big Sandy crayfish have been collected at two sites in the lower portion of this subunit. The USGS topographic maps and aerial imagery (ESRI) indicate the Peter Creek watershed is mostly forested, with evidence of significant legacy, recent, and ongoing coal mining throughout the

watershed. The riparian zone in Subunit 4e is dominated by human development in the form of small communities, residences, roads, railroads, and other infrastructure. This subunit is located almost entirely on private land, except for any small amount that is publicly owned in the form of bridge crossings or road easements. Subunit 4e contributes to the redundancy of the species.

Subunit 4f: Blackberry Creek – Pike County, KY.

Subunit 4f includes approximately 9.1 skm (5.7 smi) of Blackberry Creek, a tributary to Tug Fork. This subunit extends from the confluence of Blackberry Creek and Bluespring Branch downstream to the confluence of Blackberry Creek and Tug Fork. Recent surveys indicate moderate sedimentation in Blackberry Creek, but some unembedded bottom substrates continue to be present (Loughman 2015a, p. 12). Big Sandy crayfish have been collected at two sites in the lower portion of this subunit. The USGS topographic maps and aerial imagery (ESRI) indicate the Blackberry Creek watershed is mostly forested, with evidence of significant legacy, recent, and ongoing coal mining throughout the watershed. The narrow riparian zone in Subunit 4f is dominated by human development in the form of small communities, residences, roads, and other infrastructure. This subunit is located almost entirely on private land, except for any small amount that is publicly owned in the form of bridge crossings or road easements. Subunit 4f contributes to the redundancy of the species.

Kentucky Cave Shrimp (*Palaemonias ganteri*)

AKA: Mammoth Cave Shrimp

Species Description

Kentucky Cave Shrimp (*Palaemonias ganteri*) was listed as an **endangered** species October 12, 1983.

Once thought to have been extinct, the Kentucky cave shrimp is a fresh-water shrimp and member of the *Atyidae* family. Kentucky cave

shrimp have reduced eyes and lack body pigmentation, which is common for species with a history of subterranean existence. They can reach a maximum total length of 30 mm (1.2 inches). Kentucky cave shrimp graze the surface of sediments and consume a diet of mainly protozoan, algal cells, fungi, and other organic materials.

Some of the life history of Kentucky cave shrimp is relatively unknown. Female shrimp have been observed carrying their clutch of eggs (up to 33) under their abdomen throughout all seasons of the year. These observations suggest that reproduction is continual (rather than seasonal). It is uncertain whether a female shrimp can reproduce more than once in its life time. Aquarium studies have estimated Kentucky cave shrimp life spans to be between 10 and 15 years.



Figure 1 Photo Credits: John MacGregor - KDFWR.

Habitat Description

Kentucky cave shrimp prefers habitats within the large, base level passages of cave systems that provide slow flow, abundant organic matter, and coarse to fine grain sand and coarse silt sediment. Preferred habitat areas also contain quiet, silt-bottom pools exposed to seasonal flooding conditions.

Human-related activities that cause groundwater contamination can be threats to Kentucky cave shrimp habitat. Such activities may include random traffic accidents, oil and gas activities, agriculture, permitted discharge from industry/wastewater treatment plants/etc., release of sediment/siltation, and general non-point sources. Due to the karst systems present within the Mammoth Cave area, pollutants can quickly enter and travel throughout a groundwater basin through features such as sinkholes, sinking streams, and other karst features. These pollutants, including pesticides, could have adverse affects on Kentucky cave shrimp populations located downstream, so it is important to protect the integrity of these ‘recharge basins’.

Critical Habitat

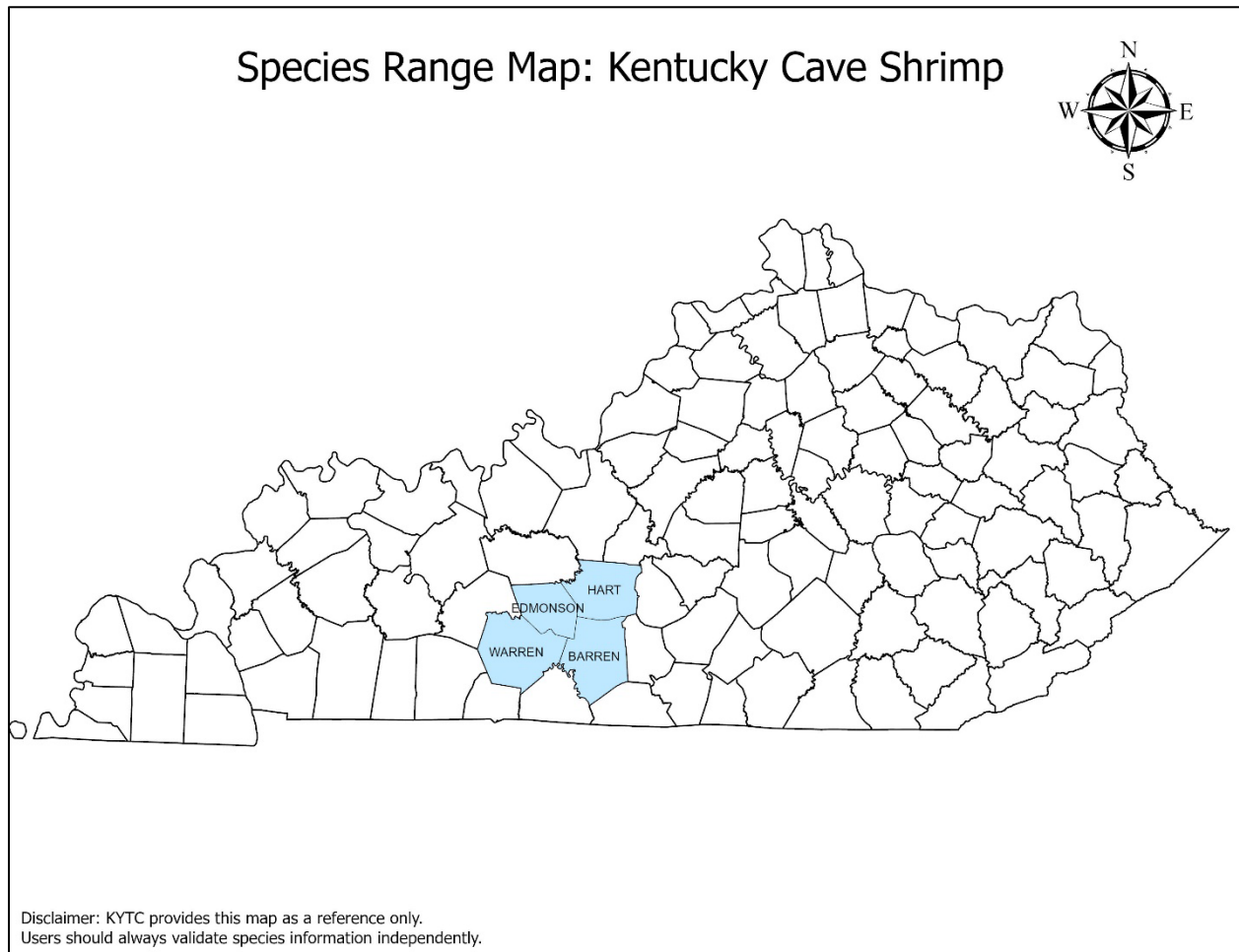
Yes – (*see additional maps and detailed recharge basin descriptions provided after the decision key*)

Approximately one-mile of the Roaring River Passage in the Mammoth Cave National Park was designated as critical habitat on October 12, 1983 at the same time the species was listed as endangered. No additional critical habitats have been designated since that date.

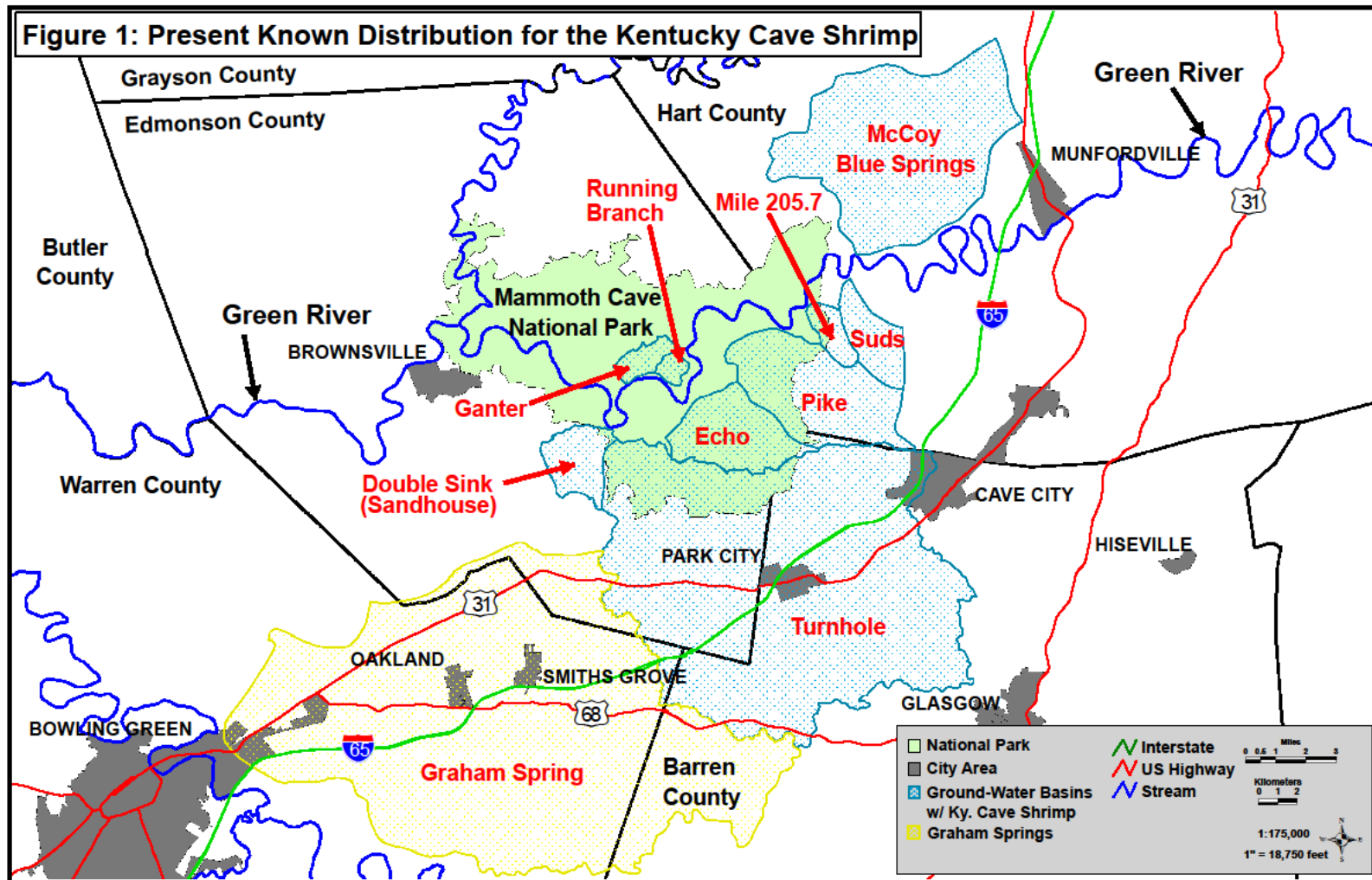
Range

The Kentucky cave shrimp is endemic to the Mammoth Cave National Park region of west-central Kentucky. The species occurs in cave systems on both the north and south sides of the Green River, primarily within the Park boundaries. There are known populations outside of the Park; however, the surface/underground watersheds that feed most of the caves that contain these endangered shrimp extend well beyond the Park boundaries. The current known distribution includes nine distinct groundwater basins in the Mammoth Cave region including: Echo River

Spring, Ganter Spring, Running Branch Spring, Mile 205.7 Spring, Pike Spring, Double Sink (Sandhouse Cave), Turnhole Spring, McCoy Blue Spring, and Suds Spring (Figure 1). Although unconfirmed, Graham Springs Basin and Hidden River Cave may also be areas of potential Kentucky cave shrimp habitat. Currently, this species is listed for four counties in west-central Kentucky.



The following map was provided to KYTC by USFWS (Mike Floyd, personal communication) in January 2014 representing ground-water basins and areas of Kentucky cave shrimp habitat distribution within Kentucky. ***Please see updated mapping after CH.**



Decision Key

****Note:** This assessment is best determined from office resources due to the availability of dye-tracing research (GIS shapefiles available). Please use map provided above and the second recharge map to help determine if a project area occurs within the boundaries of a recharge basin.******

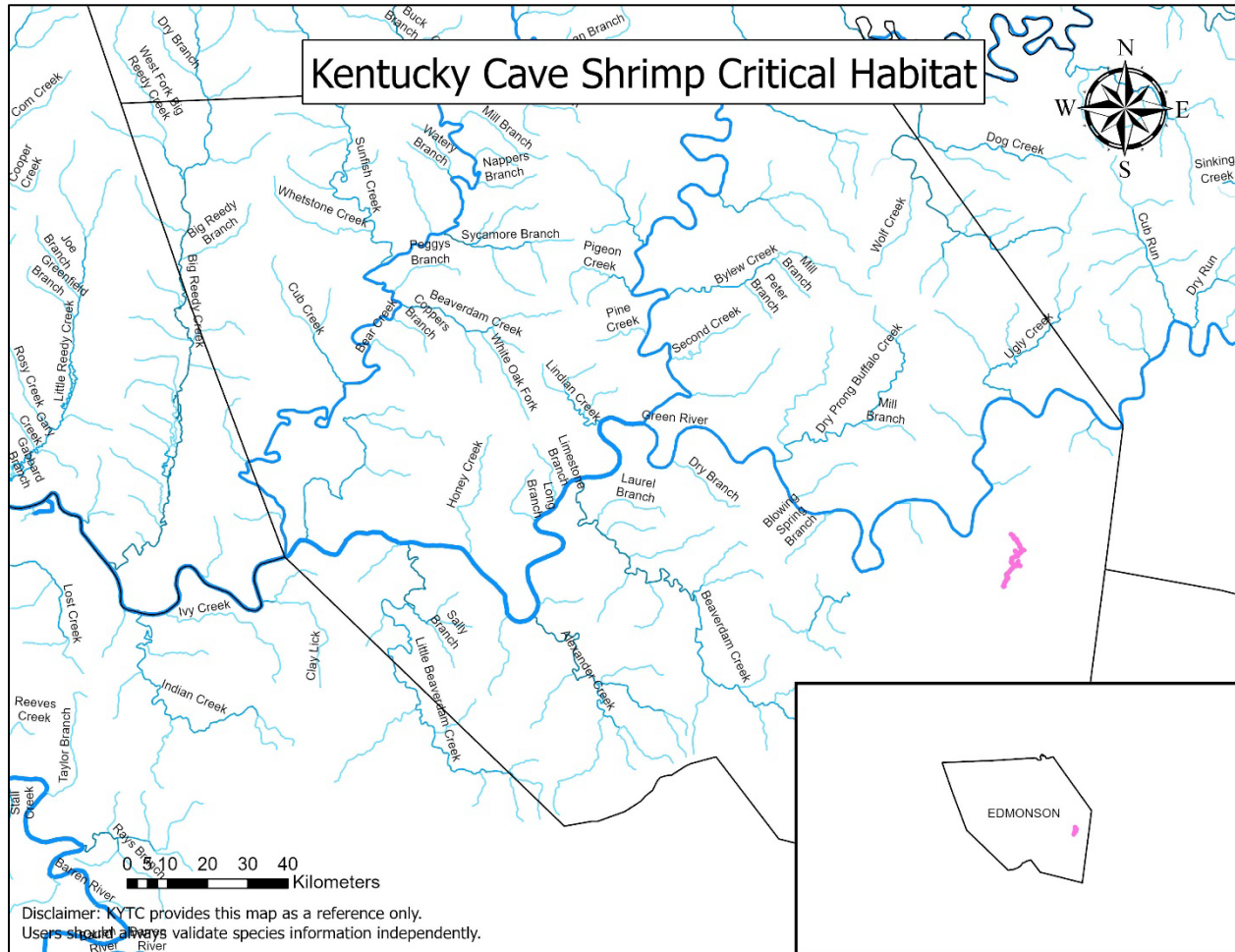
- 1) Does the project area lie partially or totally within, or have any direct or indirect effects to a Kentucky cave shrimp recharge basin?
 - a. Yes: Contact SME
 - b. No: Prepare NE finding.

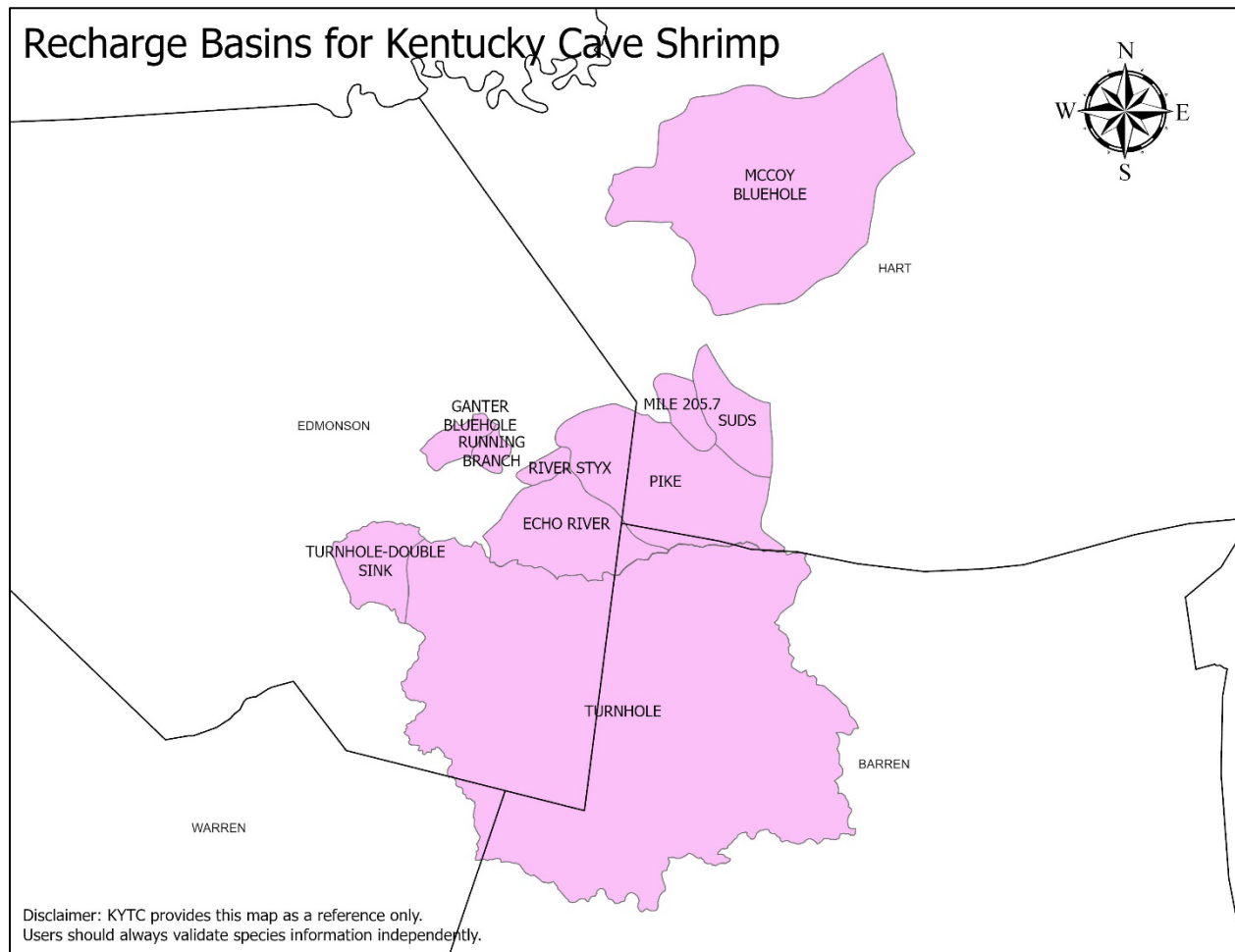
References

U.S. Fish and Wildlife Service. 1980. Endangered and Threatened Wildlife and Plants; Proposed Endangered Status and Critical Habitat for the Kentucky Cave Shrimp. 45 FR 68975-68978.

U.S. Fish and Wildlife Service. 1988. Kentucky cave shrimp recovery plan. Atlanta, Georgia. 47 pp.

U.S. Fish and Wildlife Service. 2007. Kentucky cave shrimp (*Palaemonias ganteri*); 5-Year Review: Summary and Evaluation. Southeast Region, Kentucky Ecological Services Field Office. Frankfort, Kentucky.



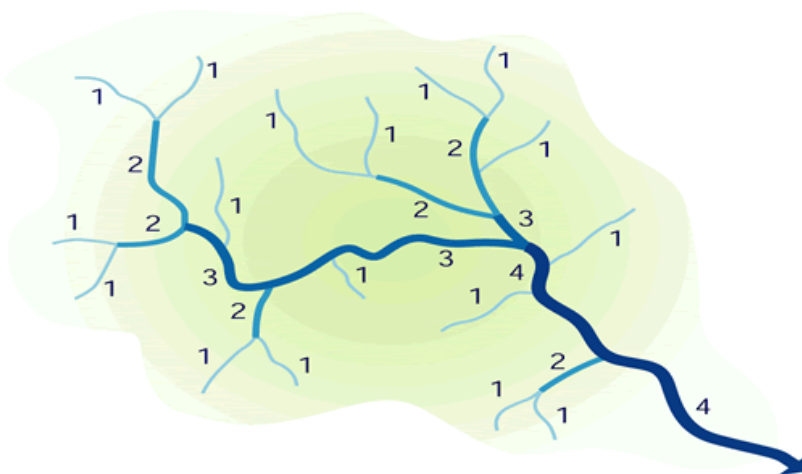


Basic Introduction to Fish and Watersheds

A river basin is defined as the land area drained by a river and its tributaries. These boundaries are naturally existent due to topography changes in an area. The state of Kentucky contains 13 major river basins: Big Sandy, Green, Kentucky, Licking, Little Sandy, Lower Cumberland, Mississippi, Ohio, Salt, Tennessee, Tradewater, Tygarts, and Upper Cumberland.

These 13 river basins are further divided into many smaller watersheds. A watershed is a network of smaller rivers or streams and their tributaries. A watershed can drain or seep into a marsh, stream, river, lake, or groundwater. Often watersheds are characterized by their drainage size and classified into one of 6 levels of hydrological unit code (HUC). HUCs are useful in providing more detailed information about a localized drainage area and also maintain context of its function within the whole river basin system.

Watersheds are further described with Strahler's stream classification system. Strahler's stream order measures the relative size of streams within a watershed. The smallest tributaries are referred to as first-order streams. As multiple streams meet, their order increases at each additional confluence (See Figure 1). First through third-order streams are referred to as headwater streams. The largest river in Kentucky is the Ohio River, a ninth-order waterway. The largest river in the world is the Amazon River, a twelfth-order waterway.



Individual stream lengths are further described in three categories:

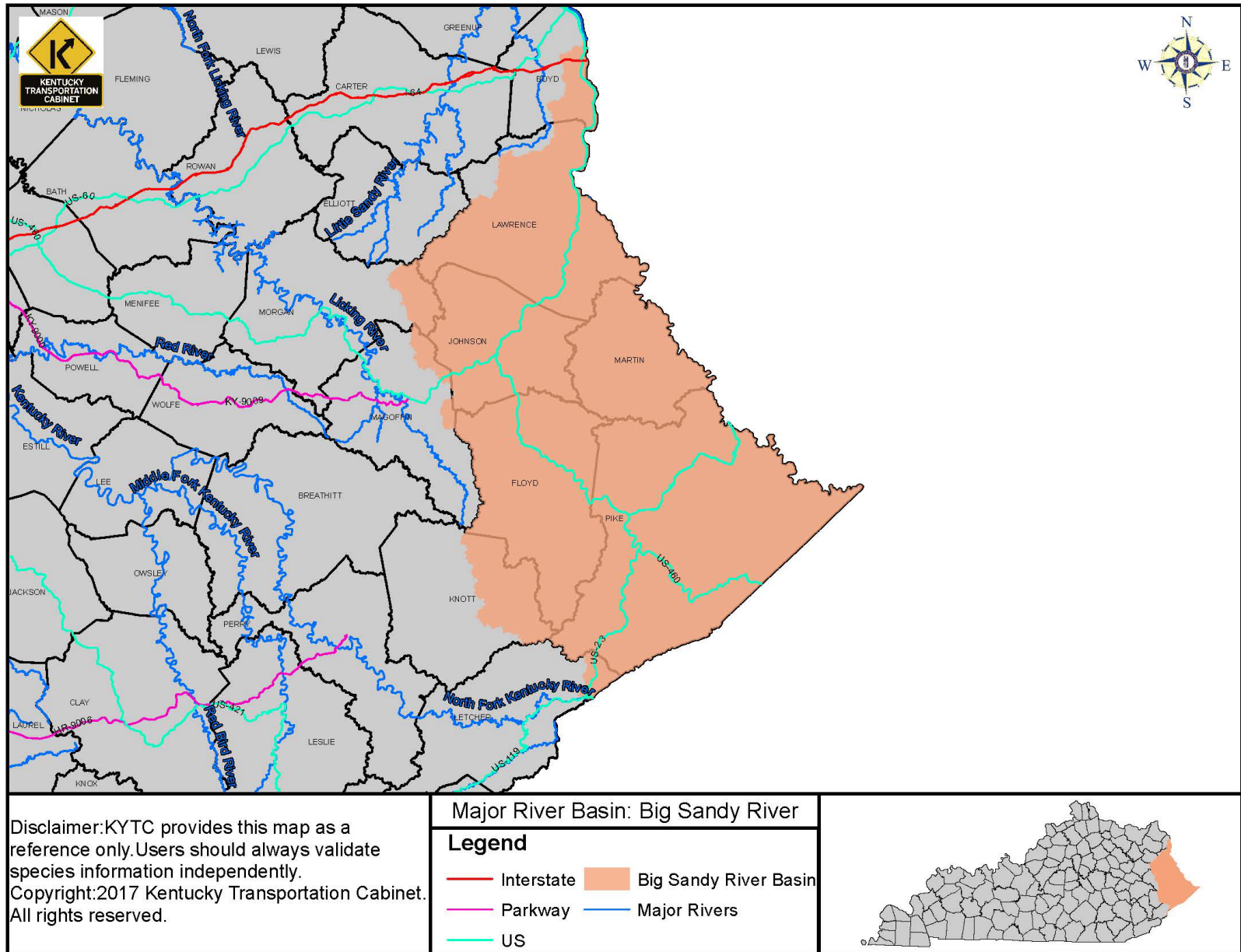
1. *Ephemeral* - Small, temporary streams which occur only during heavy rainstorm. Stream channels are often undefined or heavily lined with grass/vegetation.
2. *Intermittent* - Flow occurs only part of the year from springs or rain event runoff. Can still support aquatic life in dry times with a series of disconnected pools.
3. *Perennial* - Flow occurs year-round and has a defined channel.

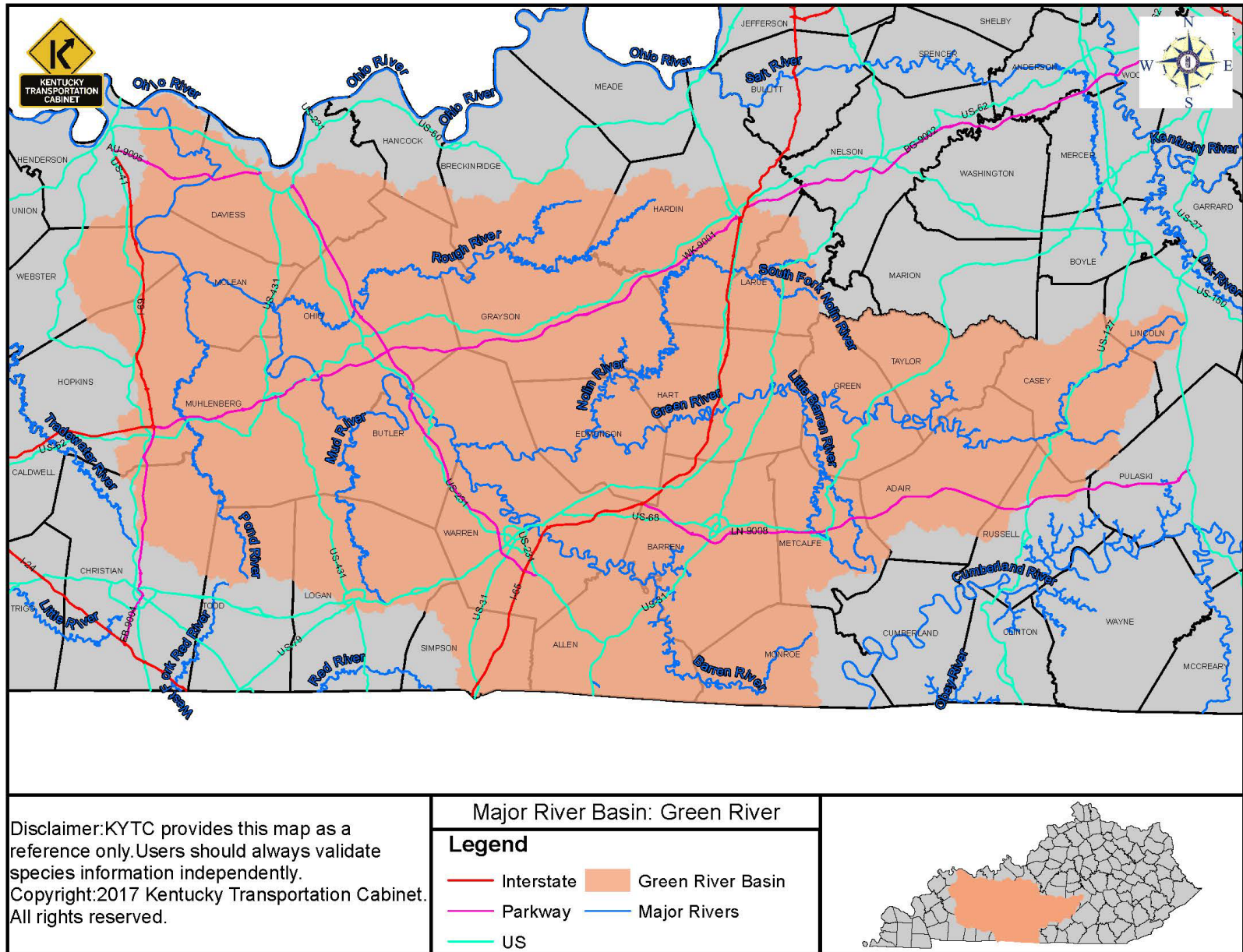
First-order streams may be either ephemeral, intermittent, or perennial dependent on its relation to groundwater connection.

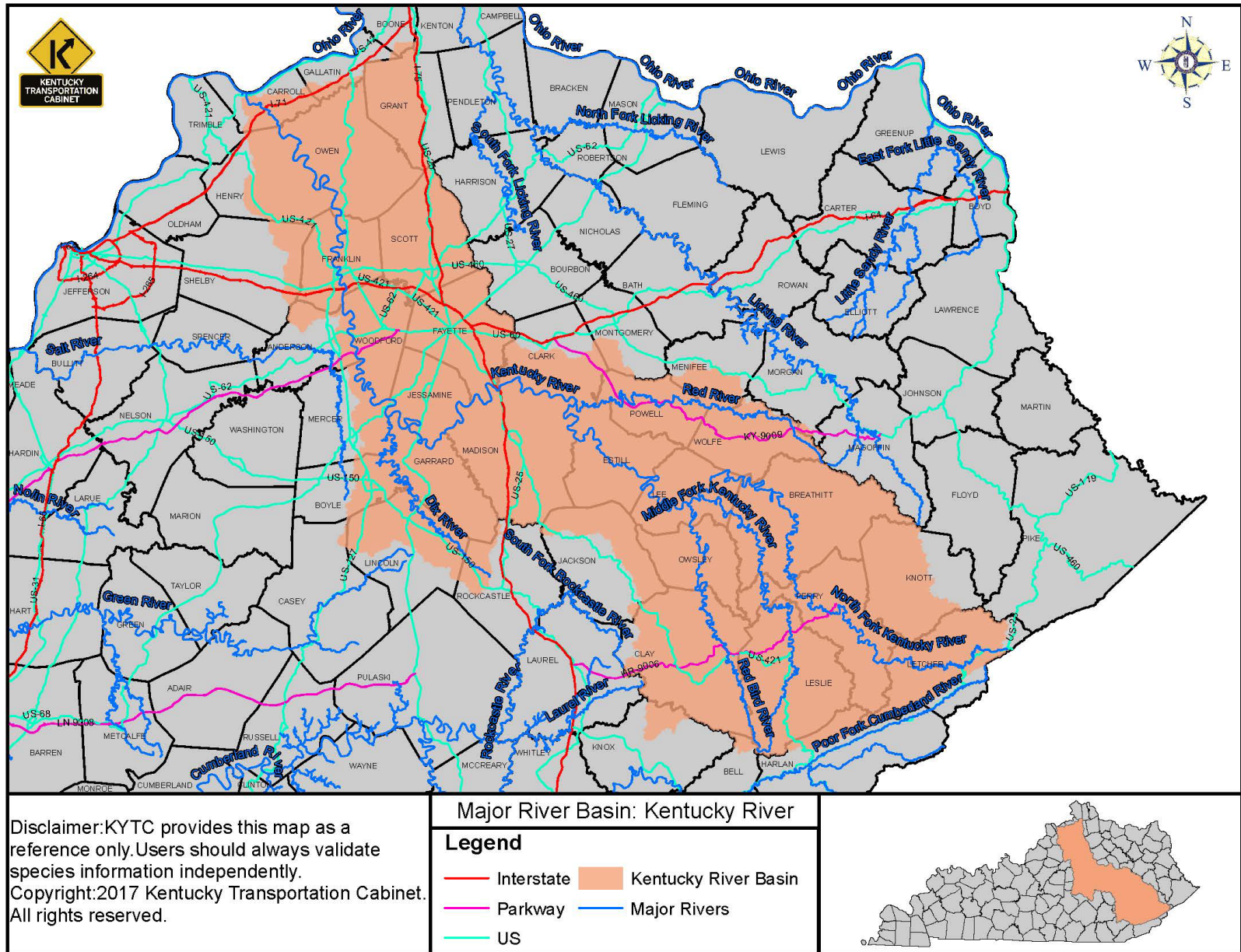
Due to the dependence on waterbody connectivity for fish travel from one area to another, Kentucky's watersheds provide unique and isolated habitats for many native and rare fish species. The variety and isolated nature of Kentucky's many watersheds is why this state provides some of the greatest fish diversity in North America.

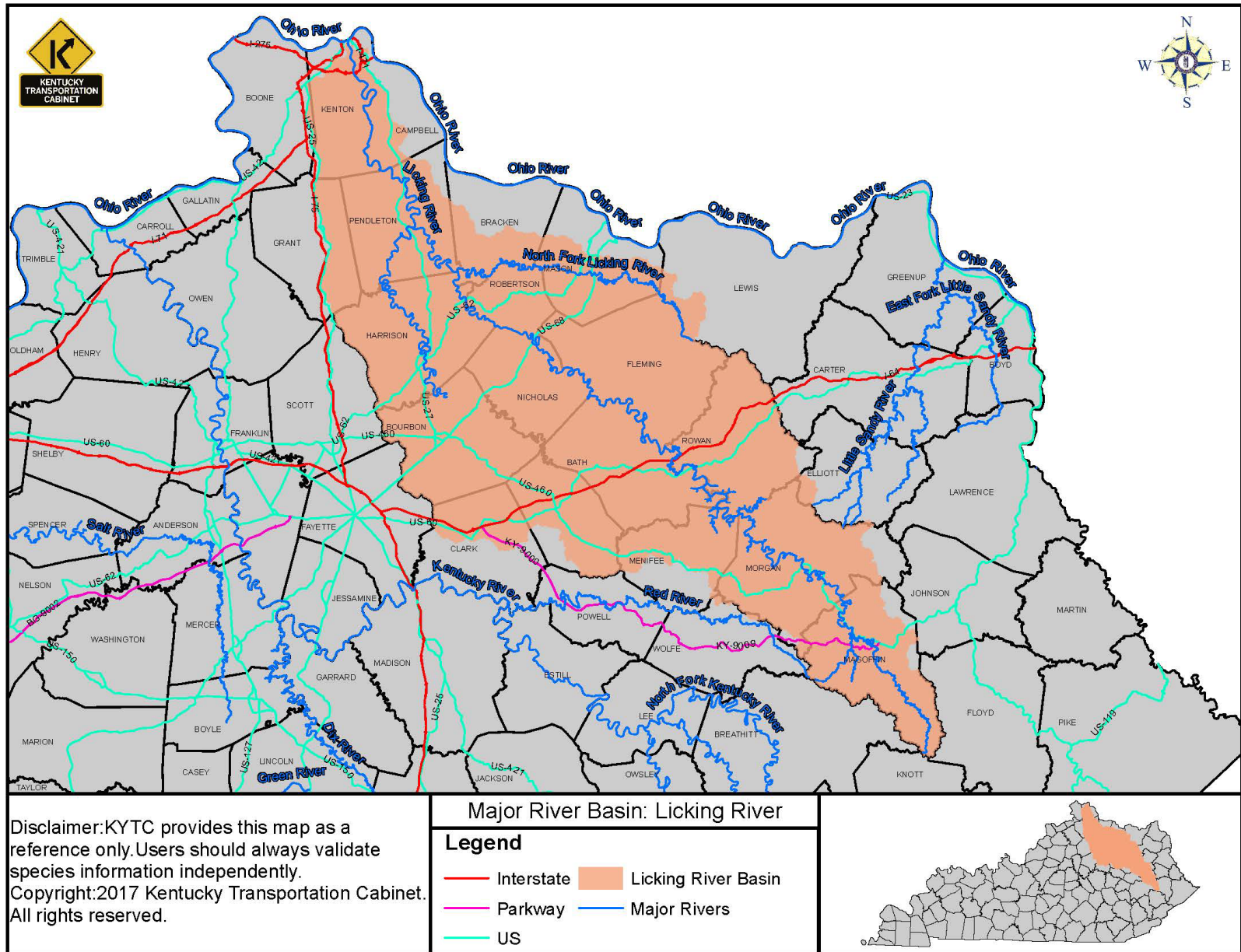
In regards to the protection of endangered species, fish are confined mostly to perennial and some intermittent rivers and streams within a specific river basin. Habitat potential for endangered species is better defined by watershed than by county, since multiple watersheds can occur within a single county. Occasionally fishes can be transferred outside of their basin by human activities such as an accidental bait bucket release.

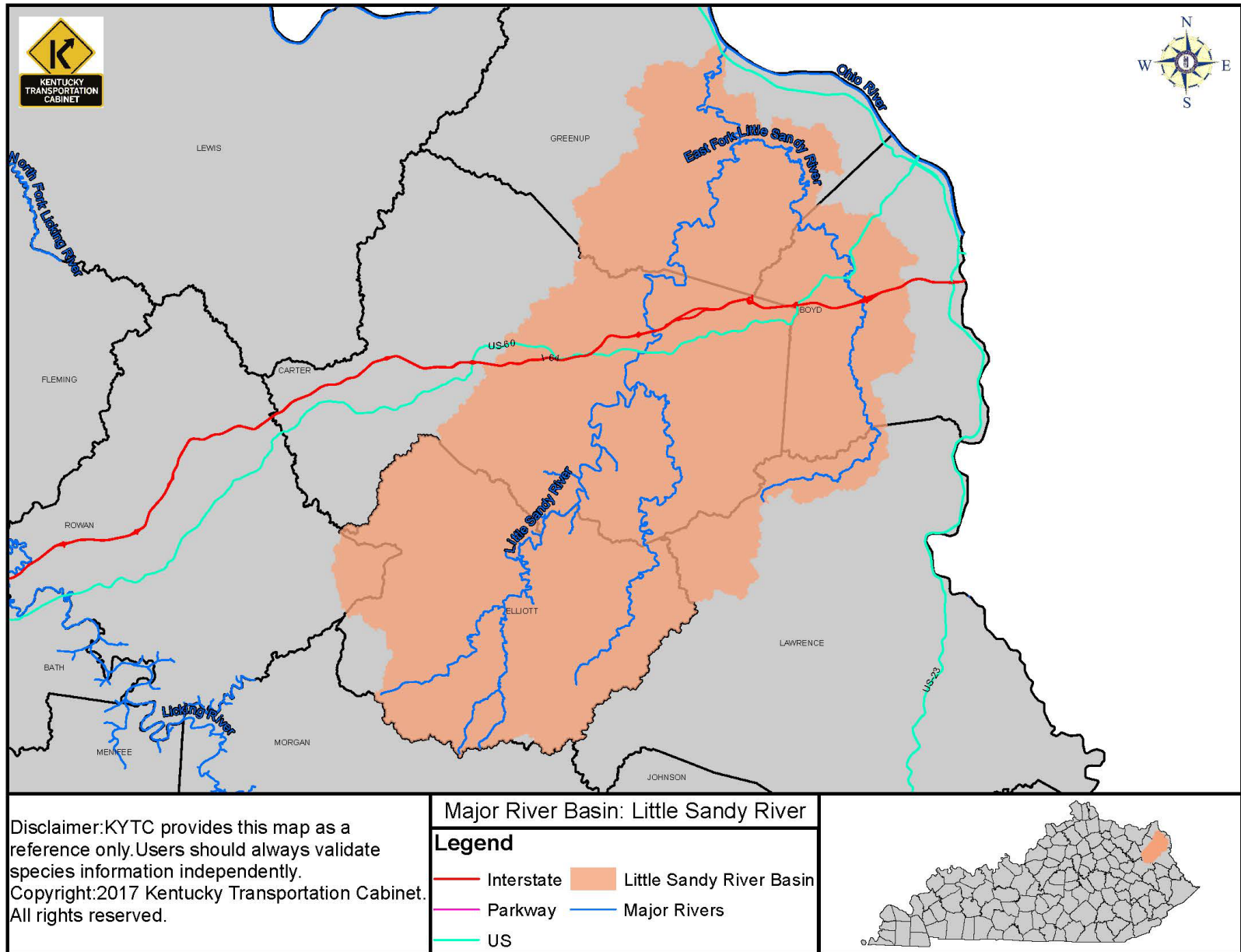
The following maps depict the locations of the 13 river basins of Kentucky.

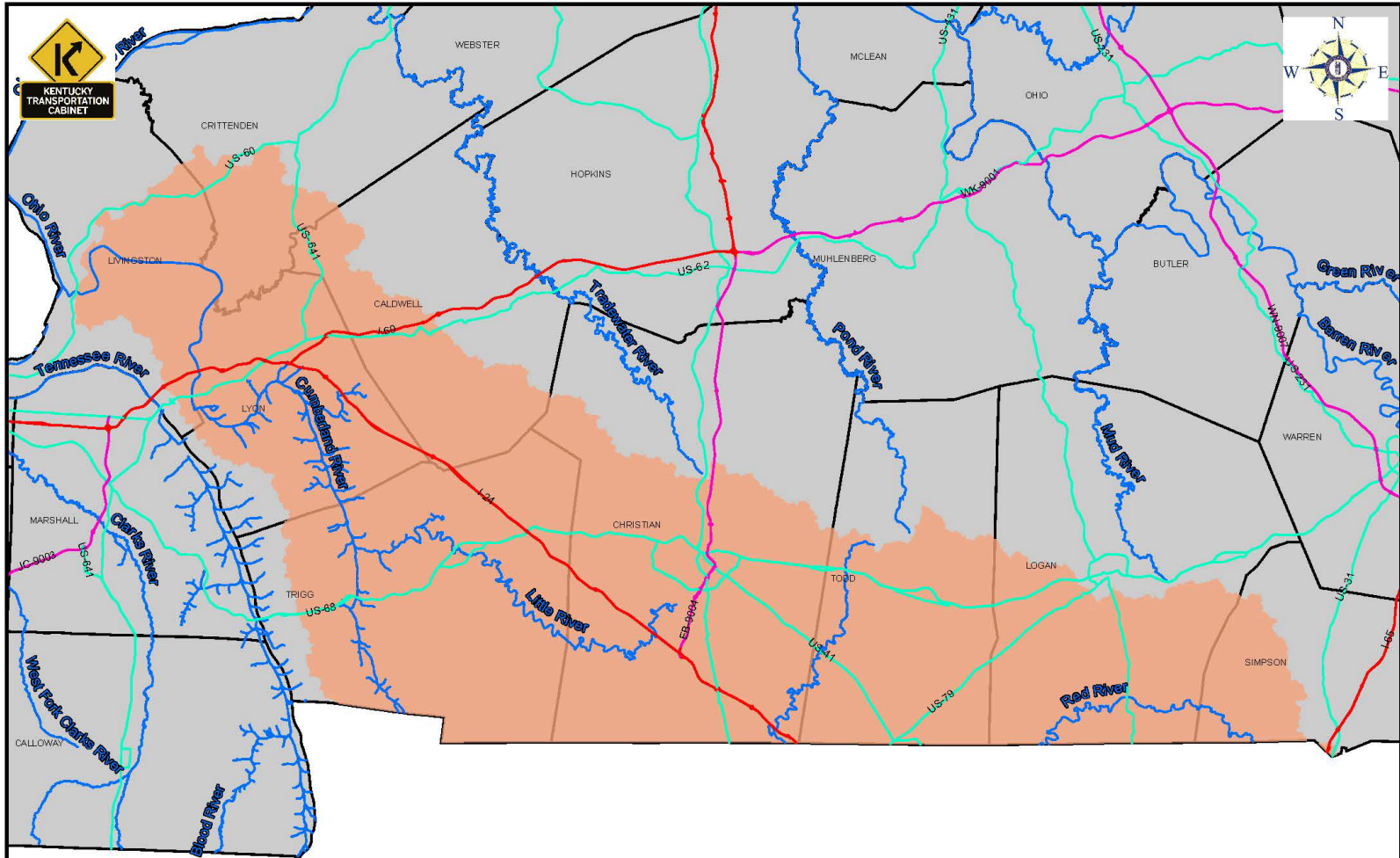










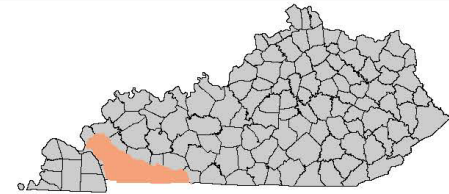


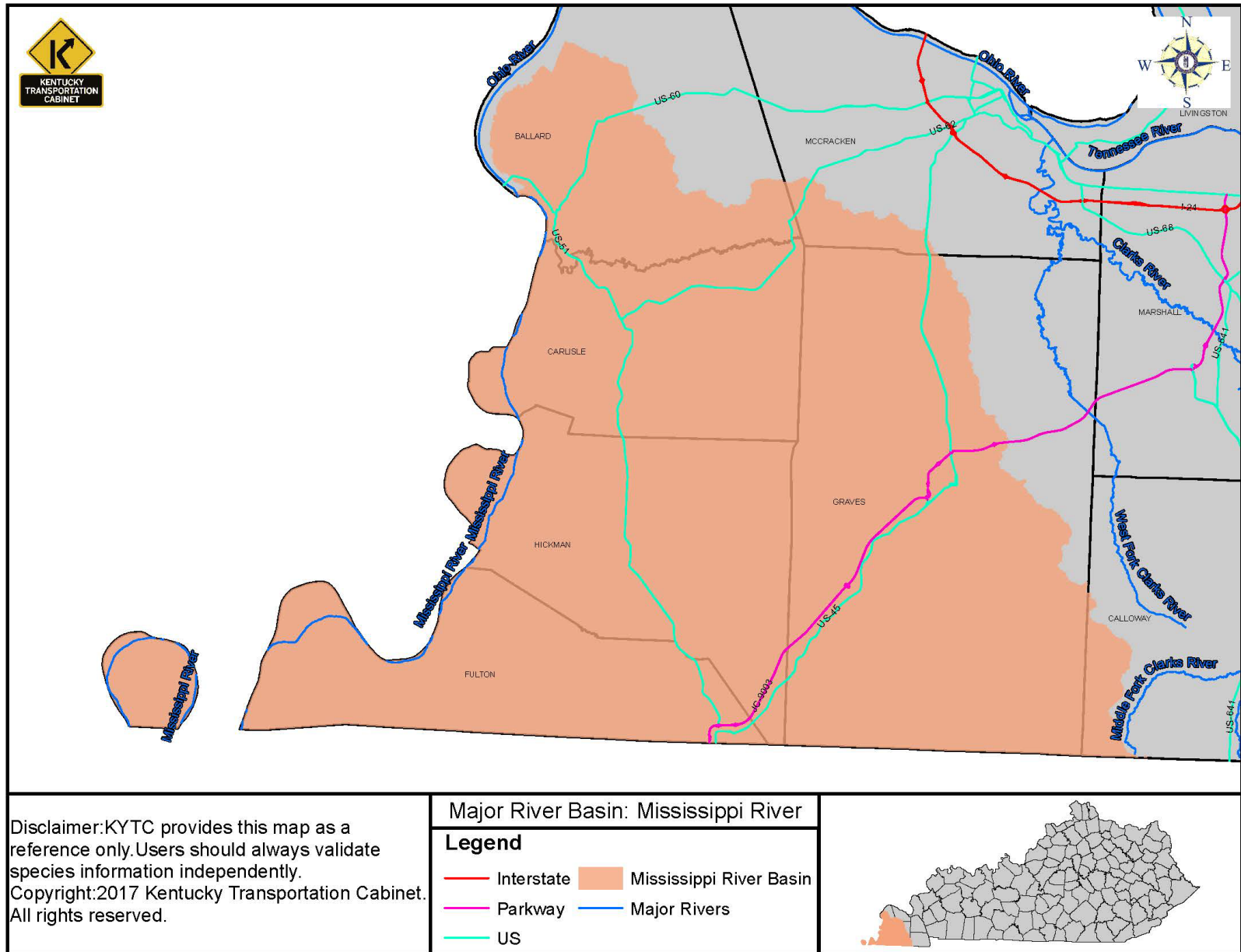
Disclaimer: KYTC provides this map as a reference only. Users should always validate species information independently.
Copyright: 2017 Kentucky Transportation Cabinet.
All rights reserved.

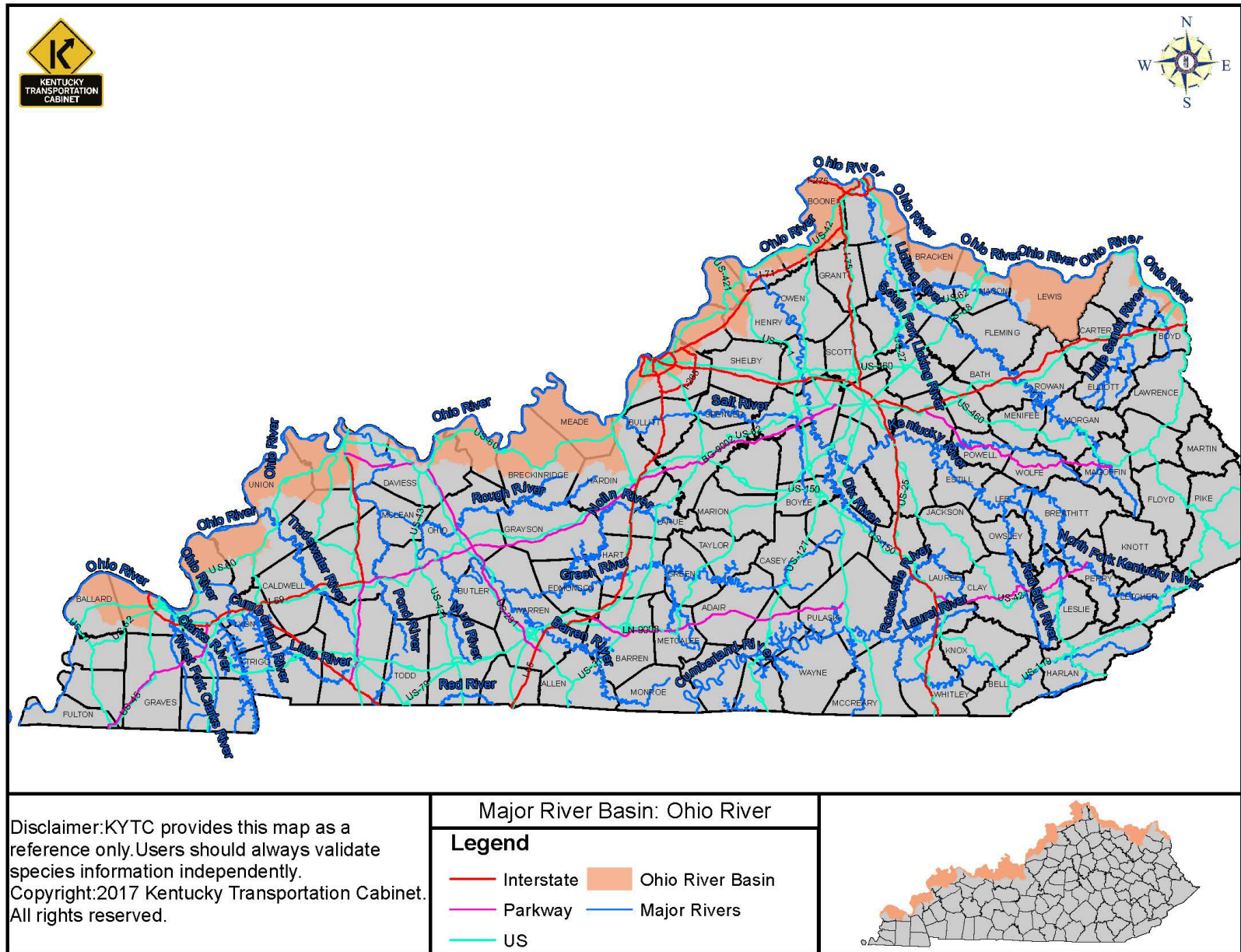
Major River Basin: Lower Cumberland River

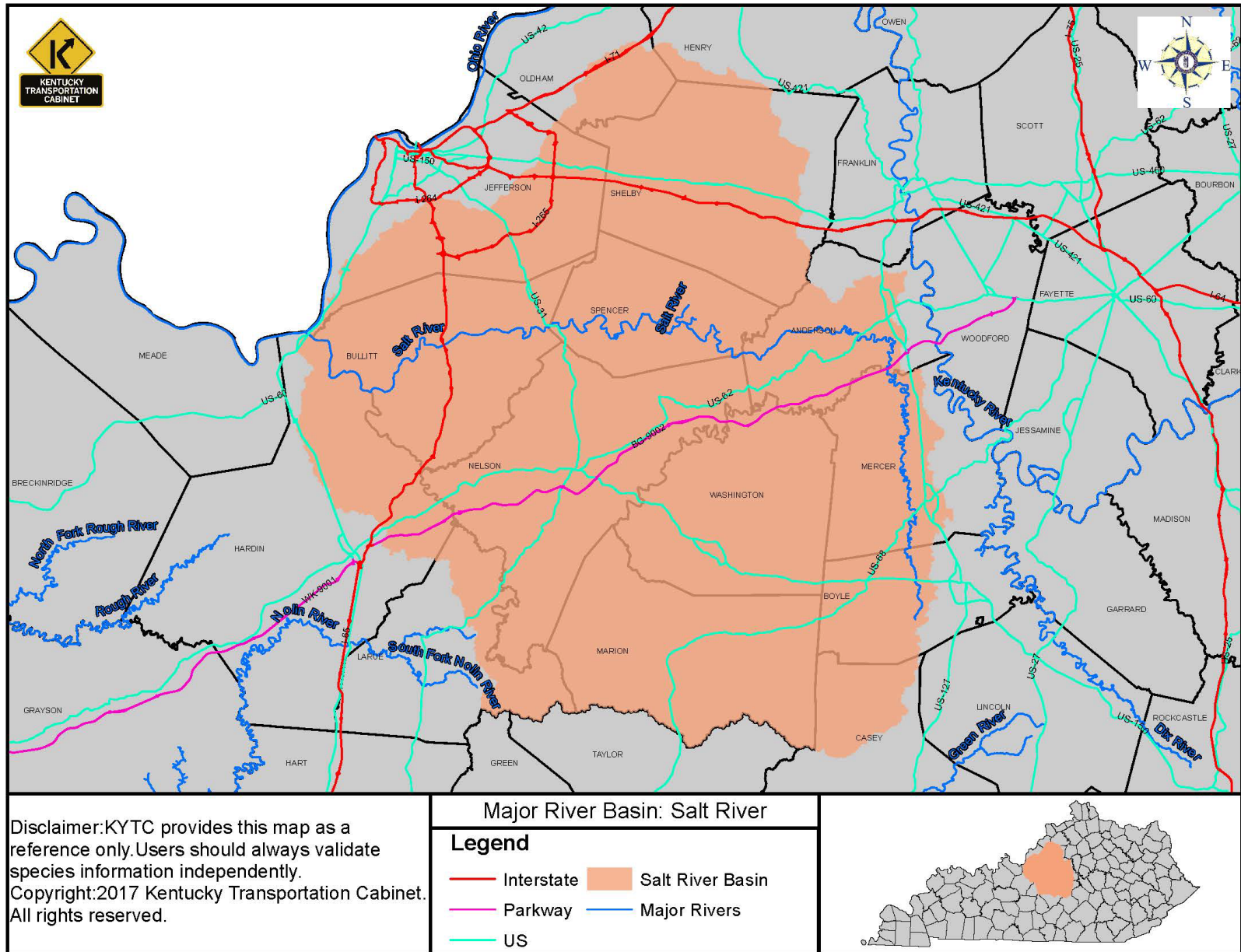
Legend

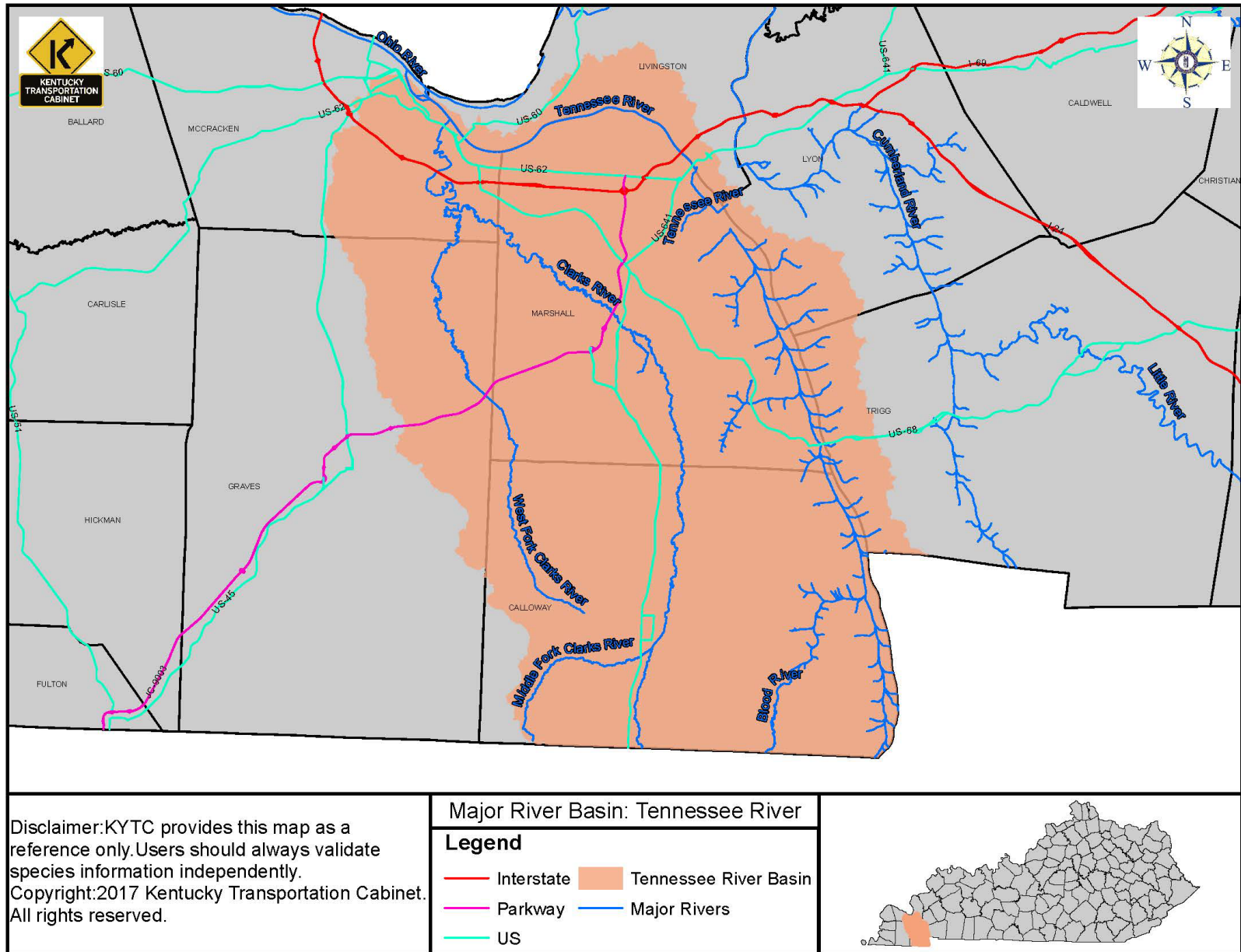
- Interstate Lower Cumberland River Basin
— Parkway — Major Rivers
— US

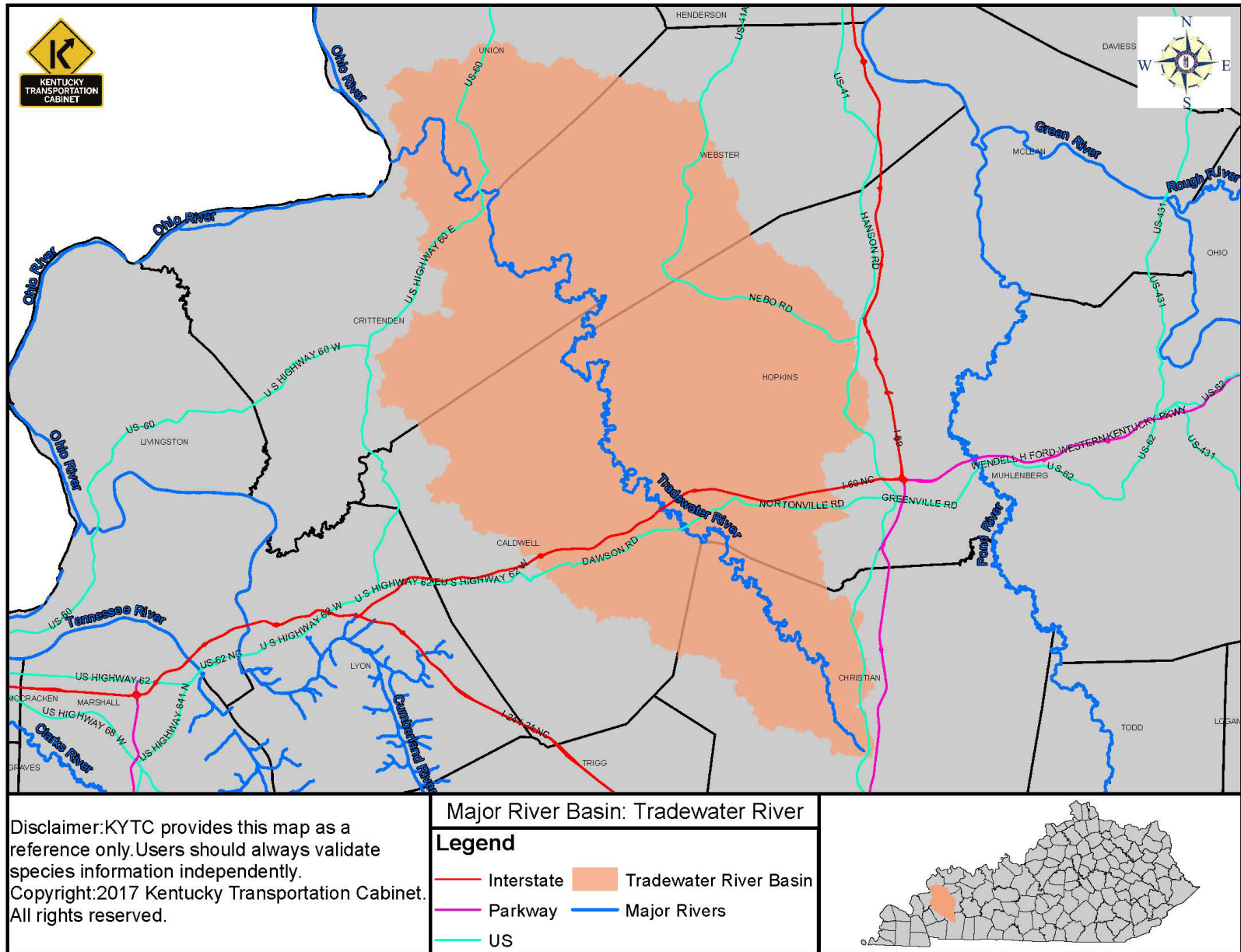


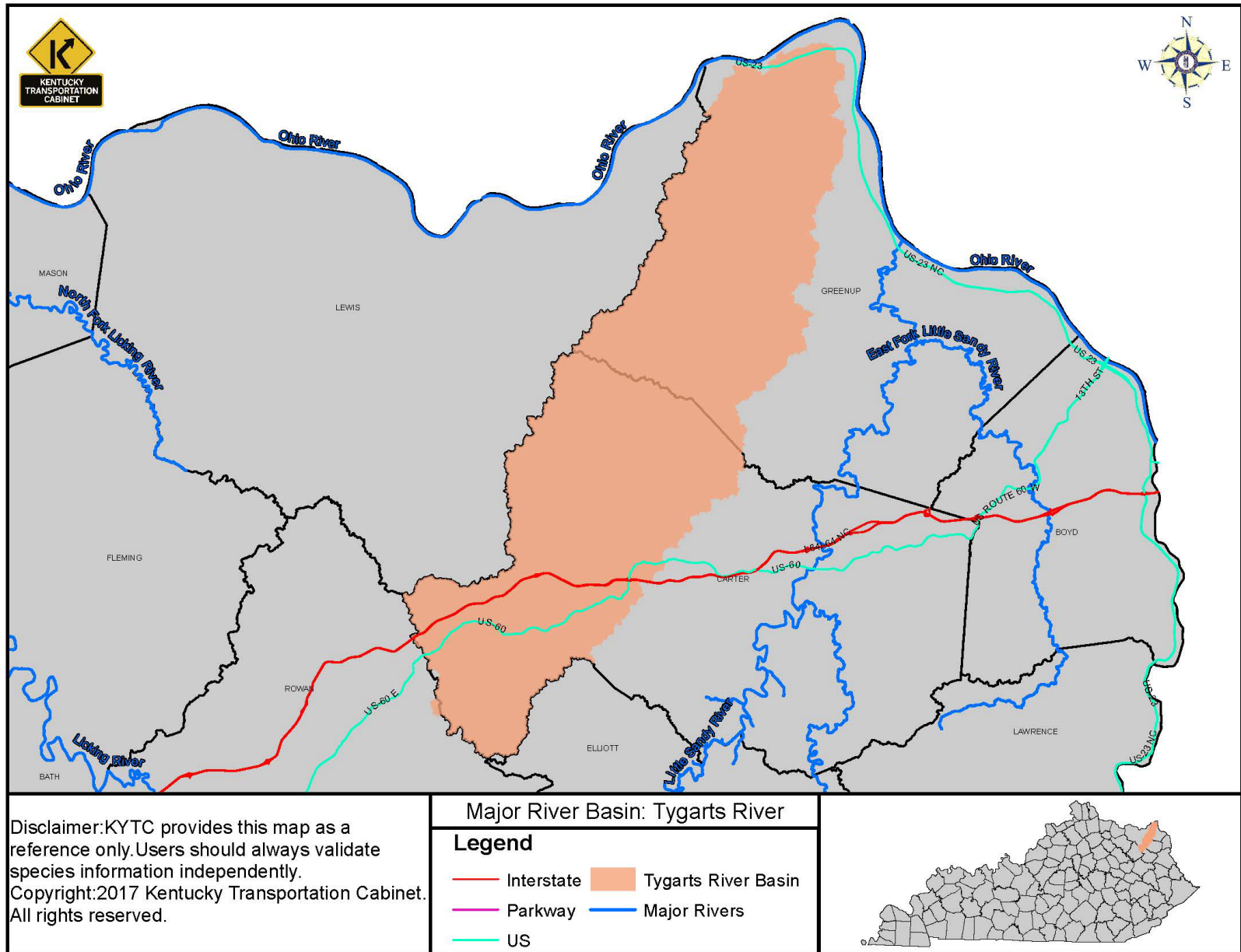


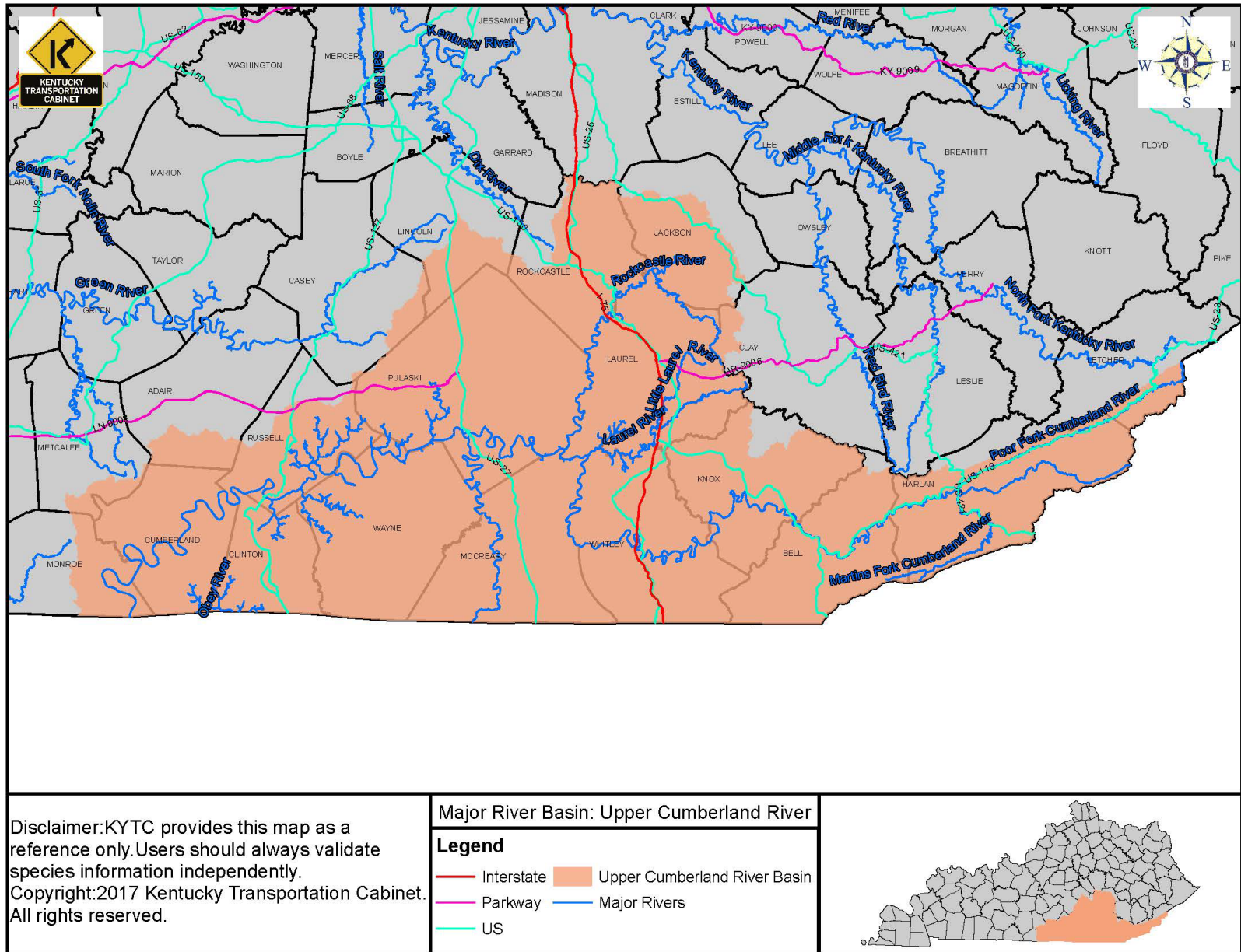












Blackside Dace (*Phoxinus cumberlandensis*)

Species Description

Blackside dace was listed as **threatened** in 1987.

Distinguishing characteristics for this species are its single black lateral stripe, green/gold back with black specks, with

a scarlet belly (varies from pale to brilliant). Fins are bright yellow with metallic silver surrounding the base of the pelvic and pectoral fins.



Figure 1 Photo Credit: Bert Remley, Third Rock Consultants, Inc.

Habitat Description

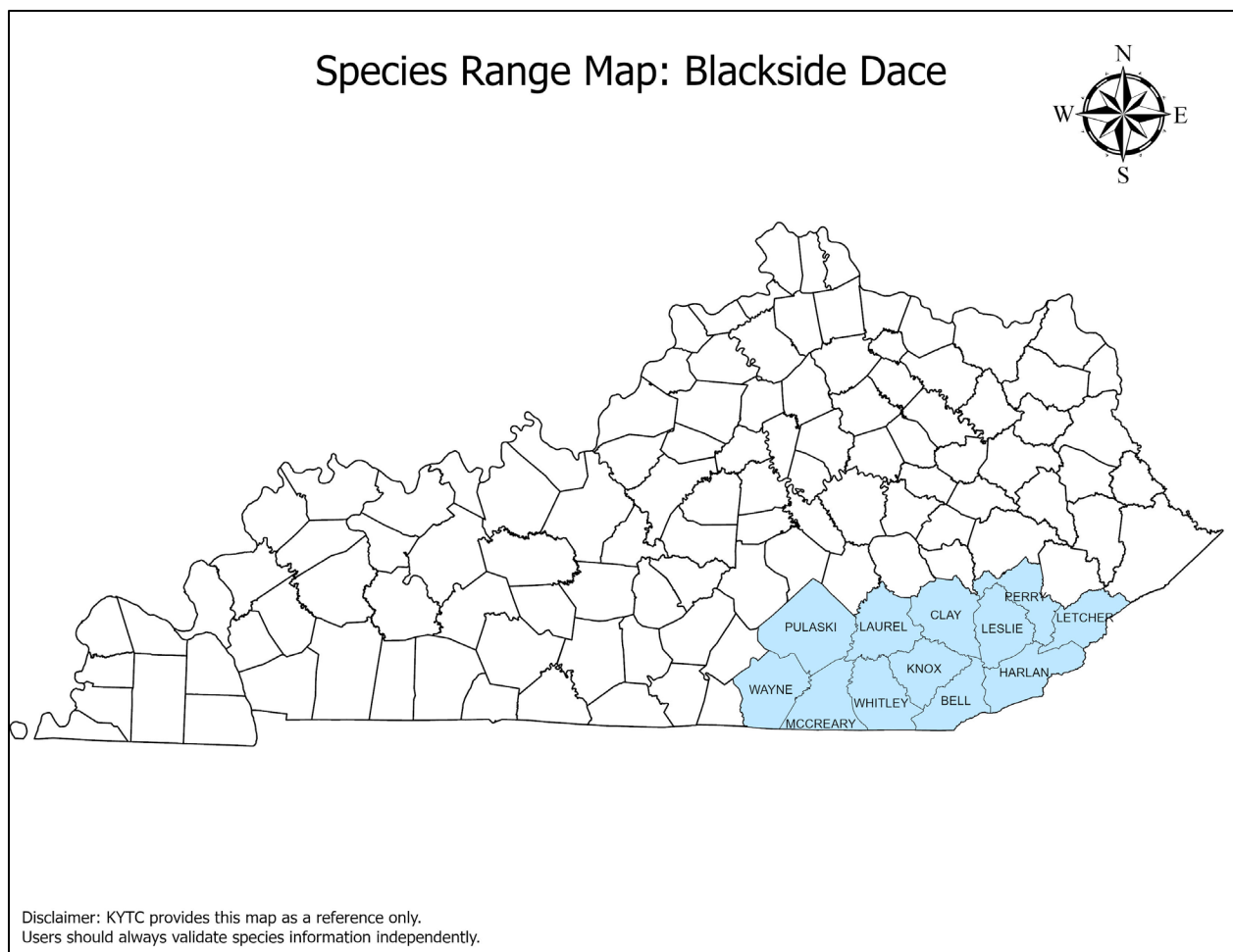
Blackside dace (BSD) inhabit perennial headwater (1st -3rd order) streams that have a wetted width of 6–17 feet and relatively high riffle-pool ratios (35-50 % riffles). BSD streams have a moderate current velocity because of an ideal gradient ranging from 1–6 %. They are not found in steeper, high gradient (>6%) upper headwater reaches, or in low gradient (<1%) downstream reaches with a much higher proportion of deeper pools that contain large predators. Other habitat factors that correlate well with the presence of BSD are low turbidity and low silt loads, conductivity below 450 μ S/cm, and relatively cool summer water temperatures (i.e., good riparian cover and shading). Adult BSD are found in pools with undercut banks, root wads, or over-hanging vegetation. Pool depth can vary from less than a foot to more than three feet. Fry and small juveniles inhabit the shallow edges of pools, or more commonly, very shallow runs. Spawning areas are generally located in pools just above or just below the riffles where the current is sufficient to keep the gravel swept free of silt.

Critical Habitat

None

Range

Historically, BSD were limited to the Upper Cumberland River System in southeastern Kentucky northeastern Tennessee. However, in 2013 BSD were found in the Big South Fork of the Cumberland River Drainage, and also in the Powell River and Clinch River in Virginia. In addition, a 2013 KYTC fish survey found BSD in the Kentucky River drainage within the Right Fork Maces Creek in Perry County, KY. Although all federally endangered and threatened species are protected ‘wherever found’, this R. Fork Maces Creek location is considered to be an isolated occurrence so BSD populations elsewhere in Perry County are considered unlikely.



Decision Key

- 1) Does the project include any direct or indirect effects on perennial (1st – 3rd order) streams or nearby tributaries in the Upper Cumberland or Big South Fork of the Cumberland River Drainage or within the Right Fork Maces Creek in Perry County? (e.g. remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers)
 - a. Yes: Contact SME
 - b. No: Prepare NE finding

Cumberland Darter (*Etheostoma susanae*)

Species Description

The Cumberland darter was listed as **endangered** in September 2011.

This rare fish may reach lengths up to 2.5 inches. It is pale yellow in color with six brown saddle-like markings on the sides. During the breeding season, these markings on males fade and the fish become darker.



Figure 2 Photo Credit: <http://conservationfisheries.org>.

Habitat Description

The Cumberland darter inhabits pools or shallow runs of low–moderate gradient sections of streams with stable sand, silt, or sand-covered bedrock. Stream size ranges from 2nd–4th order streams, 11-30 feet wide and 8–30 inches deep.

Critical Habitat

Yes – (*see additional maps and detailed descriptions provided after the decision key*)

Critical habitat for the Cumberland darter was designated on October 16, 2012.

Primary constituent elements of critical habitat for this species include:

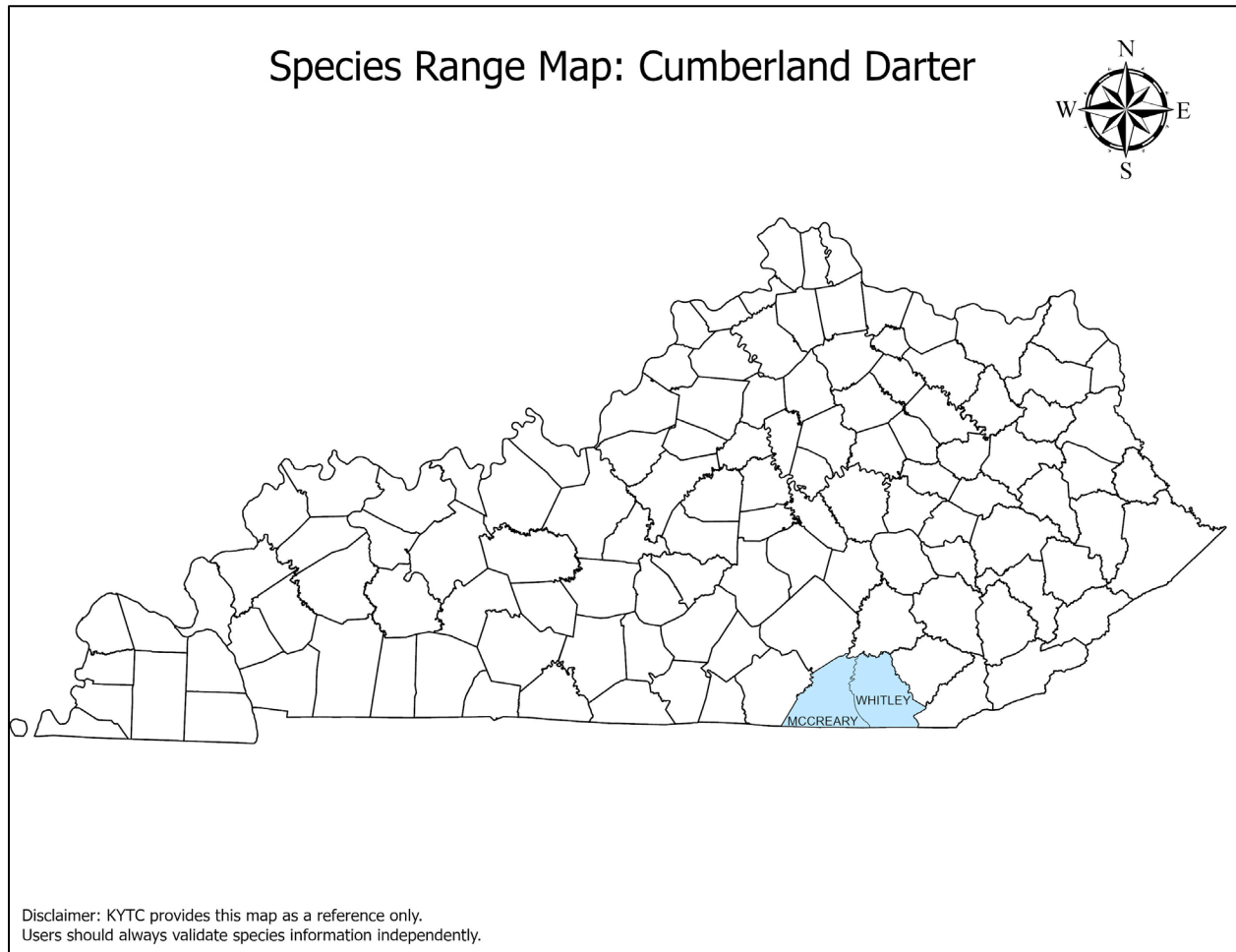
1. Shallow pools and gently flowing runs of geomorphically stable, second- to fourth-order streams with connectivity between spawning, foraging, and resting sites to promote gene flow throughout the species' range.
2. Stable bottom substrates composed of relatively silt-free sand and sandcovered bedrock, boulders, large cobble, woody debris, or other cover.

3. An instream flow regime (magnitude, frequency, duration, and seasonality of discharge over time) sufficient to provide permanent surface flows, as measured during years with average rainfall, and to maintain benthic habitats utilized by the species.
4. Adequate water quality characterized by moderate stream temperatures, acceptable dissolved oxygen concentrations, moderate pH, and low levels of pollutants. Adequate water quality is defined for the purpose of this rule as the quality necessary for normal behavior, growth, and viability of all life stages of the Cumberland darter.
5. Prey base of aquatic macroinvertebrates, including midge larvae, mayfly nymphs, caddisfly larvae, and microcrustaceans.

Species, Stream (unit), and State	Currently Occupied River Miles	Currently Unoccupied River Miles
Cumberland Darter		
Bunches Creek (1), KY	3.6	
Calf Pen Fork (2), KY	1.8	
Youngs Creek (3), KY	4.6	
Barren Fork (4), KY	3.9	
Indian Creek (5), KY	-	2.5
Cogur Fork (6), KY	5.4	
Kilburn Fork (7), KY	-	2.9
Laurel Fork (8), KY	2.2	
Laurel Creek (9), KY	5.9	
Elisha Branch (10), KY	1.3	
Jenneys Branch (11), KY	1.9	
Wolf Creek (12), KY	3.9	
Jellico Creek (13), KY	7.2	
Rock Creek (14), KY	3.8	
Capuchin Creek (15), KY	2.6	

Range

The Federal Register states that the Cumberland darter is known from 15 occurrences in 13 streams in McCreary and Whitley Counties. Its potential habitat is small streams in the upper Cumberland drainage **above** the Falls (of the Cumberland). Refer to critical habitat for stream locations.



Decision Key

- 1) Does the project include any direct or indirect effects to perennial (2nd–4th order) streams in the Cumberland River drainage above the Falls (e.g. remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers)?
 - a. Yes: Contact SME
 - b. No: Prepare NE finding

Unit 1: Bunches Creek – Whitley County, KY.

This unit is located between Kentucky Highway 90 (KY 90) and the Cumberland River and includes 3.6 rmi of Bunches Creek from the confluence of Seminary Branch and Amos Falls Branch downstream to its confluence with the Cumberland River. Live Cumberland darters have been captured at two sites within Unit 1, specifically at the mouth of Bunches Creek and just below its confluence with Calf Pen Fork. This unit was included in the geographical area occupied by the species at the time of listing and contains elements of essential physical or biological features. This unit is located entirely on Federal lands within the DBNF. Land and resource management decisions and activities within the DBNF are guided by DBNF's LRMP. The lower portion of Bunches Creek (rmi 0 to 0.1) flows through a designated Kentucky Wild River corridor (KRS 146.200 to 146.360) that extends along an approximately 16 mi reach of the Cumberland River. This Wild River corridor extends from Summer Shoals downstream to the backwaters of Lake Cumberland (KRS 146.241). The Bunches Creek Cumberland River confluence is located approximately 1.9 mi upstream of Cumberland Falls. The Bunches Creek watershed is relatively undisturbed, and access is limited (no road crossings). The channel within Unit 1 is relatively stable, with excellent instream habitat. There is an abundance of pool and run habitats, with relatively silt-free sand and bedrock substrates and adequate instream flows. Water quality is good to excellent, as evidenced by diverse fish and macroinvertebrate communities.

Unit 2: Calf Pen Fork – Whitley County, KY.

This unit includes 2.9 1.8 rmi of Calf Pen Fork, a tributary of Bunches Creek, from its confluence with Polly Hollow downstream to its confluence with Bunches Creek. Live Cumberland darters have been captured in Calf Pen Fork just above its confluence with Bunches Creek. This unit was included in the geographical area occupied by the species at the time of listing and contains elements of essential physical or biological features. This unit is located entirely on Federal lands within the DBNF. Land and resource management decisions and activities within the DBNF are guided by DBNF's LRMP. Similar to the watershed of Unit 1, the Calf Pen Fork watershed is relatively undisturbed, and access is limited (no road crossings). Within Unit 2, the channel is relatively stable, with excellent instream habitat, an abundance of run and pool habitats, relatively silt-free sand and bedrock substrates, and adequate instream flows. Water quality is good to excellent, with diverse fish and macroinvertebrate communities.

Unit 3: Youngs Creek – Whitley County, KY.

Unit 3 includes 4.6 rmi of Youngs Creek from Brays Chapel Road downstream to its confluence with the Cumberland River. Live Cumberland darters have been captured within Unit 3, specifically at the KY 204 bridge crossing. This unit was included in the geographical area occupied by the species at the time of listing and contains elements of essential physical or biological features. This unit is located entirely on private land. The watershed of Youngs Creek is less forested than Units 1 and 2, with scattered residences and small farms. The channel is relatively stable, but activities associated with agriculture, silviculture, and residential development have contributed to a more open riparian zone, increased bank erosion, and some siltation of instream habitats. Despite these impacts, Unit 3 continues to provide pool and run habitats with suitable sand and bedrock substrates for Cumberland darters to use in spawning, foraging, and other behaviors. Flow is adequate as measured during years with average rainfall, water quality is adequate, and macroinvertebrate prey items are present.

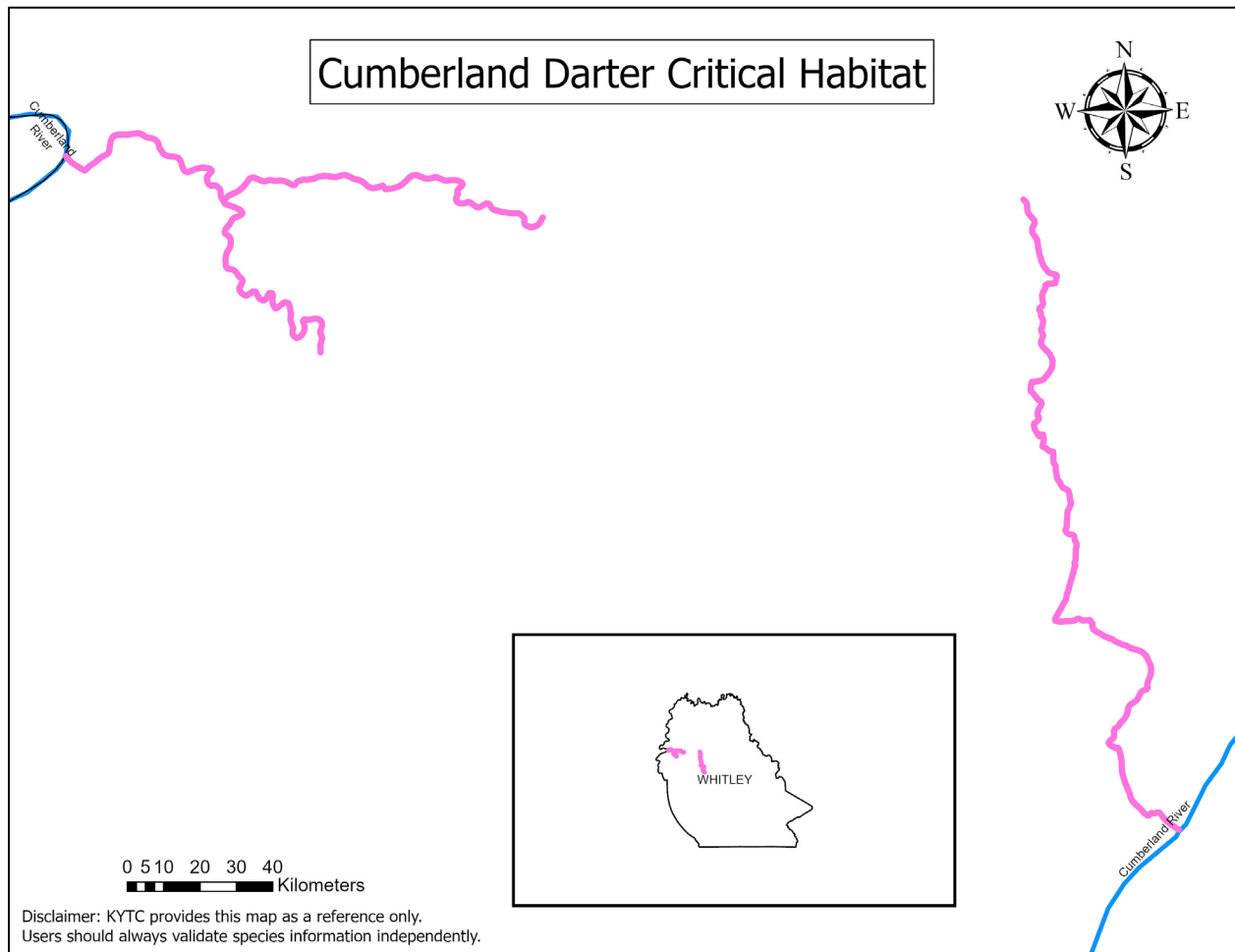


Figure 3 This map includes 1-3 CH units in Whitley County, KY.

Unit 4: Barren Fork – McCreary County, KY.

Unit 4 includes 3.9 rmi of Barren Fork from its confluence with an unnamed tributary downstream to its confluence with Indian Creek. Based on survey results by Thomas and Stephens, Barren Fork supports the most robust population of Cumberland darters within the species' range. Over the past 4 years, over 75 Cumberland darters have been observed within this unit. This unit was included in the geographical area occupied by the species at the time of listing and contains elements of essential physical or biological features. This unit is located entirely on Federal lands within the DBNF. Land and resource management decisions and activities within the DBNF are guided by DBNF's LRMP. In the summer and fall of 2008, the Barren Fork watershed was adversely affected by several large sedimentation events originating from a county park construction site in the headwaters of the basin. Inadequate site planning and poor BMP implementation allowed significant quantities of sediment to leave the construction site and enter headwater tributaries of Barren Fork. The sediment was carried downstream into the mainstem of Barren Fork, eventually affecting the entire reach of Unit 4. Until the construction site was stabilized in 2009, important spawning and foraging habitats for the Cumberland darter were degraded. Despite these significant adverse effects, habitat conditions have improved since 2008, and are now similar to those described for Units 1 and 2. The watershed is mostly forested, with relatively stable channels, abundant pool and run habitats, relatively silt-free sand and bedrock substrates, adequate flow, adequate water quality, and a diverse macroinvertebrate community.

Unit 5: Indian Creek – McCreary County, KY.

Unit 5 includes 2.5 rmi of Indian Creek from its confluence with Strunk Branch, downstream to its confluence with Barren Fork. Live Cumberland darters have not been captured within Unit 5. This unit was not included in the geographical area occupied by the species at the time of listing, and it is not currently occupied by the species. This unit is located entirely on Federal lands within the DBNF. Land and resource management decisions and activities within the DBNF are guided by DBNF's LRMP. This unit is located within the historical range of the species, and is adjacent to currently occupied areas where there is potential for natural dispersal and reoccupation by the Cumberland darter. This unit is essential for the conservation of the Cumberland darter because it provides additional habitat for population expansion and will promote connectivity and genetic exchange between adjacent units to the south.

Unit 6: Cogur Fork – McCreary County, KY.

Unit 6 includes 5.4 rmi of Cogur Fork from its confluence with an unnamed tributary downstream to its confluence with Indian Creek. Live Cumberland darters have been captured at several locations within an approximately 0.62-mi reach upstream of the KY 1045 road crossing. This unit was included in the geographical area occupied by the species at the time of listing and contains elements of essential physical or biological features. The majority of this unit (3.7 rmi)

is in public ownership (DBNF), with the remainder of the unit (1.7 rmi) in private ownership. Land and resource management decisions and activities within the DBNF are guided by DBNF's LRMP. Cumberland darters have been captured within Unit 6, but the population is considered to be small. From 2008 to present, the fauna has been bolstered through propagation and augmentation efforts by KDFWR, Conservation Fisheries, Inc. (CFI), and the Service. Initial brood stock were collected in 2008, with subsequent releases of propagated darters in 2009 (60 individuals and 2010 (335 inds). Both tagged (propagated, 50 inds) and non-tagged (native, 4 inds) darters were observed during recent surveys in November 2010. Individuals tagged and released by KDFWR and CFI traveled distances ranging from 0.2 to 0.4 rmi between their release date of September 22, 2010, and their recapture date of November 9, 2010. Similar to other units located entirely or predominately on the DBNF (Units 1, 2, 4, and 5), this unit has relatively stable channels, abundant pool and run habitats, relatively silt-free sand and bedrock substrates, adequate flow, adequate water quality, and a diverse macroinvertebrate community.

Unit 7: Kilburn Fork – McCreary County, KY.

Unit 7 includes 2.9 rmi of Kilburn Fork from its confluence with an unnamed tributary downstream to its confluence with Laurel Fork. Live Cumberland darters have not been captured within Unit 7 over the last 15 years. This unit was not included in the geographical area occupied by the species at the time of listing, and it is not currently occupied by the species. The majority of this unit 2.3 rmi is in public ownership (DBNF), with the remainder of the unit 0.6 rmi in private ownership. Land and resource management decisions and activities within the DBNF are guided by DBNF's LRM. This unit is located within the historical range of the species, and is adjacent to currently occupied areas where there is potential for natural dispersal and reoccupation by the Cumberland darter. This unit is essential for the conservation of the Cumberland darter because it provides additional habitat for population expansion and will promote connectivity and genetic exchange between adjacent units to the south.

Unit 8: Laurel Fork – McCreary County, KY.

Unit 8 includes 2.2 rmi of Laurel Fork from its confluence with Tom Fork downstream to its confluence with Indian Creek. Live Cumberland darters have been captured within Unit 8, specifically just upstream of its confluence with Kilburn Fork. This unit was included in the geographical area occupied by the species at the time of listing and contains elements of essential physical or biological features. The majority of this unit 1.4 rmi is in public ownership (DBNF), with the remainder of the unit 0.8 rmi in private ownership. Land and resource management decisions and activities within the DBNF are guided by DBNF's LRMP. Similar to other streams with major portions of their basins in the DBNF, the watershed of Laurel Fork is relatively intact, and access is limited (limited roads and residential development). The channel within Unit 8 is relatively stable, with suitable instream habitat to support the life-history functions of the Cumberland darter. There is an abundance of pool and run habitats, with relatively silt-free sand

and bedrock substrates and adequate flows. Water quality is good to excellent, as evidenced by diverse fish and macroinvertebrate communities.

Unit 9: Laurel Creek – McCreary County, KY.

Unit 9 includes 5.9 rmi of Laurel Fork Creek from Laurel Fork Reservoir downstream to its confluence with Jenneys Branch. Live Cumberland darters have been captured within Unit 9, specifically just upstream of its confluence with Elisha Branch and at the KY 478 bridge crossing. This unit was included in the geographical area occupied by the species at the time of listing and contains elements of essential physical or biological features. The majority of this unit 5.5 rmi is in public ownership (DBNF), with the remainder of the unit 0.4 rmi in private ownership. Land and resource management decisions and activities within the DBNF are guided by DBNF's LRMP. The watershed of Laurel Creek is relatively intact, with extensive forest cover and few roads. The channel within Unit 9 is relatively stable, with suitable instream habitat to support the life-history functions of the Cumberland darter. There is an abundance of pool and run habitats, with relatively silt-free sand and bedrock substrates and adequate instream flows. Water quality is good to excellent, with a diverse macroinvertebrate community.

Unit 10: Elisha Branch – McCreary County, KY.

Unit 10 includes 1.3 rmi of Elisha Branch from its confluence with an unnamed tributary (36.70132, -84.40843) downstream to its confluence with Laurel Creek. Live Cumberland darters have been captured within Unit 10, specifically just upstream of its confluence with Laurel Creek. This unit was included in the geographical area occupied by the species at the time of listing and contains elements of essential physical or biological features. This unit is located entirely on public lands within the DBNF. Land and resource management decisions and activities within the DBNF are guided by DBNF's LRMP. The watershed of Elisha Branch is relatively intact, with extensive forest cover and no road crossings. Within Unit 10, the channel is relatively stable, with excellent instream habitat, an abundance of run and pool habitats, relatively silt-free sand and bedrock substrates, and adequate flows. Water quality is good to excellent, with diverse fish and macroinvertebrate communities.

Unit 11: Jenneys Branch – McCreary County, KY.

Unit 11 includes 1.9 rmi of Jenneys Branch from its confluence with an unnamed tributary (36.73680, -84.42420) downstream to its confluence with Laurel Creek. Live Cumberland darters have been captured within Unit 11, specifically just upstream of its confluence with Laurel Creek. This unit was included in the geographical area occupied by the species at the time of listing and contains elements of essential physical or biological features. This unit is located entirely on public lands within the DBNF. Land and resource management decisions and activities within the DBNF are guided by DBNF's LRMP. The watershed of Jenneys Branch is relatively intact and remote, with extensive forest cover and only one road crossing in its

headwaters. Within Unit 11, the stream channel is relatively stable, with excellent instream habitat, an abundance of run and pool habitats, relatively silt-free sand and bedrock substrates, and adequate instream flows. Water quality is good to excellent, with diverse fish and macroinvertebrate communities.

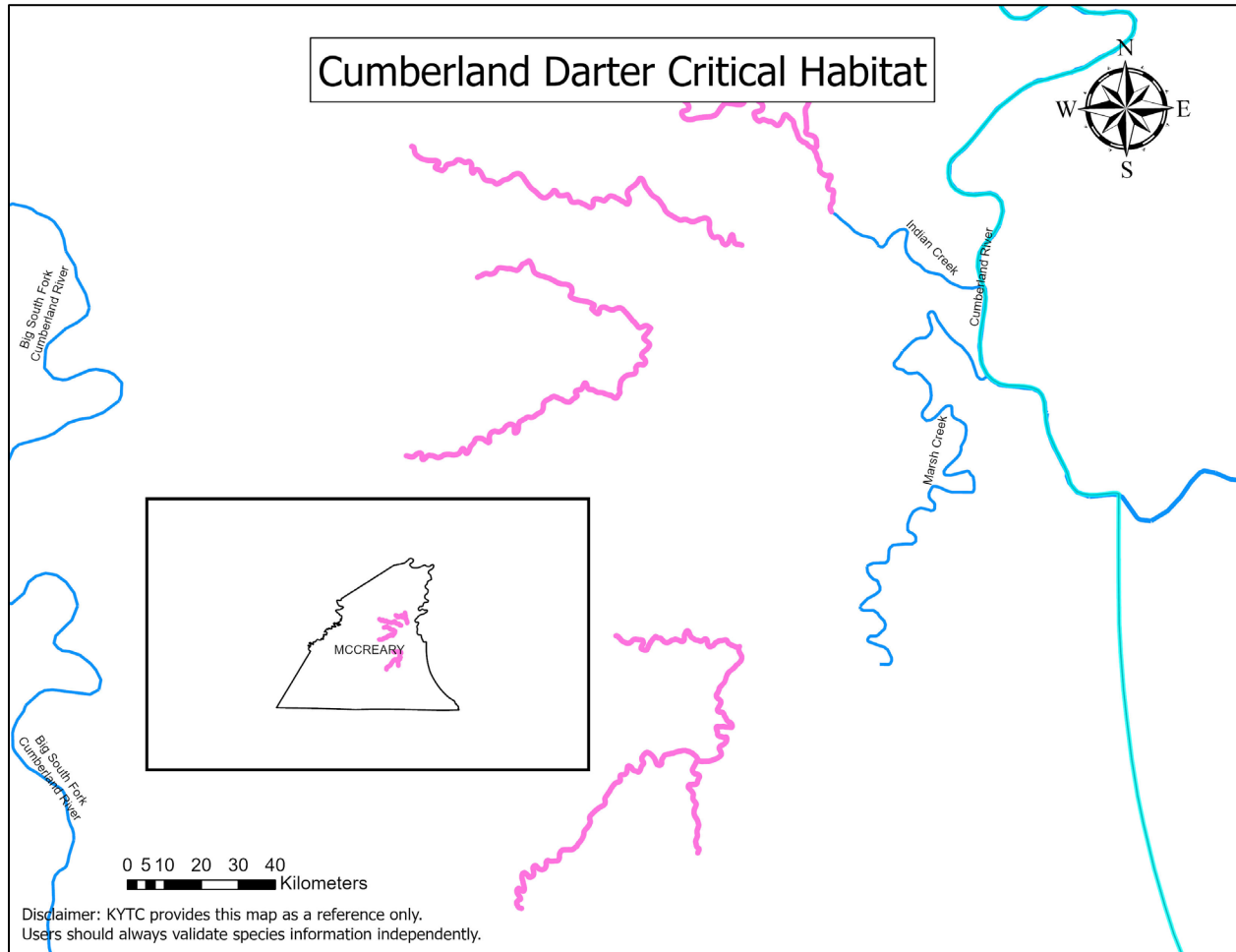


Figure 4 This map covers CH units 4-11.

Unit 12: Wolf Creek – Whitley County, KY.

Kentucky Unit 12 includes 3.9 rmi of Wolf Creek from its confluence with Sheep Creek downstream to Wolf Creek River Road. Live Cumberland darters have been captured within Unit 12 just downstream of the Little Wolf Creek River Road bridge crossing. This unit was included in the geographical area occupied by the species at the time of listing and contains elements of essential physical or biological features. This unit is located entirely on private land. Land use within the watershed of Wolf Creek is similar to Unit 3, and Unit 12 is less forested than units within the DBNF. The channel is relatively stable, but activities associated with agriculture, silviculture, and residential development have contributed to a more open riparian zone, increased bank erosion, and some siltation of instream habitats. Despite these impacts, Unit 12 continues to provide pool and run habitats with suitable sand and bedrock substrates for Cumberland darters to use in spawning, foraging, and other behaviors. Flow is adequate as measured during years with average rainfall, water quality is adequate, and macroinvertebrate prey items are present.

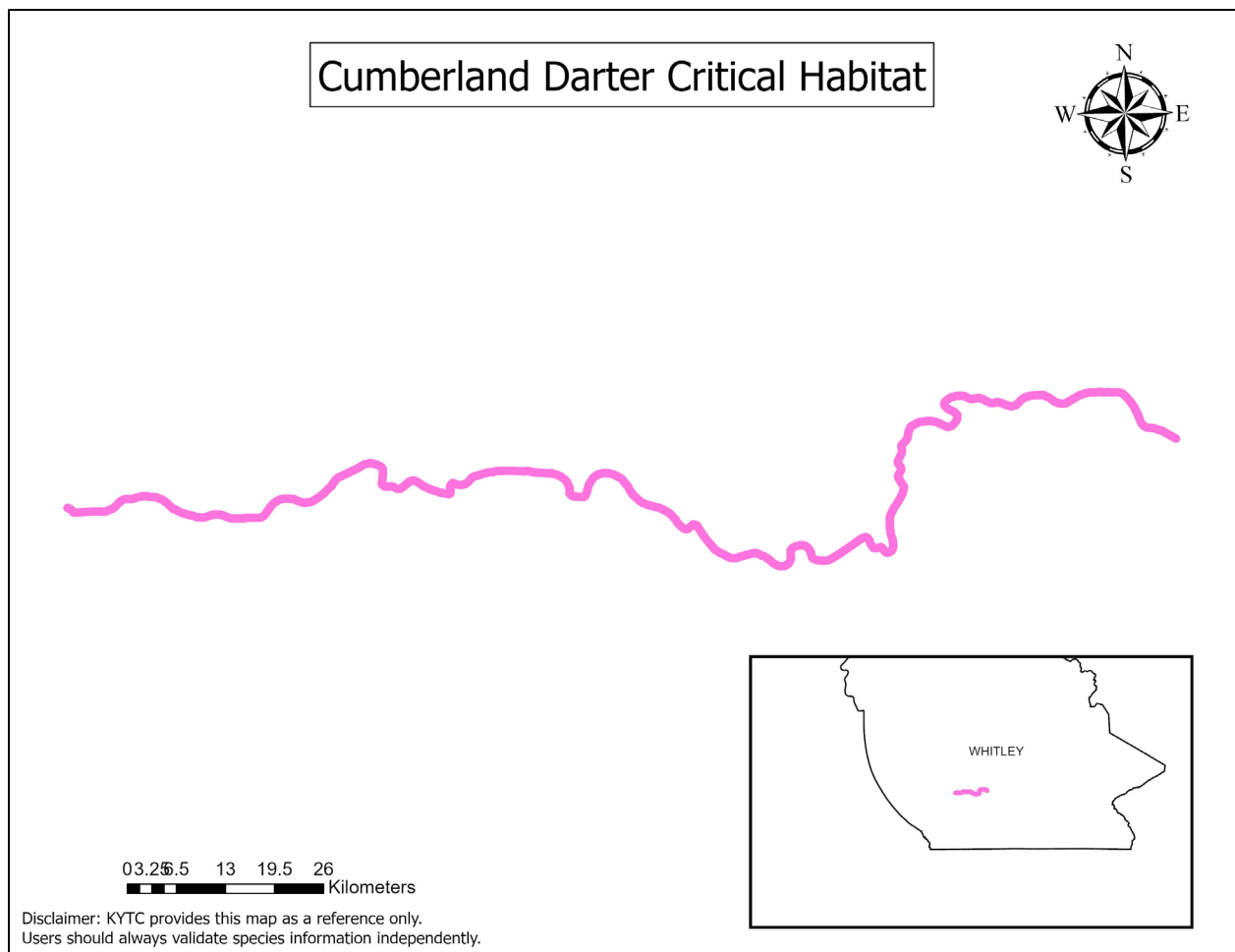


Figure 5 This map covers CH unit 12.

Unit 13: Jellico Creek – McCreary County, KY.

Unit 13 includes 7.2 rmi of Jellico Creek from its confluence with Scott Branch, Scott County, Tennessee, downstream to its confluence with Capuchin Creek, McCreary County, Kentucky. Live Cumberland darters have been captured within Unit 13 at the Jellico Creek and Shut-In Branch confluence and at the Gum Fork and Jellico Creek confluence. This unit was included in the geographical area occupied by the species at the time of listing and contains elements of essential physical or biological features. A portion of this unit in Kentucky 2.1 rmi is in public ownership (DBNF), with the remainder of the unit 5.1 rmi in private ownership. Land and resource management decisions and activities within the DBNF are guided by DBNF's LRMP. Land use within the watershed of Jellico Creek is predominately forest, with scattered residences and small farms (cattle and hay production). The channel in Unit 13 is relatively stable, but activities associated with agriculture, silviculture, and residential development have contributed to a more open riparian zone, increased bank erosion, and some siltation of instream habitats. Despite these impacts, Unit 13 continues to provide pool and run habitats with suitable sand and bedrock substrates for Cumberland darters to use in spawning, foraging, and other behaviors. Flow is adequate as measured during years with average rainfall, water quality is adequate, and macroinvertebrate prey items are present.

Unit 14: Rock Creek – McCreary County, KY.

Unit 14 includes 3.8 rmi of Rock Creek from its confluence with Sid Anderson Branch downstream to its confluence with Jellico Creek. Live Cumberland darters have been captured within Unit 14 just above the mouth of Rock Creek at its confluence with Jellico Creek. This unit was included in the geographical area occupied by the species at the time of listing and contains elements of essential physical or biological features. A portion of this unit 1.4 rmi is in public ownership (DBNF), but the majority 2.4 rmi is in private ownership. Land and resource management decisions and activities within the DBNF are guided by DBNF's LRMP. Most of the watershed is forested (especially along the ridge tops), but the valley floor has several open fields and is easily accessible via Little Rock Creek Road. Portions of the channel in Unit 14 have been modified by beaver (with some ponding), but it continues to be relatively stable, with excellent instream habitat, an abundance of run and pool habitats, relatively silt-free sand and bedrock substrates, and adequate instream flows. Water quality is good to excellent, with diverse fish and macroinvertebrate communities.

Unit 15: Capuchin Creek – McCreary and Whitley Counties, KY.

Unit 15 includes 2.6 rmi of Capuchin Creek from its confluence with Hatfield Creek downstream to its confluence with Jellico Creek. Live Cumberland darters have been captured within Unit 15 at the Kentucky/Tennessee State line. This unit was included in the geographical area occupied by the species at the time of listing and contains elements of essential physical or biological features. A portion of this unit in Kentucky 0.5 rmi is in public ownership (DBNF); the

remainder in Kentucky and Tennessee 2.1 km is in private ownership. Land and resource management decisions and activities within the DBNF are guided by DBNF's LRMP. Land use within the watershed of Capuchin Creek is predominately forest, with scattered residences and small farms (cattle and hay production). The channel in Unit 15 is relatively stable, but activities associated with agriculture, silviculture, and residential development have contributed to a more open riparian zone, increased bank erosion, and some siltation of instream habitats. Despite these impacts, Unit 15 continues to provide pool and run habitats with suitable sand and bedrock substrates for Cumberland darters to use in spawning, foraging, and other behaviors. Flow is adequate as measured during years with average rainfall, water quality is adequate, and macroinvertebrate prey items are present.

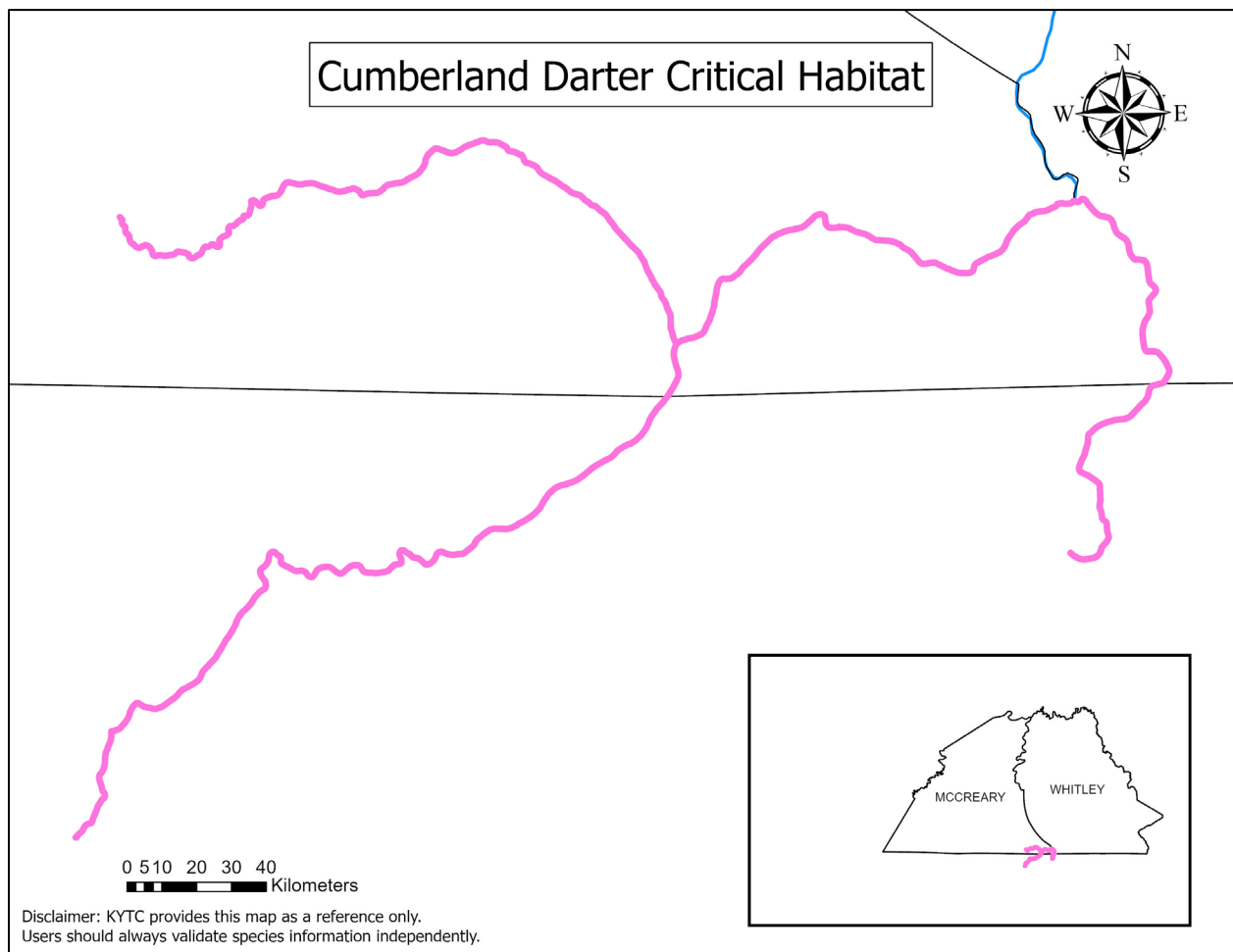


Figure 6 This map covers CH units 13-15.

Duskytail Darter (*Etheostoma percnurum*)

Species Description

The duskytail darter was listed as **endangered** on April 27th, 1993.

Duskytail darters are small fish, generally reaching up to 3 inches (about 7.5 cm) in length. Their body is elongated and slender, which allows them to navigate effortlessly through their riverine habitat.



Figure 7 Photo Credits:
<https://dwr.virginia.gov/wildlife/information/duskytail-darter/>

The coloration of duskytail darters is incredibly beautiful; they can exhibit bright hues of yellow and orange combined with dark spots and a distinctive dusk-colored tail. This coloration serves both for camouflage and mating displays (Marine Life Identification 2026).

Habitat Description

Like other members of the darter family, the duskytail darter is a benthic (bottom-dwelling) species of fish, and specializes in using the gaps between rocky stream substrates for protective cover and opportunistic feeding. duskytail darters require clean, fast moving water and are considered an indicator species of overall watershed health, as their required habitat is degraded by erosion and siltation (VDWR 2025).

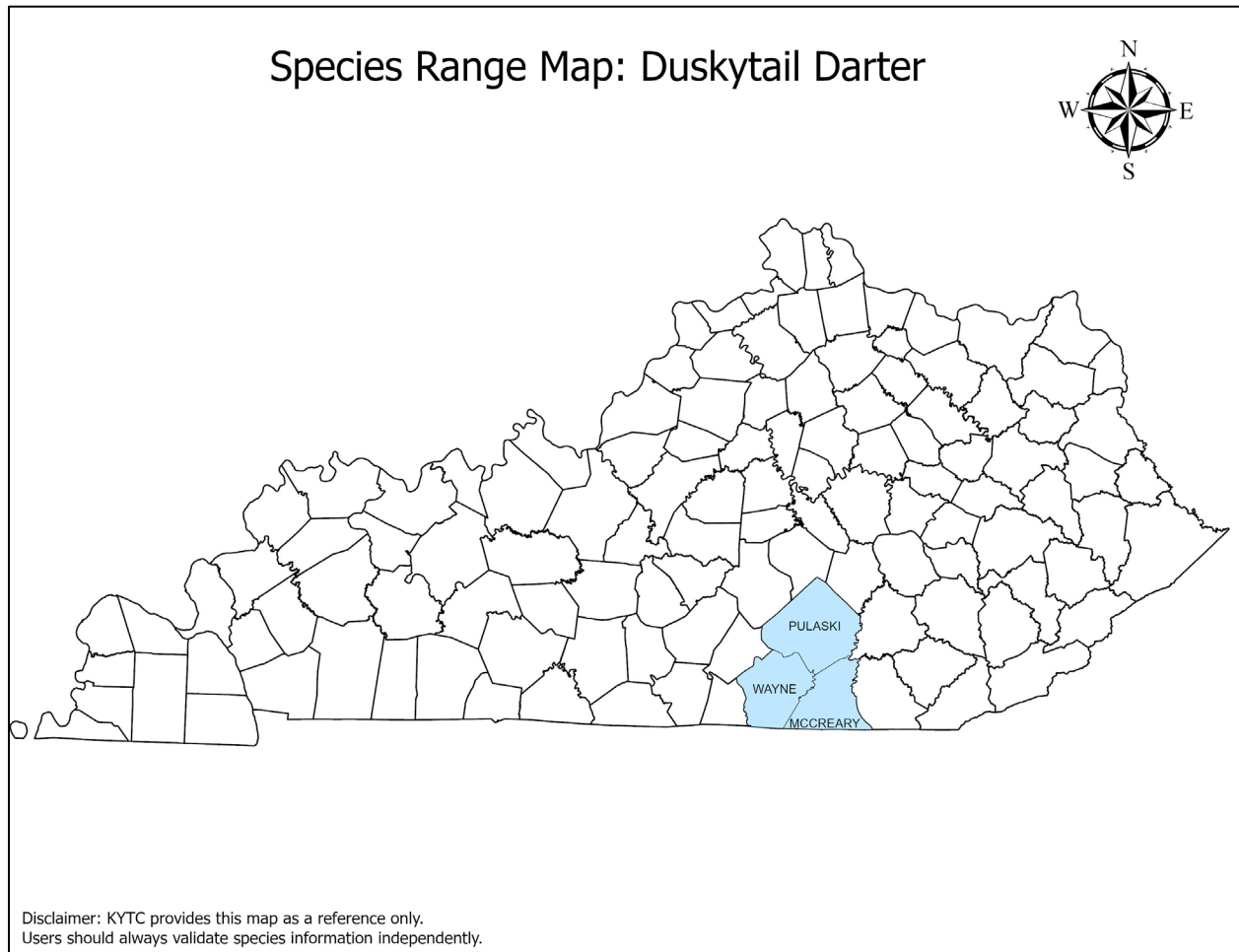
Critical Habitat

None

Range

Duskytail darters are primarily found in the rivers and streams of the eastern United States. They inhabit clear, cool waters with sandy or rocky bottoms, preferring areas with abundant vegetation and gentle currents. Populations are concentrated in parts of the Ohio River Basin and its tributaries, where they thrive in the diverse habitat offered by these waterways (Marine Life

Identification 2026). In Kentucky, they have been found in the Upper Cumberland River Basin only.



Decision Key

- 1) Does the project include any direct or indirect effects to the Upper Cumberland River Basin in Pulaski, Wayne, or McCreary Counties (e.g. remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers)?
 - a. Yes: Contact SME
 - b. No: Prepare NE finding

Diamond Darter (*Crystallaria cincotta*)

Species Description

The diamond darter was listed as **endangered** in August 2013.

The diamond darter is considered one of the “Desperate Dozen”, the 12 species most likely to become extinct which conservation efforts are focused on.



Figure 8 Photo Credit: <http://conservationfisheries.org>.

This small member of the perch family is translucent with silvery sides and a white underbelly. The body and head is yellow-tan with four wide, olive-brown saddles on the body. There is also a dark blotch on the snout below the eyes. Adults can reach 3 to 5 inches in size.

Habitat Description

The diamond darter inhabits medium to large (e.g. Ohio, Cumberland, and Green River), warm water streams with moderate current and clean sand and gravel bars. It has been collected in riffles and pools, and is known to be nocturnal, burrowing into the substrate during daylight.

The widespread loss of the diamond darter has been related to effects from impoundment of rivers from dams, siltation of the river bottom habitat, and poor water quality.

Critical Habitat

Yes – (see additional maps and detailed descriptions provided after the decision key)

Critical habitat for the diamond darter was designated on August 22nd, 2013.

Primary constituent elements of critical habitat for this species include:

1. A series of connected riffle-pool complexes with moderate velocities in moderate- to large-sized (fourth- to eighth-order), geomorphically stable streams within the Ohio River watershed.
2. Stable, undisturbed sand and gravel stream substrates, that are relatively free of and not embedded with silts and clays.
3. An instream flow regime (magnitude, frequency, duration, and seasonality of discharge over time) that is relatively unimpeded by impoundment or diversions such that there is minimal departure from a natural hydrograph.
4. Adequate water quality characterized by seasonally moderated temperatures, high dissolved oxygen levels, and moderate pH, and low levels of pollutants and siltation. Adequate water quality is defined as the quality necessary for normal behavior, growth, and viability of all life stages of the diamond darter.
5. A prey base of other fish larvae and benthic invertebrates including midge, caddisfly, and mayfly larvae.

Species, Stream (unit), and State	Currently Occupied River Miles	Currently Unoccupied River Miles
Diamond Darter		
Green River (2), KY	-	94.5

Range

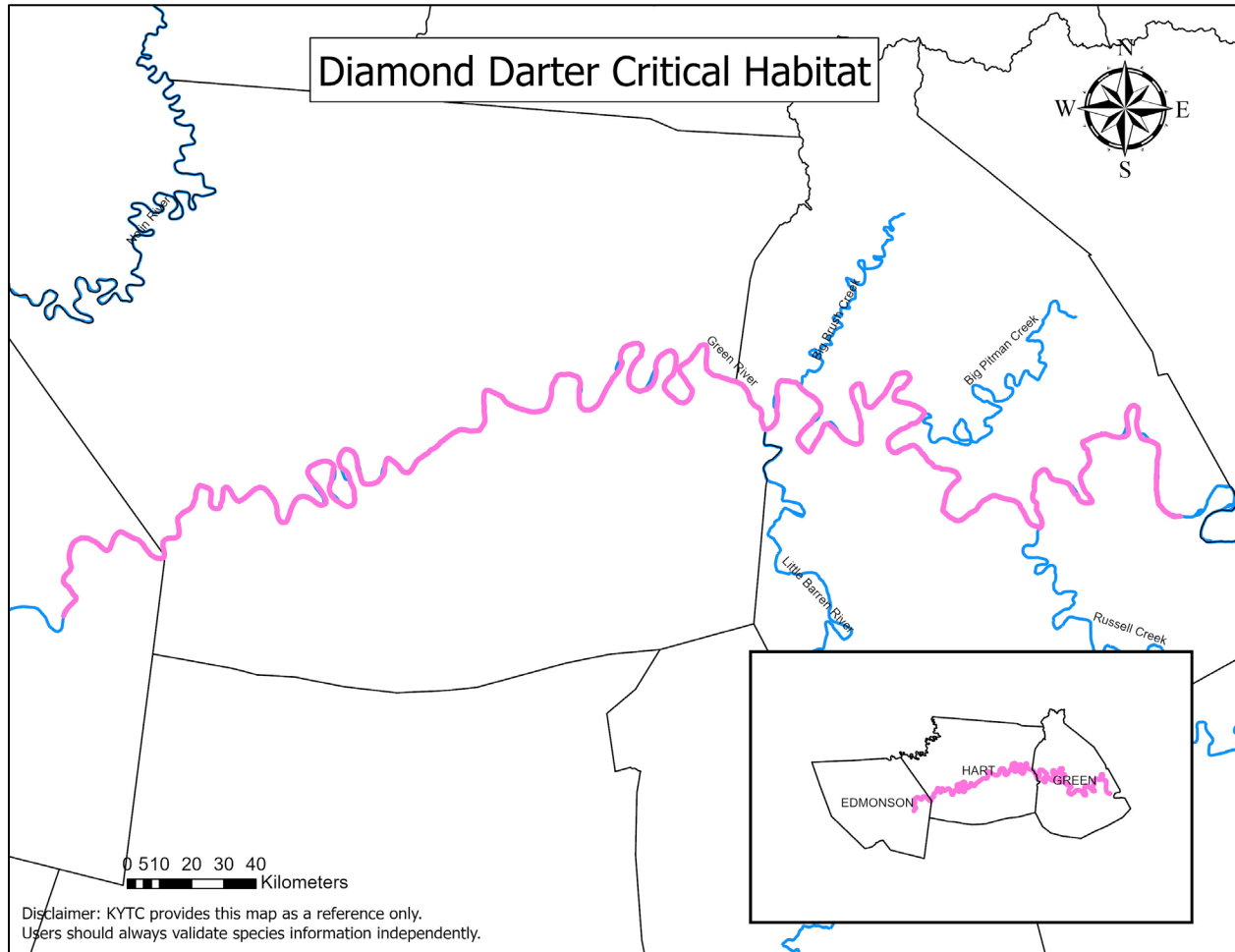
Historically, the diamond darter was found throughout the Ohio River Basin including the Muskingham River, Ohio River, and the Green River. This species is currently known to exist only within the lower Elk River drainage in Kanawha and Clay Counties, West Virginia.

Decision Key

- 1) Does the project include any direct or indirect effects to the Green River in Hart, Green, or Edmonson Counties (e.g. remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers)?
 - a. Yes: Contact SME
 - b. No: Prepare NE finding

Unit 2: Green River – Edmonson, Hart, and Green Counties, KY.

Unit 2, although it is not currently occupied by the diamond darter, represents the best remaining historically occupied habitat for future diamond darter reintroductions that will improve the species' redundancy, resiliency, and representation essential for its conservation. Unit 2 includes 94.5 mi of the Green River from Roachville Ford near Greensburg downstream to the end of Cave Island in Mammoth Cave NP. Approximately 10.1 mi of this unit is publicly owned and is contained within the 20,750-ha Mammoth Cave NP. The remainder of the unit, 84.4 mi, is privately owned. This unit is within the historical range of the species, but is not currently considered occupied. The Green River historically supported approximately 170 species of fish, including the diamond darter. Between 1890 and 1929, diamond darters were recorded from three locations within this unit: adjacent to Cave Island in Edmonson County, and near Price Hole and Greensburg, in Green County. The Green River is a seventh-order, warmwater stream with a total drainage area of 9,220 mi². The largely free-flowing 100-mi section of the Green River from the Green River Dam downstream to its confluence with the Nolin River in Mammoth Cave NP is among the most significant aquatic systems in the United States in terms of aquatic species diversity and endemism. This reach of the Green River currently supports over 150 species of fish and 70 species of freshwater mussels, including 9 federally endangered mussel species, but there is no designated critical habitat in this section of the Green River. Populations of fish species that have similar habitat preferences as the diamond darter, such as the shoal chub and streamline chub are present throughout this reach. As described in the Criteria Used To Identify Critical Habitat section above, the inclusion of this unoccupied area is essential for the conservation of the diamond darter. This area will provide currently suitable habitat for a population reintroduction that will allow expansion of diamond darter populations into historically occupied habitat, adding to the species' redundancy, resiliency, and representation. While not required under section 3(5)(A)(ii) of the Act, this area also contains all of the PCEs. This reach of the Green River is a moderate-to-large warmwater stream with a series of connected riffle-pool complexes that is unaffected by impoundment. The reach has good water quality and supports fish species that have similar habitat requirements including clean sand and gravel substrates, low levels of siltation, and healthy benthic macroinvertebrate populations for prey items.



Kentucky Arrow Darter (*Etheostoma spilotum*)

AKA: Cumberland Plateau Darter
Formerly known as: *E. sagitta spilotum*

Species Description

Kentucky arrow darter (*Etheostoma spilotum*) was listed as **threatened** with a special **4(d) rule** on November 4, 2016.

A member of the Perch family (*Percidae*), darters are native only to freshwater streams in North America east of the

Rocky Mountains. Kentucky arrow darter is a rather large darter reaching 116 mm (4.6 in) total length. It has a slender body, elongated snout, large mouth, and virtually scaleless head. The coloration is mainly straw yellow to pale greenish, and the back is crossed with 5 to 7 weak dorsal saddles, some of which may fuse with the 8 to 11 vertical lateral blotches. *E. sagitta* subspecies are difficult to distinguish between, but are separable based on various scale counts. Their diet consists predominately of larval insects, but also includes copepods and crayfishes.

Kentucky arrow darters can tolerate moderate siltation, but heavy siltation and acid runoff (commonly associated with coal mining activities) are likely reasons for elimination of Kentucky arrow darter populations in eastern Kentucky.

Kentucky arrow darters spawn in spring or early summer. During this time, the males can possess brilliant colors, while the females remain pale straw yellow with grayish markings.



Habitat Description

Kentucky arrow darter is a native species that is distributed only throughout the upper Kentucky River basin. Darters are often present in the swift-flowing sections of clear, rocky streams, and spend most of their time beneath or between rocks to protect them from the flow of the currents. This species occurs in slow to moderate current in cool, sluggish pools or areas above and below riffles over bedrock, rubble, cobble, and pebble, substrate that is often interspersed with sandy areas. Kentucky arrow darters are mostly present in upland creeks and streams, generally in headwaters, but can also be found using large streams as travel corridors.

Kentucky arrow darter is common only in 1st – 3rd order streams (most often 2nd order) and prefers habitat along banks, ledges and recesses at stream margins which provide stone areas where it can be better protected. Stream conductivity, the measure of water's capability to pass electrical flow that increases as the concentration of dissolved solids increases (e.g. salts, heavy metals), is a limiting factor for its suitable habitat. Freshwater streams supporting quality fisheries range from 50 -500 microSiemens/ per centimeter ($\mu\text{S}/\text{cm}$), and significantly decline as conductivity increases. Studies of Kentucky arrow darter show its ideal habitat conditions at $< 250 \mu\text{S}/\text{cm}$; however, due to potential fluctuation of conductivity readings we have chosen a more conservative number for use in our Decision Key ($< 450 \mu\text{S}/\text{cm}$).

Species commonly associated with Kentucky arrow darter habitat include creek chub (*Semotilus atromaculatus*), central stoneroller (*Camptostoma anomalum*), white sucker (*Catostomus commersonii*), emerald darter (*Etheostoma baileyi*), rainbow darter (*E. caeruleum*), fantail darter (*E. flabellare*), and Johnny darter (*E. nigrum*).

Human-related activities in the upper Kentucky River basin that cause stream degradation can be threats to Kentucky arrow darter habitat. Such activities may include coal mining, silviculture, agriculture, gas/oil well exploration, human development, and inadequate sewage treatment. Common adverse impacts include inputs of dissolved solids and elevation of instream conductivity, sedimentation, removal of riparian vegetation, bank erosion and channel instability, inputs of untreated sewage, and agricultural runoff.

Critical Habitat

Yes – (*See more detailed information and maps provided after the decision key*)

In 2016, the USFWS designated 38 units as critical habitat in Breathitt, Clay, Harlan, Jackson, Knott, Lee, Leslie, Owsley, Perry, and Wolfe Counties, KY.

The designation of the critical habitat area is limited to the stream channel (areas within the ordinary high-water mark).

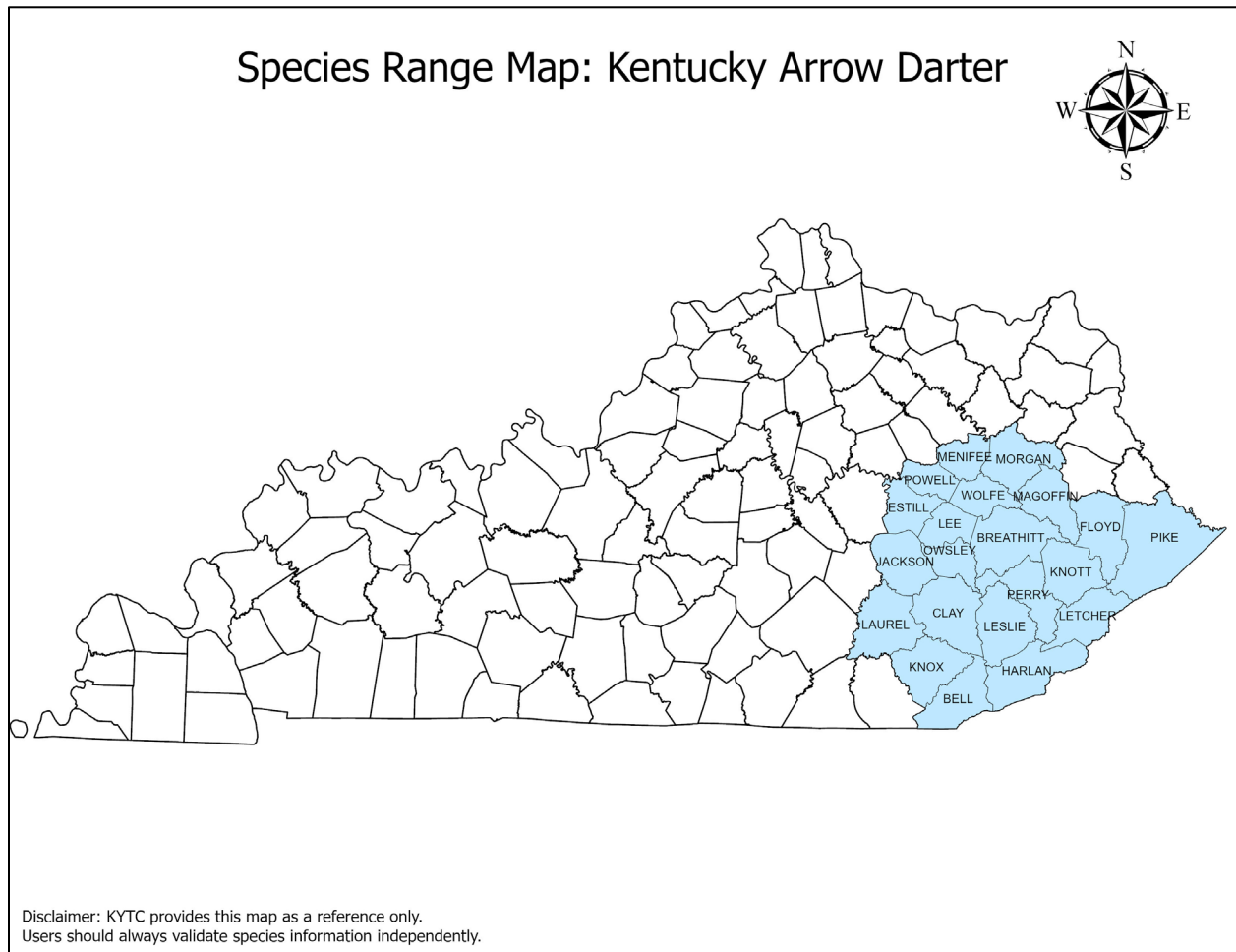
Primary constituent elements of critical habitat for this species include:

- 1) Riffle-pool complexes and transitional areas (glides and runs) of geomorphically stable, first- to third-order streams of the upper Kentucky River drainage with connectivity between spawning, foraging, and resting sites to promote gene flow through the species' range.
- 2) Stable bottom substrates composed of gravel, cobble, boulders, bedrock ledges, and woody debris piles with low levels of siltation.
- 3) An instream flow regime (magnitude, frequency, duration, and seasonality of discharge over time) sufficient to provide permanent surface flows, as measured during years with average rainfall, and to maintain benthic habitats utilized by the species.
- 4) Adequate water quality characterized by seasonally moderate stream temperatures (generally $\leq 24^{\circ}\text{C}$ or 75°F), high dissolved oxygen concentrations (generally $\geq 0.6\text{ mg/L}$), moderate pH (generally 6.0 to 8.5), low stream conductivity (species' abundance decreases sharply as conductivities exceed $261\text{ }\mu\text{S/cm}$ and species is typically absent above $350\text{ }\mu\text{S/cm}$), and low levels of pollutants. Adequate water quality is defined for the purpose of this rule as the quality necessary for normal behavior, growth, and viability of all life stages of the Kentucky arrow darter.
- 5) A prey base of aquatic macroinvertebrates, including mayfly nymphs, midge larvae, blackfly larvae, caddisfly larvae, stonefly nymphs, and small crayfishes.

Critical Habitat Unit	County (KY)	Land Ownership	Total Length (stream miles)
1. Buckhorn Creek and Prince Fork	Knott	Private	0.7
2. Eli Fork	Knott	Private	0.6
3. Coles Fork and Snag Ridge Fork	Breathitt/Knott	State	6.8
4. Clemons Fork	Breathitt	Private/State	4.4
5. Laurel Fork Quicksand Creek and Tributaries	Knott	Private	12.4
6. Middle Fork Quicksand Creek and Tributaries	Knott	Private	15.6
7. Spring Fork Quicksand Creek	Breathitt	Private	1.4
8. Hunting Creek and Tributaries	Breathitt	Private	9.7
9. Frozen Creek and Tributaries	Breathitt	Private	16.4
10. Holly Creek and Tributaries	Wolfe	Private	11.5
11. Little Fork	Lee/Wolfe	Private	2.3
12. Walker Creek and Tributaries	Lee/Wolfe	Private	15.5
13. Hell Creek and Tributaries	Lee	Private	7.4
14. Big Laurel Creek	Harlan	Private	5.7
15. Laurel Creek	Leslie	Private/Federal	2.6
16. Hell For Certain Creek and Tributaries	Leslie	Private/Federal	9.8
17. Squabble Creek	Perry	Private	7.5
18. Blue Hole Creek and Left Fork Blue Hole Creek	Clay	Federal	3.5
19. Upper Bear Creek and Tributaries	Clay	Private/Federal	4.3
20. Katies Creek	Clay	Private/Federal	3.5
21. Spring Creek and Little Spring Creek	Clay	Private/Federal	5.7
22. Bowen Creek and Tributaries	Leslie	Private/Federal	8.5
23. Elisha Creek and Tributaries	Leslie	Private/Federal	5.9
24. Gilberts Big Creek	Clay/Leslie	Private/Federal	4.5
25. Sugar Creek	Clay/Leslie	Private/Federal	4.5
26. Big Double Creek and Tributaries	Clay	Federal	6.4
27. Little Double Creek	Clay	Federal	2.1
28. Jacks Creek	Clay	Private/Federal	3.7
29. Long Fork	Clay	Federal	1.4
30. Horse Creek	Clay	Private/Federal	3.1
31. Bullskin Creek	Clay/Leslie	Private/Federal	13.5
32. Buffalo Creek and Tributaries	Owsley	Private/Federal	23.8
33. Lower Buffalo Creek	Lee/Owsley	Private	4.6
34. Silver Creek	Lee	Private	3.9
35. Travis Creek	Jackson	Private	2.5
36. Wild Dog Creek	Jackson/Owsley	Private/Federal	5.1
37. Granny Dismal Creek	Lee/Owsley	Private/Federal	4.3
38. Rockbridge Fork	Wolfe	Federal	2.8
Total	-----	-----	247.8

Range

Kentucky arrow darter is a native species that is distributed throughout Kentucky. The Kentucky arrow darter can be found in portions of the upper Kentucky River basin in eastern Kentucky including the five sub-basins: Red River (Rockbridge Fork of Swift Camp Creek), Sturgeon Creek, South Fork Kentucky River, Middle Fork Kentucky River, and North Fork Kentucky River.



Special 4(d) Rule

With a threatened status, a special rule can be issued under Section 4(d) of the Endangered Species Act. The US Fish and Wildlife Service has authorized certain species-specific exemptions for the Kentucky arrow darter that may be appropriate to promote the conservation of this species, which include:

- 1) Channel reconfiguration or restoration projects that create natural, physically stable, ecologically functioning streams (or stream and wetland systems) that are reconnected with their groundwater aquifers.
- 2) Bank stabilization projects that use bioengineering methods specified by the Kentucky Energy and Environment Cabinet and the Kentucky Transportation Cabinet.
- 3) Bridge and culvert replacement/removal projects that remove migration barriers (e.g. collapsing, blocked, or perched culverts) or generally allow for improved upstream and downstream movements of Kentucky arrow darters.
- 4) Repair and maintenance of U.S. Forest Service (USFS) concrete plank stream crossings in the Daniel Boone National Forest (DBNF).

If elevation of status to ‘endangered’ is later necessary, these exemptions would no longer apply.

Decision Key

- 1) Does the project occur near any of the designated critical habitat units?
 - a. Yes: Contact SME.
 - b. No: Continue to Step 2.
- 2) Does the project include any direct or indirect effects to perennial or intermittent streams or their nearby tributaries? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)
 - a. Yes: Continue to Step 3.
 - b. No: Prepare NE finding.
- 3) Is the stream a 1st to 3rd order stream?
 - a. Yes: Continue to Step 4.
 - b. No: Prepare NE finding.
- 4) Measure the electrical conductivity (E.C.) of the stream waters. Is the E.C. $\leq 450 \mu\text{S}/\text{cm}$?

Note: Be sure to walk upstream to your sampling location so that additional sediment is not disturbed.

** Note: E.C. measurements can vary dependent on season and time since last rain event. Be sure to sample during typical stream conditions and not directly after a rain event. Taking readings in multiple locations (i.e. upstream and downstream of a bridge replacement) may be preferred.**

- a. Yes: Contact SME.
- b. No: Prepare NE finding.

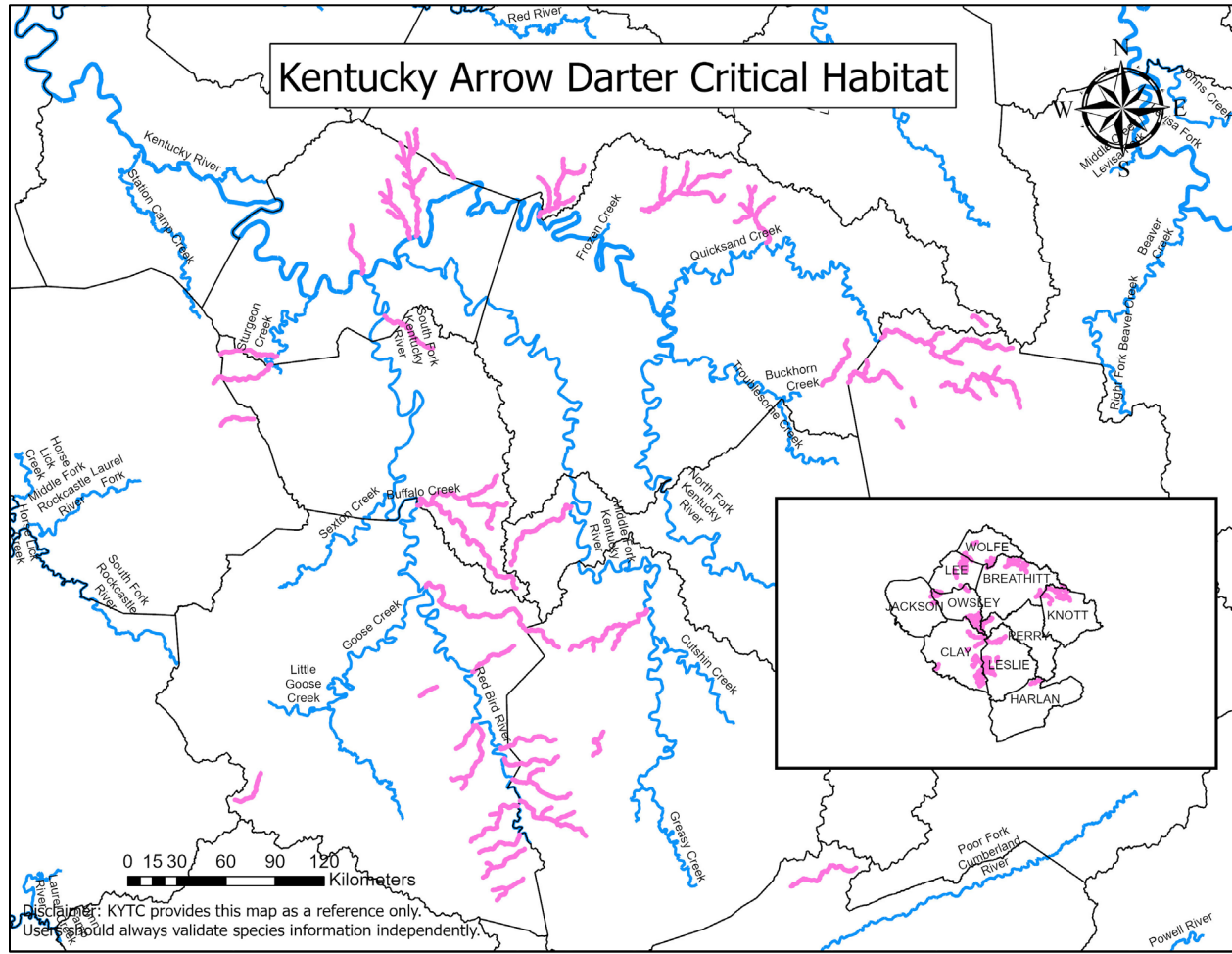


Figure 9 More info about the specific CH units can be found here: <https://www.govinfo.gov/content/pkg/FR-2016-10-05/pdf/2016-23539.pdf#page=1>.

Palezone Shiner (*Notropis albizonatus*)



Figure 10 Photo Credit: <http://www.outdooralabama.com>.

Species Description

The palezone shiner was listed as **endangered** in 1993.

This small fish reaches about two inches in length and possesses a translucent, straw-colored body with a dark mid-lateral stripe. Occupying short river reaches coupled with relatively short life spans makes Palezone shiners especially vulnerable to toxic chemical spills and short-term or localized habitat alterations.

Habitat Description

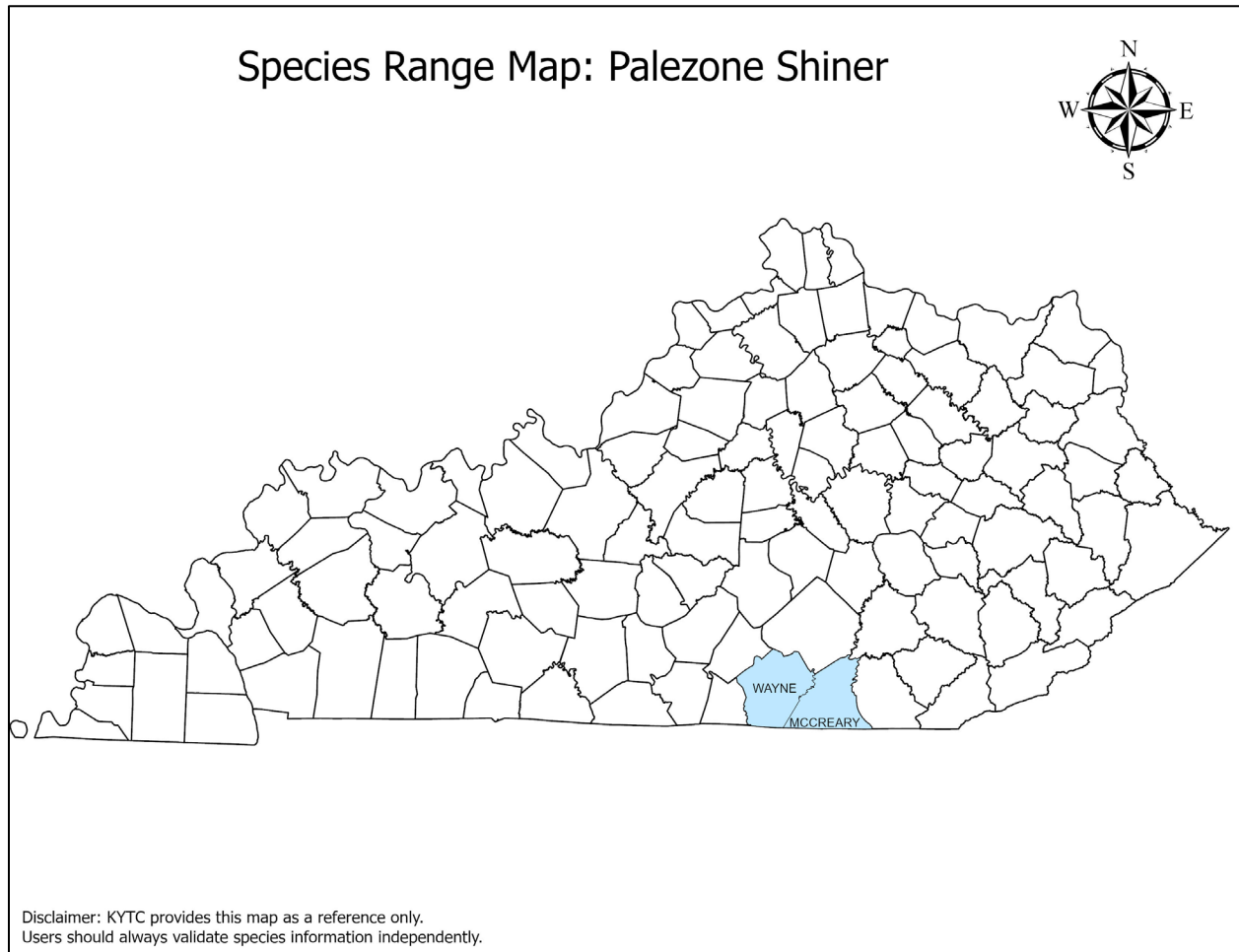
Palezone shiners (prefer flowing, shallow pools) inhabit flowing pools and runs of upland streams that have permanent flow with the following characteristics of large creeks and small rivers: clean, clear water, substrates of bedrock, cobble, pebble, and gravel mixed with sand. They have been found in swift moving pools or runs in depths ranging from 12–18 inches.

Critical Habitat

None

Range

The Palezone shiner is currently only found in the Little South Fork Cumberland River and Paint Rock River in Alabama. It was formerly found in Marrowbone Creek in Cumberland County, Kentucky but is considered extirpated.



Decision Key

- 1) Does the project have direct or indirect effects in the stream reaches of the Little South Fork Cumberland River (e.g. remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers)?
 - a. Yes: Contact SME
 - b. No: Prepare NE Finding

Pallid Sturgeon (*Scaphirhynchus albus*)

Species Description

The pallid sturgeon was listed as **endangered** in 1990.

Pallid sturgeon have a flattened shovel-shaped snout; a long, slender, and completely armored caudal



Figure 11 Photo Credit: <http://www.fws.gov>.

peduncle (the tapered portion of the body which terminates at the tail); and lack a spiracle (small openings found on each side of the head) (Forbes and Richardson 1905). As with other sturgeon, the mouth is toothless, protrusible (capable of being extended and withdrawn from its natural position), and ventrally positioned under the head. The skeletal structure is primarily composed of cartilage rather than bone.

Habitat Description

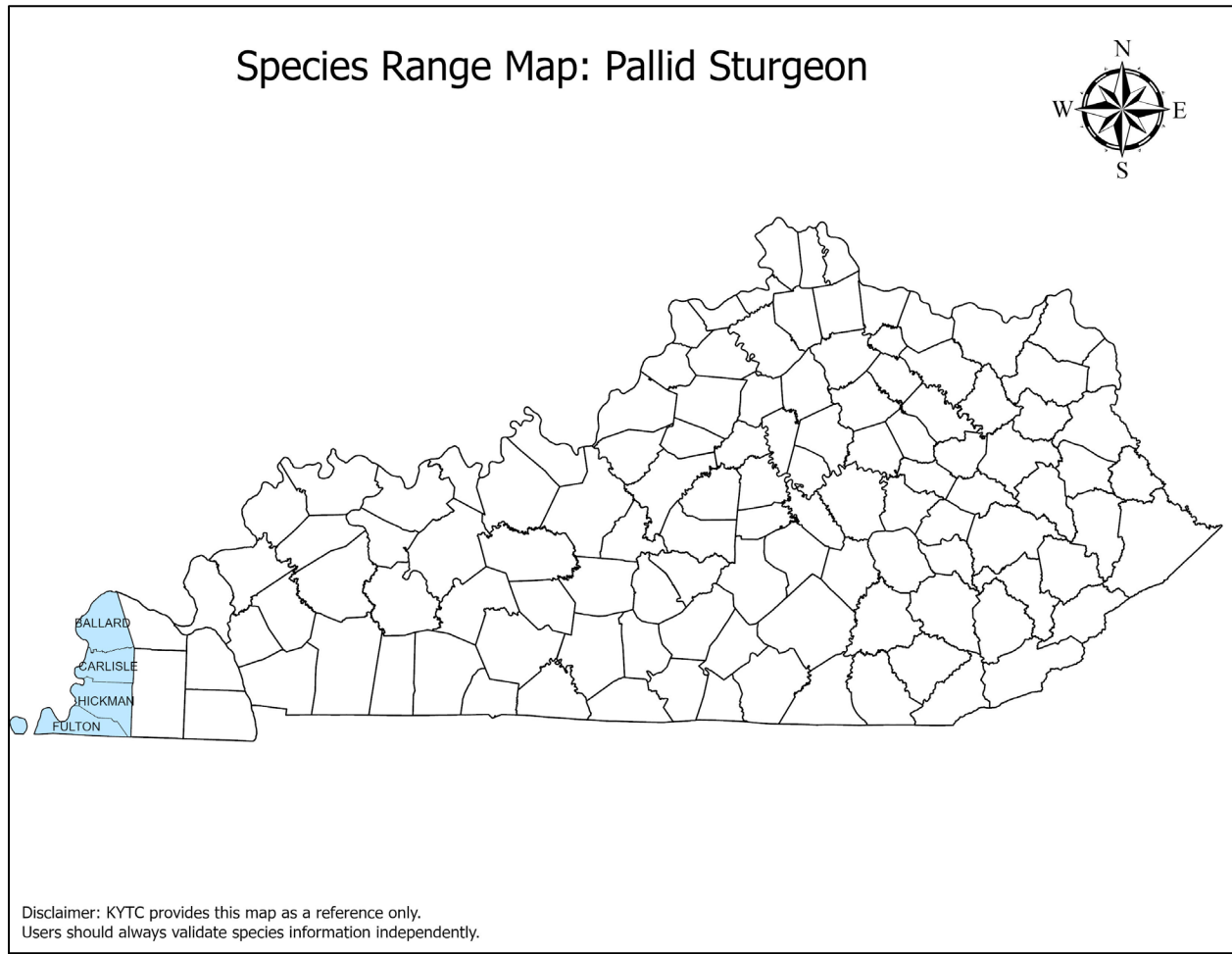
Pallid sturgeons require large, turbid, free-flowing riverine habitat with rocky or sandy substrate. They are adapted for living close to the bottom of large, silty rivers with swift currents. The preferred habitat is comprised of sand flats and gravel bars.

Critical Habitat

None

Range

This fish is found primarily in the Missouri River and the Mississippi River downstream of the junction with the Missouri River (although it has been found as far north and west as Montana).



Decision Key

- 1) Does the project include any direct or indirect effects to the Mississippi River?
 - a. Yes: Contact SME
 - b. No: Prepare NE Finding

Relict Darter (*Etheostoma chienense*)



Figure 12 Image source unknown.

Species Description

The relict darter was listed as **endangered** in 1993, but was reclassified as **threatened** on September 27, 2023.

This small perch can reach sizes up to 2.5 inches. Females and non-breeding males have light tan-colored backs and sides, with brown mottling and 6–8 dark brown saddles, and white undersides. Breeding males possess gray to dark brown sides and backs with light tan undersides.

Habitat Description

The relict darter occurs in headwater streams and larger creeks in quiet, gently flowing pools, with a substrate of gravel mixed with sand. Cobble-size slabs, submerged sticks, and logs in either pools or riffles may play a role in spawning. Stream characteristics also include depths of 1–12 inches and widths of 9–45 feet. Riparian vegetation is typical because it provides stream bank stabilization.

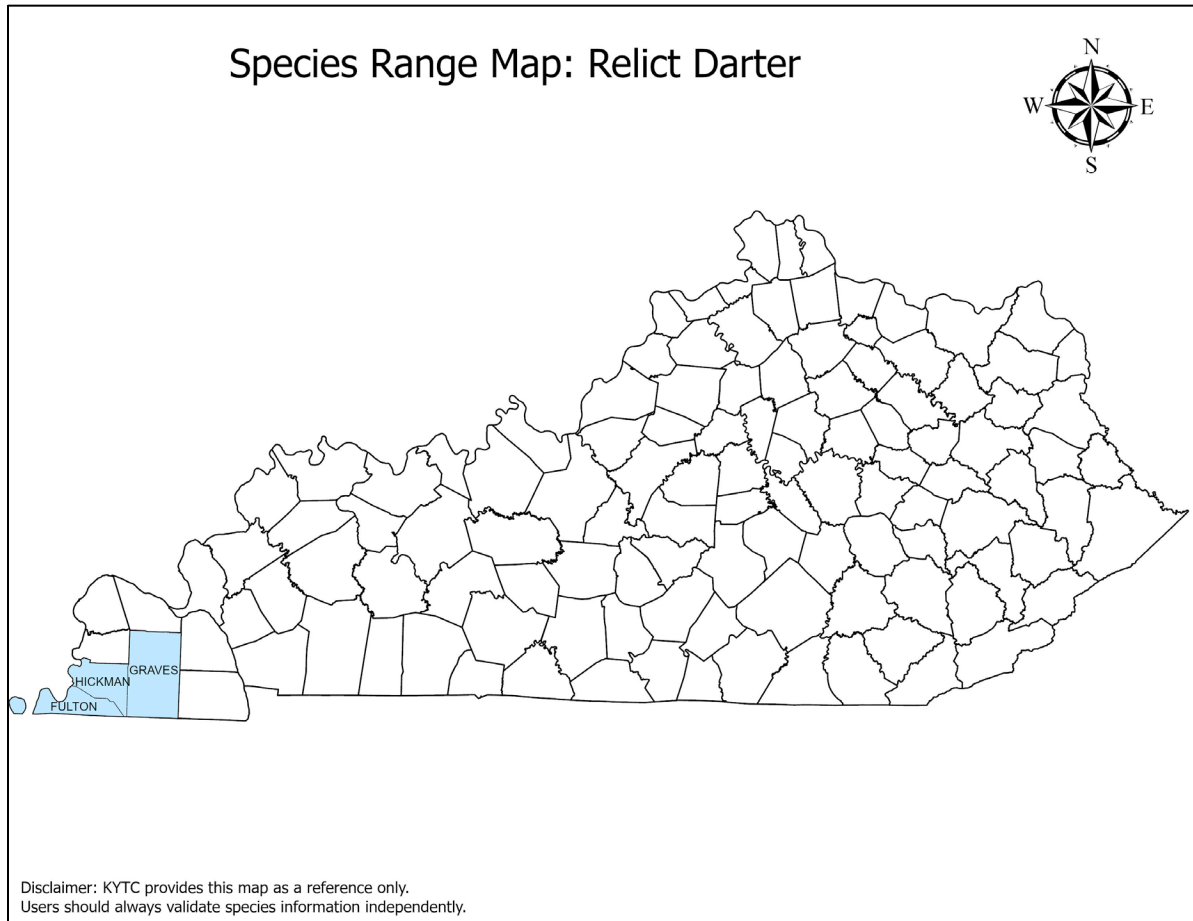
Critical Habitat

None

Range

Historically, relict darters were present throughout the Bayou de Chien system, the main stem and its tributaries, but now may be limited to the upper portion of the creek system in Graves and Hickman Counties, although it is still listed in Fulton County.

See attached 11x17 map for more detailed layout of the Bayou de Chien drainage area after the Decision Keys.



Decision Key

- 1) Does the project include any direct or indirect effects to streams, including the Bayou de Chien and all its tributaries, within the Bayou de Chien drainage system in Graves, Fulton, and Hickman Counties (e.g. remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers)?
 - a. Yes: Contact SME
 - b. No: Prepare NE finding

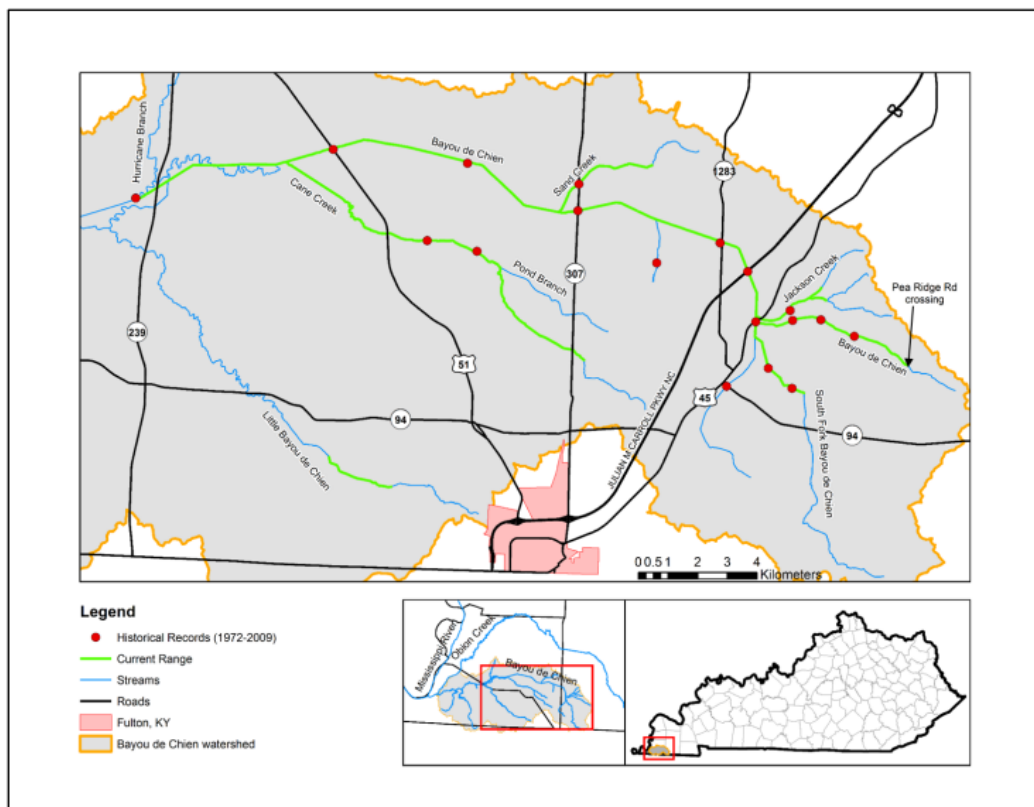


Figure 7. Historical distribution of the Relict Darter in the Bayou de Chien system, Kentucky, based on positive occurrence records (1972-2009).

Figure 13 Taken from the SSA.

Basic Introduction to Bats

Bats are of the mammalian order Chiroptera and the only true flying mammals. Kentucky is home to sixteen documented bat species and fourteen permanent resident species. Although fruit bats are present in other areas of North America, all Kentucky bat species are insectivores.

Bats use echolocation for night travel and are the only major predator of night flying insects. Some bat species have been noted to eat as many as 600 mosquitos in an hour. With this large consumption, bats play a vital role in control of the insect population and related disease.

Bats are known carriers for the rabies virus; although transferal to humans is actually rarer than from other species more frequently encountered, such as raccoons. However, it is also notable that bats' small bones are delicate and unnecessary handling of bats should be avoided. Additionally, handling of any bat species that are provided federal protections under the Endangered Species Act requires both a state and federal permit.

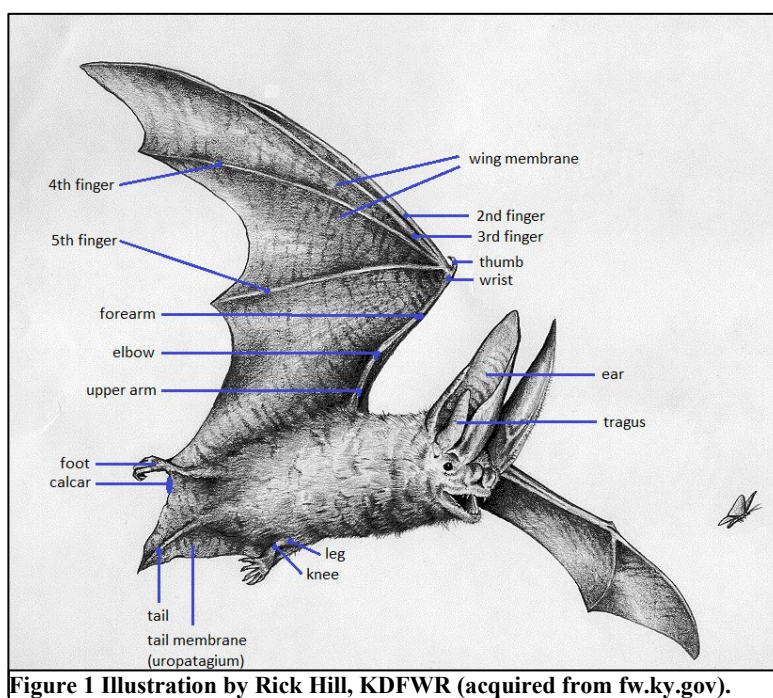


Figure 1 Illustration by Rick Hill, KDFWR (acquired from fw.ky.gov).

Four of Kentucky's bats are provided federal protections under the Endangered Species Act:

- **gray bat** (*Myotis grisescens*)
- **Indiana bat** (*Myotis sodalis*)
- **northern long-eared bat** (*Myotis septentrionalis*)
- **Virginia big-eared bat** (*Corynorhinus townsendii virginianus*)
- **tricolored bat** (*Perimyotis subflavus*) - proposed

Indiana bats are considered potentially present statewide in Kentucky, while grays and northerns are no longer considered statewide. The Virginia big-eared bat has a more localized range within eastern Kentucky. More detailed range mapping is provided in each species' review section, following this Introductions to Bats section.

White Nose Syndrome

One of the most notable threats to bats is currently White nose syndrome (WNS). WNS was named for the white fungus observed around the muzzles, ears, and wing membranes of affected bats; but was later identified as the previously unknown, cold-loving fungus *Geomyces destructans* (formerly known as *Pseudogymnoascus destructans*) that thrives in low temperatures and high humidity. Although it was first observed in New York during winter 2006/2007, WNS was not found within Kentucky until 2011 (Figure 2). In Kentucky, WNS was first observed inside a Trigg County cave, but the fungus has since spread throughout the state and continues to affect hibernating bats. This fungus does not cause direct mortality of bats, but instead disrupts their hibernation by prompting them to wake to clean themselves, and ultimately depleting their winter fat reserves.

Each bat species has slightly different preferences or habits, so some species have been more heavily impacted by the presence of WNS than others. For example, gray bats have not exhibited the same mortality rates as other *Myotis* species; although some gray bats have been confirmed as infected with WNS. As of 2017, two of Kentucky's larger bodied, big-eared bat species [Rafinesque's big-eared bat (*Corynorhinus rafinesquii*) and Virginia big-eared bat] have not been seen infected by WNS; there is hope that studying these species' survival will help researchers develop more information on how to combat the spread of WNS.

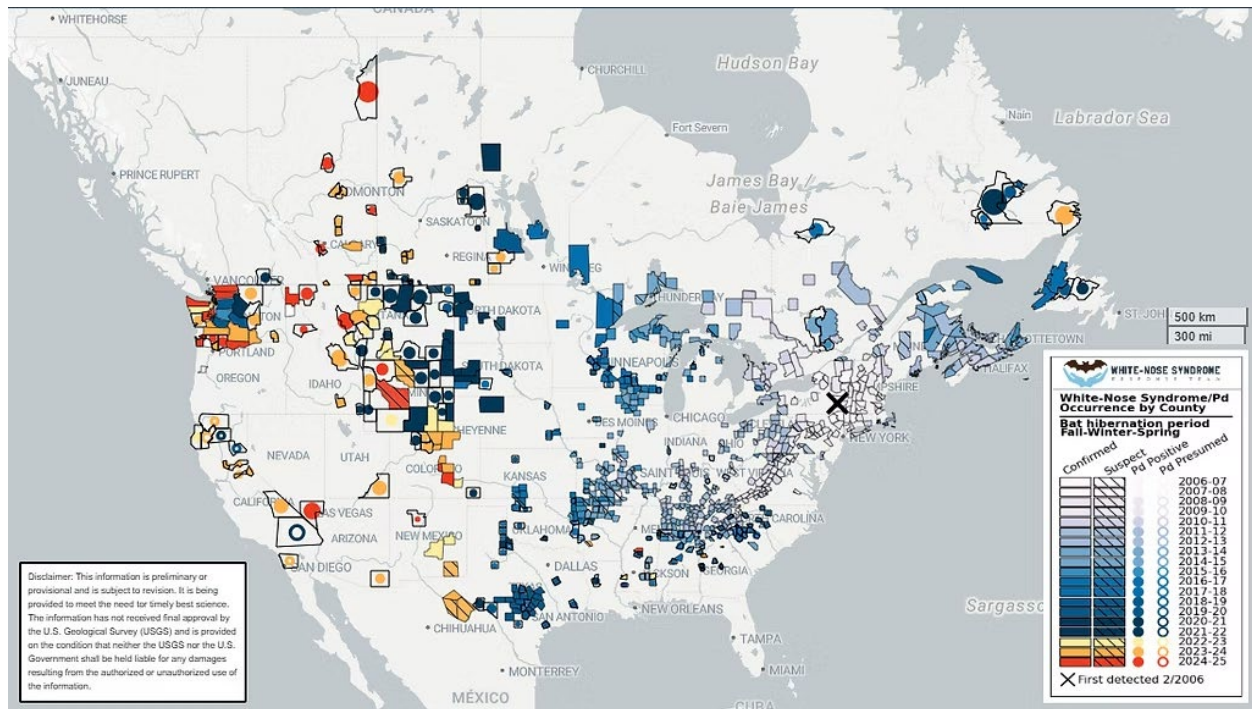


Figure 2 White nose syndrome occurrences in the United States by county and year.

Bat Habitat

Bats travel across the landscape to forage for food. Many of the insects often have aquatic larval stages, so foraging along open stream corridors is relatively common. Other potential foraging habitats can include places like upland forested areas and open fields.

Each bat species has slight to significant differences in behavior and habitat preferences. Overall, Kentucky bat species can be relatively well described in two major categories: cave-dwelling bats and forest-dwelling bats. Additionally, bats can also be found using man-made structures such as bridges or buildings.

Cave-Dwelling Bats:

Cave-dwelling bats roost year-round in caves and cave-like features (hibernacula) such as portals, abandoned mines, and/or rockshelters. Although these bats do exhibit site fidelity, they also will travel across the landscape and can roost at numerous different sites throughout the year, often based on variance of structure characteristics such as size, temperature, or humidity. Examples of cave-dwelling species include both the gray and Virginia big-eared bats.

Cave-dwelling bats swarm at the entrances of the caves in early Fall to mate before they enter caves for hibernation. Female bats have delayed fertilization, so emerge from their caves and conceive in Spring. They cluster together in the caves during summer months in maternity colonies to raise their young. These young are non-volant when born, so with their inability to fly or move June-July are particularly vulnerable months for these bat young. Compared to other small mammals, bats have an exceptionally low reproductive rate with typically only one young per year. With few young and anticipated threats (WNS, habitat loss, etc.), bats are apt to have slow population recovery rates. While females and young are clustered in their maternity colonies, male bats can be singular on the landscape or congregated in separate groups called bachelor colonies.

Forest-Dwelling Bats:

Forest-dwelling bats roost in forest habitat (i.e. trees) during the summer months but then later roost in caves and cave-like features (hibernacula) during the Winter months. Although these bats do exhibit site fidelity, they also will travel across the landscape and can roost at numerous different sites throughout the year, often based on variance of structure characteristics such as size, temperature, or humidity. Examples of cave-dwelling species include both the Indiana and northern long-eared bats.

Like cave-dwelling bats, forest-dwelling bats also swarm at the entrances of the cave in early Fall to mate before they enter caves for hibernation. Female bats have delayed fertilization, so emerge from their cave and conceive during Spring. They cluster together in forest roost

structures, which typically include live or dead (snag) trees exhibiting sloughing bark, or small cracks/crevices, during summer months in maternity colonies to raise their young. Being in the forest-setting, these sites are often focused in areas with high quality foraging potential nearby. The young are non-volant when born, so with their inability to fly or move June-July are particularly vulnerable months for these bat young; hence some tree removal restrictions during June 1 to July 31. Compared to other small mammals, bats have an exceptionally low reproductive rate with typically only one young per year. With few young and anticipated threats (WNS, habitat loss, etc.), bats are apt to have slow population recovery rates. While females and young are clustered in their maternity colonies, male bats can be singular on the landscape or congregated in separate groups called bachelor colonies.

Bridge/Building/Structure Roosting:

Although bats are traditionally tied to natural cave and tree features, bats have also adapted to the introduction of humans and man-made structures on the landscape. Bats can enter holes as small as 3/8 inch diameter. With small gaps and crevices present at both bridges and buildings, it is not uncommon that bats will use these features as temporary or long-term roost sites. Of the federally protected bats, all four species have been observed using bridge structures, and the most common protected species using buildings has been the northern long-eared bat.

Bats prefer small, covered openings, which help to protect them from the weather and potential predators. It is notable that bats cannot gnaw new holes or reopen old ones. There are some ways to exclude bats from existing structures, but that must be done carefully and with guidance from a professional bat biologist who is permitted to handle federally protected species.

Gray Bat (*Myotis grisescens*)

Species Description

Gray bat was listed as **endangered** on April 28, 1976.

The gray bat is a small, gray colored bat generally weighing between 7-10 grams with an average total length of between 80-105 mm. Gray bats can be distinguished from other *Myotis* species by its uniform-colored dorsal fur from base to tip and by its attachment of wing membrane at ankle, not at base of toe.



Figure 3 Photo Credit: Todd McDaniel, HMB Professional Engineers, Inc.

Gray bats are described as a year-round, cave-dwelling species. During the winter when their food source (primarily aquatic insects) is unavailable, gray bats hibernate (torpor) in caves (known as hibernacula) that serve as cold air traps, where they form tightly packed clusters of thousands of hibernating bats. Upon emergence from hibernation in the spring (usually March) they migrate to suitable summer cave habitat, forming maternity colonies of up to 20,000 individuals. Females give birth to a single young in late May or early June. These reproductive females use caves or cave-like habitats that trap warm air in domed ceilings and are almost always located less than 1 mile from a stream or lake. Males and non-reproductive females form colonies in less suitable caves or cave-like habitats often as far as 18-20 miles from maternity sites. In September and October the bats return to the area surrounding the hibernacula to mate, and to forage in order to build up fat reserves for the winter hibernation. Normally, the bats have entered the hibernacula by early November.

Habitat Description

Summer & Winter Habitat: Gray bats use caves or cave-like habitats year-round, moving seasonally between warm and cold caves. Cave-like habitats include coal and limestone mines, large storm sewers, bridges, and tunnels. Gray bats hibernate during the winter in deep limestone caves that act as cold air traps. Very few caves meet the specific temperature requirements required for hibernating gray bats. Maternity colonies are almost always located in caves as well. During the spring and fall migration a wider variety of caves and cave-like habitats are used as roosts. Gray bats are also known to roost at bridge or culverts. These structures can provide places for bats to rest with protection from predators and adverse weather conditions.

Potential adverse impacts associated with transportation projects may include disturbance of winter or summer caves or cave-like habitats and changes to foraging areas. Construction activities such as fill, blasting, diversion of water away from or toward a cave system (which could affect access), altering of airflow or temperature regimes within the system, and altering cave passages are all potential impacts. The replacement of bridges or culverts that are being used by gray bats could result in direct mortality or at the very least habitat loss. Bridge and culvert construction can also affect stream foraging areas either through the loss of riparian habitat or the production of in-stream sediment that reduces aquatic insect production.

Foraging Habitat: Gray bats forage for flying insects over streams and lakes that are bordered by forest or at least have an intact riparian zone, often up to 12-15 miles from their roost. They prefer to fly through forest canopy between caves and feeding areas, traveling considerable distances out of their way to reach a foraging area, in order to take advantage of the cover provided by even scattered trees along fencerows. These travel corridors are important to connect roost sites to feeding areas. Foraging habitat is almost always over water (streams, lakes, or wetlands) with an intact, forested riparian zone. Smaller wooded stream corridors, wooded fencerows, and connecting woodlots are used as travel lanes to reach foraging areas. Ponds and lakes with some riparian zone are used to a similar degree.

Foraging habitat can be impacted through tree clearing that removes forested travel corridors that connect foraging sites to roost sites, or removes forested borders from lakes or streams. New corridor construction, widening that requires clearing, bridge replacements that require tree removal, and borrow or fill areas that are located in wooded or partially wooded areas, are all activities that could impact gray bats. Stream relocations and riparian vegetation removal can impact gray bat foraging habitat. Any cumulative impacts (changes that are likely to occur in the reasonably foreseeable future) to gray bat habitat, as a result of the project, should be considered as well.



Wetlands or reservoirs with a forested border are foraging habitat for gray bats. These bats fly along the edges of the water, under the protection of overhanging branches, and hunt for flying insects.



Streams with forested riparian areas are foraging habitat for gray bats. These bats fly along the edges of the stream, under the protection of overhanging branches, and hunt for flying insects. Gray bat feeding areas have not been found along sections of stream where adjacent forest has been cleared.



Particular attention should be paid along stream valley walls.



Sinkhole openings can be level with the ground, and may be hidden from view by vegetation or debris. Gray bats may still be using these partially blocked sinkhole openings.



Some cave openings may be hidden from view by vegetation or debris.



Bridges are sometimes used as roosts by gray bats. These bridges mimic cave conditions and provide a protected shelter for the bats. Most bridges used by gray bats are located over water.



Cave openings will not always have a typical, recognizable, appearance.

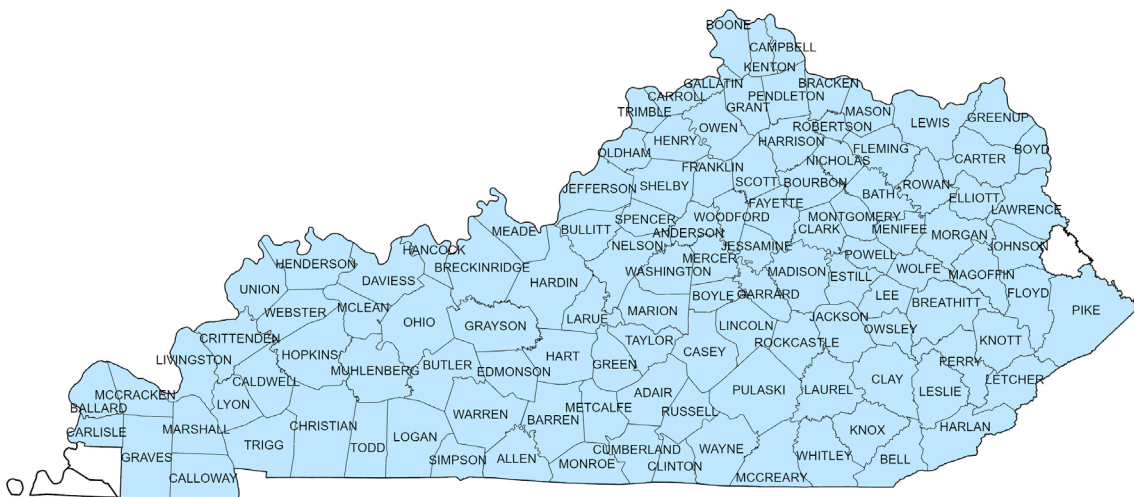
Critical Habitat:

None

Range

The range of the gray bat extends from southern Illinois, Indiana, and Ohio, east to western West Virginia, Virginia, and North Carolina, south to south western Georgia, northwestern Florida, southern Alabama, and northwest Arkansas, and west to western Missouri, northeastern Oklahoma, and southeastern Kansas, encompassing most of Kentucky and all of Tennessee.

Species Range Map: Gray Bat



Disclaimer: KYTC provides this map as a reference only.
Users should always validate species information independently.

Assessment Methods

Office Assessment:

Review geologic quads for karst and cave features, presence of karst bearing strata (Ordovician and Mississippian age limestone), underground quarry sites, and mine adits. Review any mapping that indicates vegetation and presence of streams and reservoirs, including aerial photography, topographic quadrangles, right-of-way strip maps, and plan sheets.

Field Assessment:

When on site, walk the scope of the project to locate any known openings within 1 km of the project disturbance limits and confirm their presence or absence and condition, as well as the location of any unknown openings (wildcat mines, collapsed audits, etc.). Pay particular attention to vertical cliff lines adjacent to stream valleys which may have cave openings. Look for highway and railway bridges and storm sewers that have a cave-like appearance. See Figure 1 for optional KYTC bridge assessment datasheet. Current and former landowners of subject parcels are a good source of information. NOTE:

Do not enter mines or caves.

Look for streams and reservoirs that have forested borders, as well as forested areas, like fencerows, that connect streams to caves or cave-like habitats, and verify the presence or absence of these features with an on-site visit.

Figure 1.

KENTUCKY BATS IN BRIDGES DATASHEET

Investigator Name(s): _____

KYTC Structure ID # _____ KYTC Project # _____

Date/Time: _____ County : _____

Lat: _____ Long: _____

Phone: _____ Email: _____

Location: _____

Road Type and Name: (check one)

Inter state _____

U.S. Highway _____

State Road _____

County Road _____

Bridge Type: (check one)

	Parallel Box Beam	
	Pre-stressed Girder	
	Cast in Place	
	Steel I-beam	
	Flat Slab	
	Other	

Conditions under Bridge: (circle all that apply)

Bare Ground	Concrete
Open Vegetation (not obstructing flight path)	Closed Vegetation (may obstruct flight path)
Flowing Water	Standing Water
Two Lane Road	Four (or more) Lane Highway
Dirt Road	Railroad

Surrounding Habitat: (circle all that apply)

Residential	Agriculture	Commercial	Woodland
Grassland	Ranching	Riparian	Mixed

Bats Present: (circle one) YES / NO

Species Present:

Num. Species

_____ *Myotis septentrionalis*
 _____ *Myotis sodalis*
 _____ *Myotis leibii*
 _____ *Myotis lucifugus*
 _____ *Myotis grisescens*
 _____ *Myotis austroriparius*
 _____ *Lasiurus borealis*
 _____ *Lasiurus seminolus*

Num. Species

_____ *Lasiurus cinereus*
 _____ *Lasiurus noctivagans*
 _____ *Perimyotis subflavus*
 _____ *Eptesicus fuscus*
 _____ *Nycticeius humeralis*
 _____ *Corynorhinus t. virginianus*
 _____ *Corynorhinus rafinesquii*
 _____ UNKNOWN

Bat indicators: (check all that apply)

Visual ☐
 Guano ☐

Staining ☐
 Smell ☐

Sound ☐

Please submit photos of bats/sign when possible

Areas Inspected:

Expansion joints

☐

Vertical surfaces between concrete
 end walls and bridge deck

☐

Crevices

☐

Vertical surfaces on I-beams

☐

Rough surfaces / spalls

☐

Guardrails

☐

Other: _____

☐

Other: _____

☐

Areas NOT Inspected because of safety or inaccessibility:

Summary Info (circle all that apply):

Human disturbance or traffic under bridge or at structure

High

Low

None

Evidence of bats using bird nests?

Yes

No

Additional Comments: (location description, scuppers, barrier gaps)

Decision Key

- 1) Do any of the following occur within the project area or within 1 km of the project area:
 - Limestone strata
 - Karst features (caves, sinkholes)
 - Inactive underground mining (coal, limestone)
 - a. Yes: Contact SME
 - b. No: Go to Step 2
- 2) Will the project directly impact streams with wooded banks or open water wetlands?
 - a. Yes: Contact SME
 - b. No: Prepare a No Effect finding

Indiana Bat (*Myotis sodalis*)

Species Description

The Indiana bat was listed as an **endangered** species on March 11, 1967.

The Indiana bat is a small, brown bat generally weighing between 5-11 grams with an average total length of between 75-102 mm. Its physical characteristics are similar to that of the little brown bat (*Myotis lucifugus*) and northern long-eared bat (*Myotis septentrionalis*); however, the Indiana bat is distinguished by its presence of a keeled calcar, coloration, and absence of long toe hairs.



Figure 4 Photo Credit:
http://www.nrs.fs.fed.us/sustaining_forests/conservation/wildlife_fish/habitat_resource_selection/

This species uses different habitats during the summer (forest-dwelling) and winter (cave-dwelling) months. In addition, male and female bats may use different habitat types. Both sexes overwinter in caves or open mines. During late spring/early summer, female bats form maternity colonies in characteristic trees (*Habitat Description*, Figure 1). Males roost singly or in small groups in trees and small caves and require less specific roost habitat. During mid-fall the bats migrate to their winter habitat and begin the mating behavior known as swarming. Both males and females require forested areas and wetland/riparian areas for foraging.

Habitat Description

Winter Habitat: Caves, or deep mines (including coal and limestone as well as other mineral recovery operations) are the typical wintering habitat for Indiana bats.

Threats to the species vary with its annual cycle. At the hibernacula, threats include modifications to the caves, mines, and surrounding areas that result in changes in airflow and alteration of the microclimates in the hibernacula. Human disturbance and vandalism pose significant threats to the species during hibernation by inducing arousal and consequent depletion of fat reserves and through direct mortality. Natural catastrophes (flooding and freezing events) can also have a significant effect on the population during winter because of the large number of individuals that hibernate in a relatively few sites. The Indiana bat hibernates colonially in caves and mines in the winter. During the winter months, Indiana bats are restricted to suitable underground hibernacula typically consisting of caves located in karst areas of the east-central United States; however, this species also hibernates in cave-like locations, including abandoned mines. Hibernacula tend to have large volumes with large rooms and vertical or extensive passages, often below the lowest entrance. Cave volume and complexity help buffer the cave environment against rapid and extreme changes in outside temperature, and vertical relief helps provide a range of temperatures and roost sites. Most Indiana bats hibernate in caves or mines where the ambient temperature is relatively stable and remains below 10°C (50.0°F) but infrequently drops below freezing. In these caves, tight groups are formed that can consist of hundreds to thousands of individuals. It is generally accepted that most Indiana bats return to the same hibernaculum each year. These bats also tend to hibernate in the same cave or mine at which they swarm, although there are exceptions to this pattern. Colonization of new hibernacula has been documented, indicating that this species has some capacity to exploit unoccupied habitats and expand their winter distribution.

Cluster density may also be limiting for hibernating bats. Indiana bats roost in dense clusters in hibernacula, potentially for thermal benefits or the conservation of water. Although the link between cluster size and overwinter survival has not been quantified, there are several benefits to being a member of a large hibernating population, including the social and energetic advantages

of roosting in dense clusters, and having many individuals available during fall swarming to help ensure reproductive success.

A new threat to bats emerged in upstate New York in the winter of 2006 and has since spread far across the eastern and Midwestern U.S. Referred to as White Nose Syndrome (WNS), given the name because of the white fungal growth observed on affected bats, it is caused by the bats contracting a fungus identified as *Geomyces destructans*. In as little as four years WNS has claimed the lives of at least a million bats and infected hibernacula in the northeast, resulting in mortality rates upwards of 95 percent. It's not clearly known, but the fungus appears to disrupt bats hibernation by causing them to repeatedly awaken, thereby depleting essential fat reserves. Once the fat reserves have been depleted bats attempt to emerge early to forage and are met with unfavorable weather conditions that almost always leads to mortality.

During summer months, possible threats relate to the loss and degradation of forested habitat. Migration pathways and swarming sites can also be affected by habitat loss and degradation. Habitats surrounding swarming sites may be particularly important in that these sites are discrete areas that apparently must be suitable to support large numbers of bats that, in addition to engaging in swarming activities, must forage to build up sufficient fat reserves to sustain them through the hibernation period.

Summer Habitat: Indiana bat summer habitat includes any tree greater than or equal to 5" dbh that possesses any or all of the following characteristics; exfoliating bark (e.g., shagbark hickory), dead or dying trunk/limbs (species of vegetation which do not normally possess exfoliating bark can develop this characteristic as the bark dies and begins to separate from the dying trunk/branch), cavities and fissures (e.g. woodpecker holes, lightning damage, heart rot). These trees can be found in various landscapes including floodplains and bottomlands, slopes and ridges, as well as upland areas. Some representative pictures of suitable Indiana bat summer roosting habitat in Figure 1.

Primary roosts usually receive direct sunlight for more than half the day. Roost trees are typically within canopy gaps in a forest, in a fence line, or along a wooded edge. Habitats in which maternity roosts

occur include riparian zones, bottomland and floodplain habitats, wooded wetlands, and upland communities.

The most likely impacts associated with transportation projects are disturbance and removal of forested summer habitat, disturbance of caves and cave-like openings, and alterations to foraging habitat. The loss of summer habitat could result in direct mortality if the area being cleared is inhabited by bats at the time of clearing. Foraging habitat can also be impacted through tree clearing that removes forested travel corridors that potentially connect foraging sites to roost sites or removes forested borders from streams or other water bodies. New corridor construction, widening of an existing roadway that requires clearing, bridge replacements that require tree removal, and excess fill areas that are located in wooded or partially wooded areas are all activities that could impact Indiana bats. Bridge and culvert construction can also affect stream foraging areas either through the loss of riparian vegetation or the production of in-stream sediment that could potentially reduce the aquatic insect production of that waterway.

Construction activities such as blasting, diversion of surface water away from or toward a cave or mine system, altering of airflow or temperature within a cave system, and altering cave or mine passages are all potential impacts to Indiana bat winter habitat.

Foraging Habitat: Commuting habitat that connects summer foraging and roosting areas is necessary to maximize foraging success and conserve energy. As a general rule, the Indiana bat does not cross large open areas and will follow tree lines or fencerows to reach foraging areas despite increased energy expenditures and commuting distances, although exceptions to this have been noted. Variable distances to foraging areas may be attributed to range wide differences in habitat type, interspecific competition, and landscape terrain. Fall swarming also requires the presence of suitable roost trees, foraging areas, and water in the vicinity of each occupied hibernaculum. Adequate habitat connectivity is needed to allow for movement of bats among these various elements.

Foraging habitat for both sexes is comprised of closed to semi-open forest and forest edges. There does not appear to be a preference for the type of wooded habitat, and foraging has been noted in multiple wooded habitat types including floodplain, riparian, lowland, and upland forests. Although some

observations of foraging have been documented from open areas, numerous studies have shown the dominant use of wooded edge habitat over open areas.

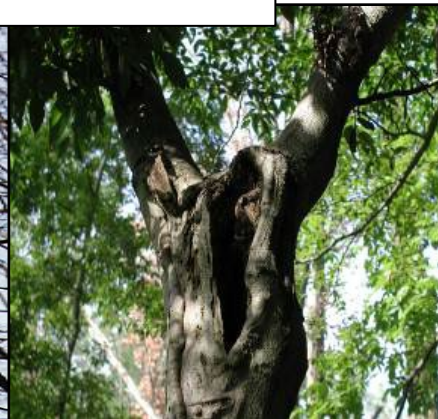
The Indiana bat shows fidelity to summer roosting and foraging areas. Benefits of site familiarity include reduction in time spent searching for new sites, more profitable exploitation of local food resources, and greater awareness of resident predators. Whenever roosts and foraging sources are eliminated, bats are forced to seek new habitat and expand their foraging range, potentially reducing foraging success and exposing bats to increased predation and competition. Availability of traditional roosting and foraging areas, at least at the landscape level, are important to survival and productivity.

The minimum size of a forest patch that will sustain Indiana bat maternity colonies has not been established. However, in highly fragmented landscapes the loss of connectivity among forested blocks may degrade the quality of the habitat for the Indiana bat. Patterson et al. (2003) noted that the mobility of bats, associated with flight, allows them to exploit fragments of habitat. However, they cautioned that reliance on already diffuse resources (e.g., roost trees) leaves bats highly vulnerable, and that energetics may preclude the use of overly patchy habitats.

Connectivity of habitats has been demonstrated to be important to this species. Murray and Kurta (2004) noted that bats within their maternity habitat in Michigan did not fly over open fields but traveled along wooded corridors, even though use of these corridors increased commuting distance by over 55 percent. Sparks et al. (2005) also noted the importance of a wooded riparian travel corridor to the Indiana bat in the maternity colony at their study site in Indiana. In addition, the distance and wooded connectivity between roosts and foraging areas may be limiting for this species at some sites.



Figure 5 Pictures of suitable Indiana bat roosting habitat.



Critical Habitat

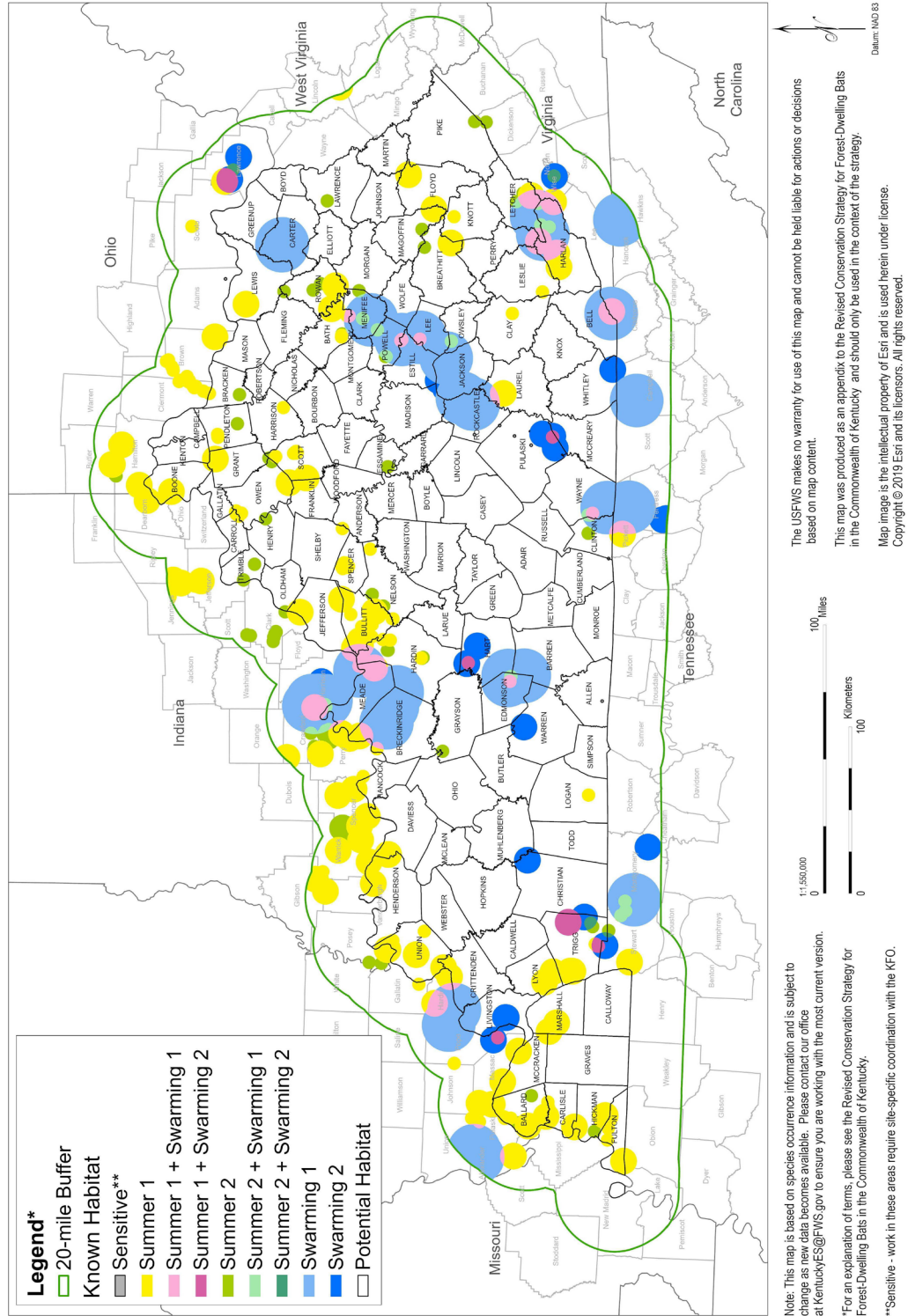
Yes – *(see additional maps and detailed descriptions provided after the decision key)*

Critical habitat was designated for the species on September 24, 1976 and included 11 caves and 3 mines in six states. In Kentucky, these critical habitat designations include Bat Cave (Carter County) and Coach Cave (Edmonson County). Five of the 23 Priority 1 hibernacula identified in the Indiana bat Draft Recovery Plan (2007) lie within Kentucky's borders. Three of these hibernacula occur within the Mammoth Cave system. The two other Priority 1 hibernacula occur in Kentucky's eastern coalfields with Bat Cave in the northeast portion of the state and Line Fork Cave in the southeast.

Range

The range of the Indiana bat includes Alabama, Arkansas, Connecticut, Florida, Georgia, Illinois, Indiana, Iowa, Kentucky, Maryland, Massachusetts, Michigan, Missouri, New Jersey, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, Tennessee, Vermont, Virginia, West Virginia, and Wisconsin. Most capture records of reproductively active female and juvenile Indiana bats have occurred in the upper Midwest including southern Iowa, northern Missouri, much of Illinois, most of Indiana, southern Michigan, western Ohio, and in Kentucky. Even though the winter range is dispersed across the eastern U.S., over 90 percent of the estimated range-wide population (in 2005) hibernated in just five states: Indiana, Missouri, Kentucky, Illinois, and New York. The Indiana bat is assumed present statewide (all counties) in Kentucky.

U.S. Fish & Wildlife Service
Known Indiana Bat Habitat in Kentucky and within 20 miles
 July 2025



Habitat Assessment Methods

Office Assessment:

Review geologic quads for indications of potential winter habitat such as karst/cave features, presence of karst bearing strata (Ordovician and Mississippian age limestone), quarry sites, mine adits, and elevations of coal seams within 1 km of the project's disturbed limits. Review should also include accessing Energy and Environment Cabinet (EEC) Division of Mines' GIS layer for the presence of active and abandoned deep mines near the project area. Begin with best available remote-sensing data including; aerial photography, topographic quadrangles, right-of-way strip maps, plan sheets indicating vegetation, etc.

Field Assessment:

On-site inspections should include walking the project area (any areas that would be directly or indirectly impacted by the project) to locate potential winter and/or summer roosting habitat. Known openings identified during office assessment as well as identifying the presence of unknown openings (wildcat mines, collapsed adits, open-throat sinkholes, etc.) should be documented.

Decision Key

- 1) Does the project require the removal of any tree(s) greater than or equal to 5" diameter at breast height regardless of the structure and characteristics of the tree(s)?
 - a. Yes: Contact a DEA Subject Matter Expert
 - b. No: Go to Step 2

- 2) Did survey of the project area, USGS quad, or any other resource (document all resources consulted or agency coordination undertaken) identify any of the following within 1 km of the project area?

● Caves	● Open throated sinkholes
● Mine adits	● Other karst features

 - a. Yes: Contact a DEA Subject Matter Expert
 - b. No: Prepare a No Effect finding

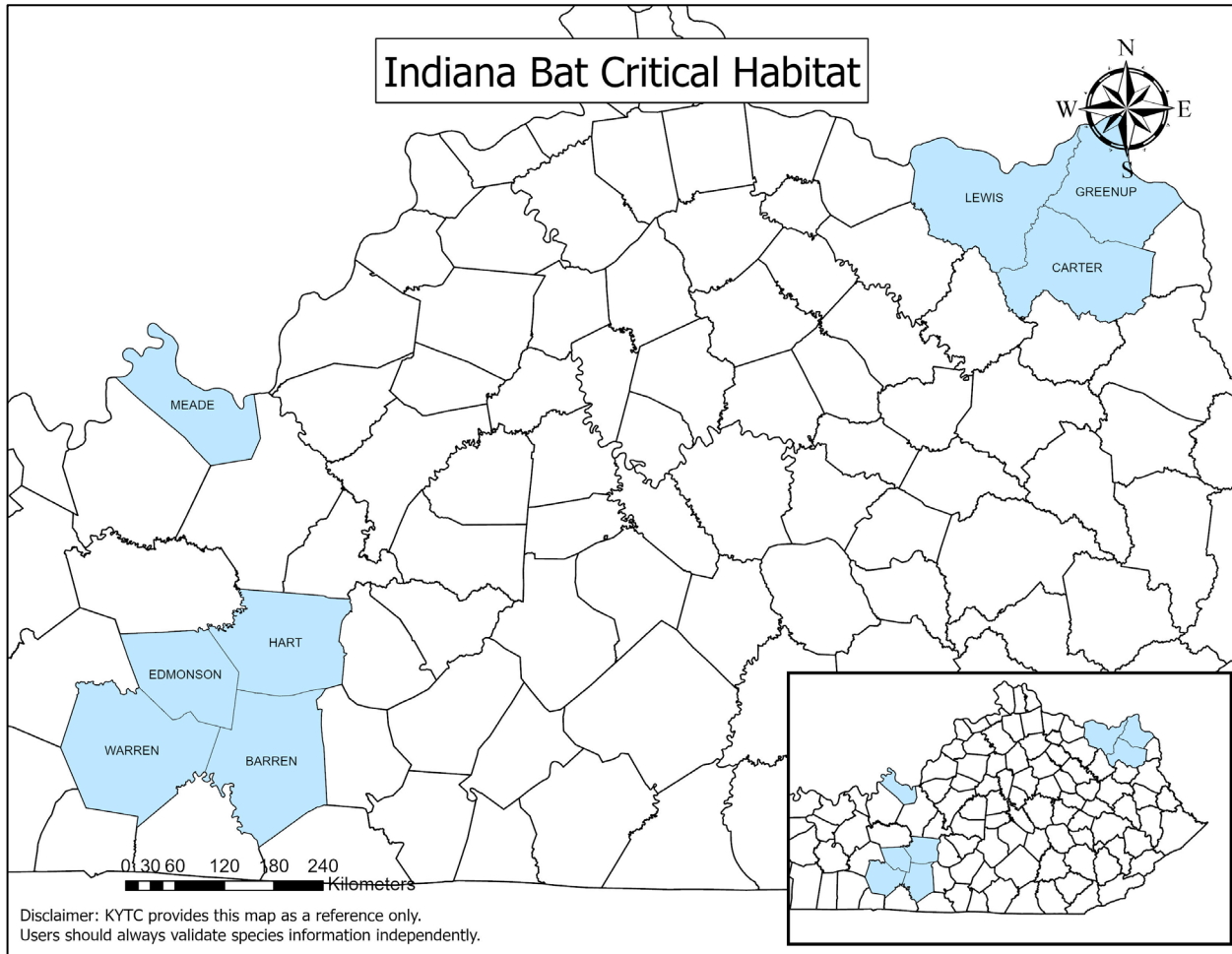


Figure 6 USFWS pulls in surrounding counties for consultation on IB CH, but the actual CH units are the caves described in this document.

Northern long-eared Bat (*Myotis septentrionalis*)

Species Description

The northern long-eared bat was listed as **endangered** under the ESA on January 26th, 2023.

The northern long-eared bat is a small, brown bat generally weighing 5-10 grams, with ears long enough to fold past the tip of the nose (17-19 mm). Its physical characteristics are similar to that of the little brown bat (*Myotis lucifugus*) and Indiana bat (*Myotis sodalis*); however, the northern long-eared bat is distinguished by its lack of a keeled calcar, coloration, and sparse to medium-long toe hairs.



Figure 7 Photo Credit: NLEB ECOS page.

This species uses different habitats during the summer (forest-dwelling) and winter (cave-dwelling) months. In addition, male and female bats may use different habitat types. Both sexes overwinter in caves or open mines. During late spring/early summer, female bats form maternity colonies in characteristic trees. Males roost singly or in small groups in trees and small caves and require less specific roost habitat. During mid-fall the bats migrate to their winter habitat and begin the mating behavior known as swarming. Both males and females require forested areas and wetland/riparian areas for foraging.

A new threat to bats emerged in upstate New York in the winter of 2006 and has since spread far across the eastern and Midwestern U.S. Referred to as White Nose Syndrome (WNS), given the name because of the white fungal growth observed on affected bats, it is caused by the bats contracting a fungus identified as *Geomyces destructans*. In as little as four years WNS has claimed the lives of at least a million bats and infected hibernacula in the northeast, resulting in mortality rates upwards of 95 percent. It's not clearly known, but the fungus appears to disrupt bats hibernation by causing them to repeatedly awaken, thereby depleting essential fat reserves. Once the fat reserves have been depleted bats attempt to emerge early to forage and are met with unfavorable weather conditions that almost always leads to mortality.

Habitat Descriptions

Winter Habitat: Caves or deep mines (including coal and limestone as well as other mineral recovery operations) are the typical wintering habitat for NLEB. This species has been found in the majority of hibernacula known to harbor bats in Kentucky. The northern long-eared bat utilizes different habitats during the summer and winter months. Hibernacula vary from large caves and abandoned mines with large entrances and passages to smaller features. Preferred features have relatively constant, cool temperatures (0 to 9° C), high humidity, and minimal air currents. This species typically roosts in small crevices and cracks in walls and ceilings; however, individuals have also been observed roosting in the open, although less frequently. In addition to mines, northern long-eared bats have been found hibernating in other cave-like, man-made structures.

Construction activities such as blasting, diversion of surface water away from or toward a cave or mine system, altering of airflow or temperature within a cave system, and altering cave or mine passages are all potential impacts to NLEB winter habitat. Any cumulative impacts (changes that are likely to occur in the reasonably foreseeable future) to NLEB habitat, as a result of the project, should be considered as well.

Summer Habitat: NLEB summer habitat includes any tree greater than or equal to 5” dbh that possesses any or all of the following characteristics; exfoliating bark, dead or dying trunk/limbs, cavities and fissures associated with lightning strikes or ice/wind damage, woodpecker holes, and heart rot. These trees can be found in various landscapes including floodplains and bottomlands, slopes and ridges, as well as upland areas. Also man-made structures such as barns, houses and sheds are used to a smaller extent by NLEB in the summer months.

Foraging Habitat: Summer habitat for the northern long-eared bat consists of a variety of forested habitats used for roosting, foraging, and commuting, including forest blocks and woodlots, as well as linear features such as fencerows, riparian forests, and other wooded corridors. These forested areas may be dense or loose aggregates of trees with variable amounts of canopy closure. Suitable summer roosting habitat consists of live or dead trees and snags with a dbh of three inches or greater that exhibit any of the following characteristics: exfoliating bark, crevices, cavities, or cracks. This species is more likely to roost in crevices, cracks, and cavities than other *Myotis* species and is more opportunistic when selecting

a roost tree, often utilizing shorter trees with smaller dbhs and tree stumps. Reproductive females typically prefer taller trees with larger dbhs located in more open areas. Non-reproductive females and males use trees of varying size and age, but may also roost in caves and mines during the summer. Northern long-eared bats have also been found roosting in man-made structures, including barns, sheds, and bat houses. Foraging habitat includes mature upland forests along hillsides and ridges. This species may also forage in more open areas, such as forest clearings, over open water, and along roads; however, it is less likely to forage in riparian areas. Commuting habitat is used to travel between roosting and foraging areas and typically includes forest edges and linear features, such as riparian corridors and fencerows.

The most likely impacts associated with transportation projects are disturbance and removal of forested summer habitat, disturbance of caves and cave-like openings, and alterations to foraging habitat. The loss of summer habitat could result in direct mortality if the area being cleared is inhabited by bats at the time of clearing. Foraging habitat can also be impacted through tree clearing that removes forested travel corridors that potentially connect foraging sites to roost sites or removes forested borders from streams or other water bodies. New corridor construction, widening of an existing roadway that requires clearing, bridge replacements that require tree removal, and excess fill areas that are located in wooded or partially wooded areas are all activities that could impact NLEB. Bridge and culvert construction can also affect stream foraging areas either through the loss of riparian vegetation or the production of in-stream sediment that could potentially reduce the aquatic insect production of that waterway.

Critical Habitat

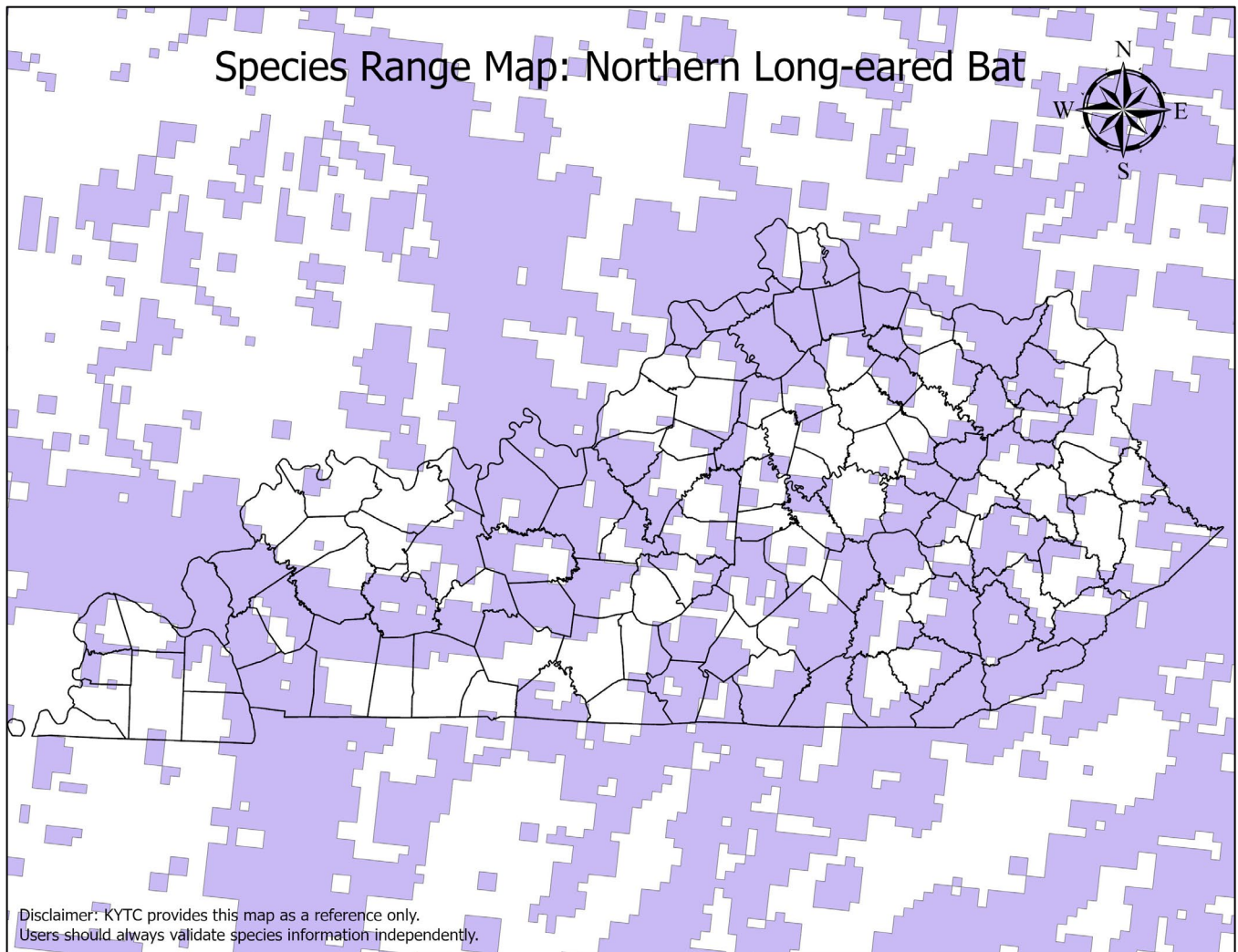
None

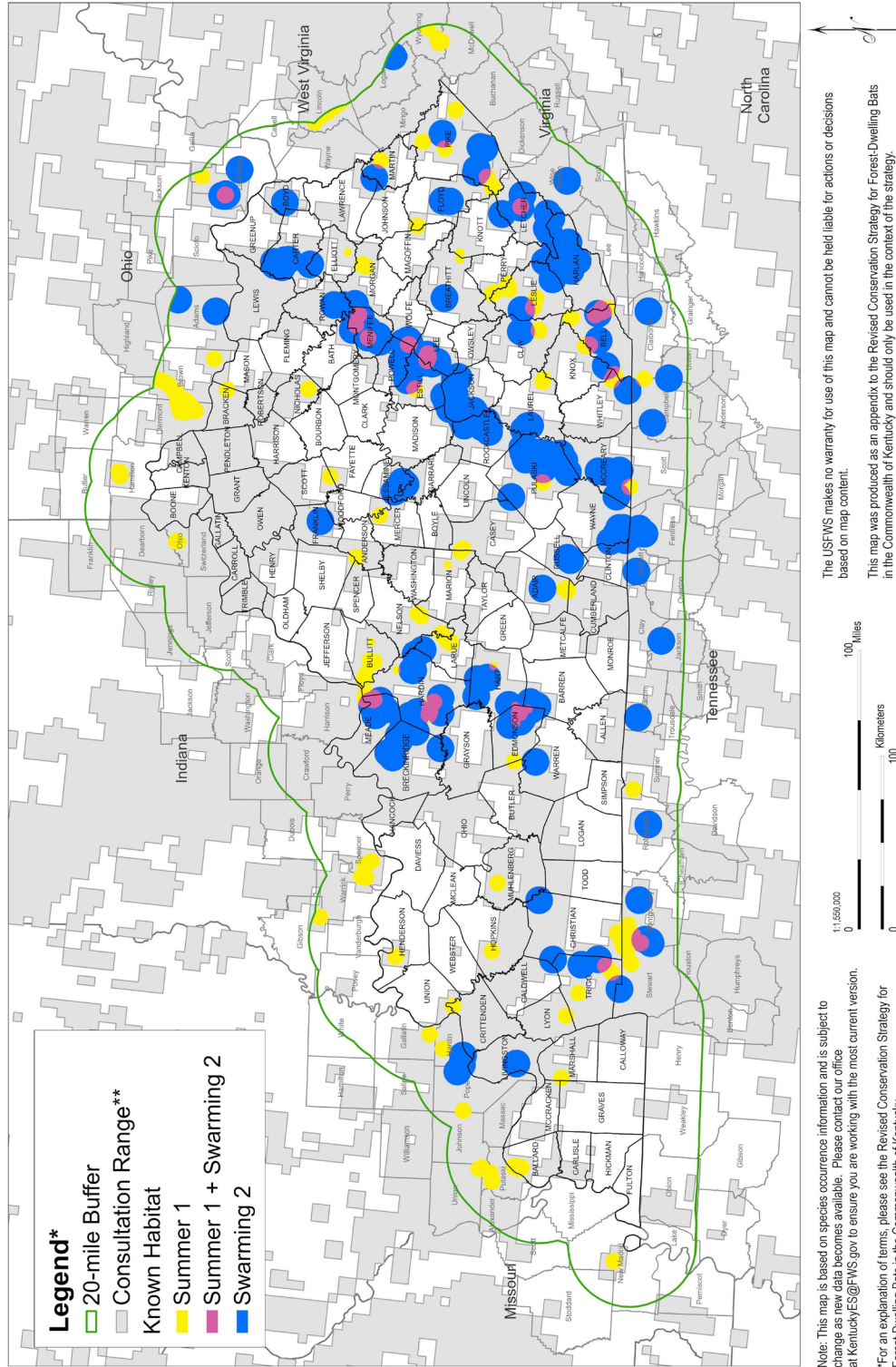
Range

The range of this species includes the eastern and north-central United States and all Canadian provinces from the Atlantic Coast to the southern Yukon Territory and eastern British Columbia. In the United States, the northern long-eared bat has been found in 37 states, ranging from Maine to Montana, south to eastern Kansas, eastern Oklahoma, and Arkansas, and east to South Carolina. Known hibernacula have been documented in 29 of the 37 states within the species' range. Northern long-eared bats in the United States can be divided into four distinct groups, including eastern, midwestern, southern, and western

populations. Historically, the northern long-eared bat was found in greatest abundance in the eastern portion of its range. The species is more scattered and less common in the midwest and southern portions of the range and is considered uncommon or rare throughout the majority of the western range.

In Kentucky, northern long-eared bats are no longer considered statewide. Rather than doing county occurrence data for listing, the USFWS has provided a range map where occurrence records are in every county in some capacity except Boyd.





Note: This map is based on species occurrence information and is subject to change as new data becomes available. Please contact our office at KentuckyES@FWS.gov to ensure you are working with the most current version.

*For an explanation of terms, please see the Revised Conservation Strategy for Forest-Dwelling Bats in the Commonwealth of Kentucky.

**See "Consultation Range" section in Northern Long-eared Bat and Tricolored Bat Voluntary Environmental Review Process for Development Projects Version 1.1 for a more detailed discussion.

The USFWS makes no warranty for use of this map and cannot be held liable for actions or decisions based on map content.

This map was produced as an appendix to the Revised Conservation Strategy for Forest-Dwelling Bats in the Commonwealth of Kentucky and should only be used in the context of the strategy.

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Habitat Assessment Methods

KYTC personnel who have received training on the implementation of the HAM may conduct project reviews to determine if potential NLEB summer and/or winter habitat is present and would be affected by a specific project.

Office Assessment:

Review geologic quads for indications of potential winter habitat such as karst/cave features, presence of karst bearing strata (Ordovician and Mississippian age limestone), quarry sites, mine adits, and elevations of coal seams within 1 km of the project's disturbed limits. Review should also include accessing Energy and Environment Cabinet (EEC) Division of Mines' GIS layers for the presence of active and abandoned deep mines near the project area. Begin with best available remote-sensing data including; aerial photography, topographic quadrangles, right-of-way strip maps, plan sheets indicating vegetation, etc.

Field Assessment:

On-site inspections should include walking the project area (any areas that would be directly or indirectly impacted by the project) to locate potential winter and/or summer roosting habitat. Known openings identified during office assessment as well as identifying the presence of unknown openings (wildcat mines, collapsed adits, open-throat sinkholes, etc.) should be documented.

Decision Key

- 1) Does the project require the removal of **any tree(s)** greater than or equal to 5" diameter at breast height regardless of the structure and characteristics of the tree(s) **OR** occur in one of the **quadrangles known for northern long-eared bat** maternity roost sites or hibernacula?
 - a. Yes: Contact SME
 - b. No: Go to Step 2
- 2) Did survey of the project area, USGS quad, or any other resource (document all resources consulted or agency coordination undertaken) identify any of the following within 1 km of the project area?

● Caves	● Open throated sinkholes
● Mine adits	● Other karst features

 - a. Yes: Contact SME
 - b. No: Prepare a No Effect finding

Tricolored Bat (*Perimyotis subflavus*)

Species Description

The tricolored bat was listed as ***proposed endangered*** by the United States Fish and Wildlife Service on September 13, 2022.

The tricolored bat is a small, uniquely-colored fur which varies from pale yellow to orange, with bits of silver-gray, brown, and black from the hair follicle to the tips of hair (SSA). This species is not sexually dimorphic, but females are generally heavier than males (LaVal and LaVal 1980). Average weight in the fall for adult males and females are 7.5 and 7.9-grams, respectively; in the spring 4.6 and 5.8-grams, respectively (Fujita and Kunz 1984).



Figure 8 Photo Credit:
<https://ecos.fws.gov/ecp/species/10515>

Habitat Description

Summer Habitat: This species uses different habitats during the summer and winter months. In the spring, summer, and fall seasons, tricolored bats will roost in live or dead leaf clusters in live or recently deceased deciduous trees; in portions of their range, tricolored bats will also utilize Spanish moss and lichen for roosting (SSA). Further, tricolored bats have also utilized pine needles, eastern red cedars, artificial roosts, and less commonly caves for summer roosting. Summer roosting can also include man-made structures, including barns, bridges, and culverts (Fujita and Kunz 1984). Sexes show roost preference differently in tricolored bats. Female tricolored bats have high site fidelity to summer roosts and form maternity colonies, switching roost trees while males typically roost singly.

Winter Habitat: Tricolored bats are cave-hibernating species in the winter, utilizing caves, abandoned mines, culverts, and less commonly, tree cavities and abandoned water wells as hibernacula. Likewise for summer roosts, site fidelity is high among winter habitats for this

species. There is some variation in portions of their range in the United States; hibernation length is shorter in the warmer and more southern portions and can even stay active to feed during the winter months. Tricolored bats leave their winter hibernacula to summer roosting habitat in the spring.

Foraging Habitat: Tricolored bats generally emerge early, and forage within tree canopies; in the evening, they may forage closer to the ground-level. Tricolored bats are considered opportunistic feeders, utilizing water sources, riparian habitat, and forest edges for foraging.

Commuting Habitat: Areas that connect summer foraging and roosting areas are necessary to maximize foraging success and conserve energy. Tricolored bats exhibit a preference for greater forest area, forest aggregation, and tree corridors, and less commonly in urban areas. Adequate habitat connectivity is needed to allow for movement of bats among these various elements.

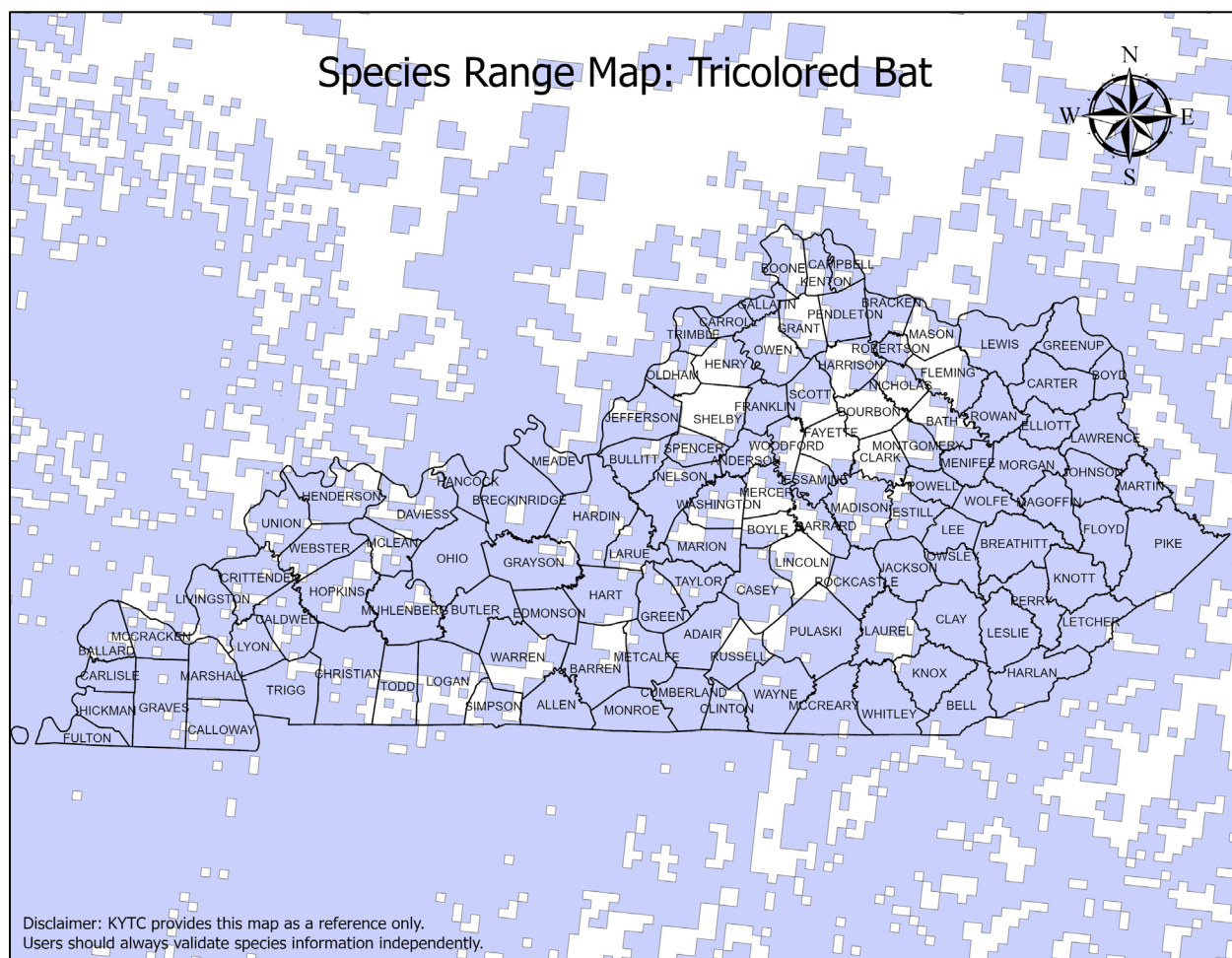
Critical Habitat

None

Range

The range of the tricolored bat in the United States includes Alabama, Arkansas, Colorado, Connecticut, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Vermont, Virginia, Wisconsin, West Virginia, Wyoming, and Washington D.C.

In Kentucky, rather than doing county occurrence data for listing, the USFWS has provided a range map where occurrence records are in every county in some capacity.



Assessment Methods:

Office Assessment: Review geologic quads for karst and cave features, presence of karst-bearing strata (Ordovician and Mississippian-age limestone), underground quarry sites, and mine adits. Review any mapping that indicates vegetation and presence of streams and reservoirs, including aerial photography, topographic quadrangles, right-of-way strip maps, and plan sheets. Identify any bridges or culverts that are in the project area which may provide suitable roosting habitat.

Field Assessment: When on site, walk the scope of the project to locate any known openings within 1-km of the project disturbance limits and confirm their presence/absence, location, conditions, and search for unknown openings. Pay particular attention to vertical cliff lines adjacent to stream valleys which may have cave openings. Look for highway and railway bridges and culverts that may provide cave-like microclimates. Utilize the KYTC Bats in Bridges

datasheet for all culverts and bridges, as tricoloreds have been found in culverts as small as 2-feet.

Decision Key

- 1) Did survey of the project area, USGS quad, or any other resource (document all resources consulted or agency coordination undertaken) identify any of the following within 1 km of the project area?
 - Caves
 - Mine adits
 - Caves
 - Mine adits
 - Limestone strata
 - Other karst features
 - Bridges
 - Culverts
 - a. Yes: Contact SME
 - b. No: Go to Step 2

- 2) Do any of the trees proposed for cutting or other means of knocking down or trimming provide potential roosts for Tricolored bats (e.g. clusters of leaves in live and dead deciduous trees, Spanish moss, clusters of dead pine needles of large, live pines)?
 - a. Yes: Contact SME
 - b. No: Prepare a NE Finding

Virginia Big-Eared Bat (*Corynorhinus townsendii virginianus*)

Species Description

Virginia big-eared bat was listed as **endangered** on November 30, 1979.

The Virginia big-eared bat is a medium-sized bat with pale to dark brown fur on the back to a light brown on the belly. They generally weigh between 7-12 grams, have large ears, and have short toe hairs.

Virginia big-eared bats are described as a year-round, cave-dwelling species. During the winter, when their food source (flying insects, primarily moths) is unavailable, Virginia big-eared bats hibernate in cool, well ventilated, portions of caves (known as hibernacula). The hibernacula may contain only a few or several thousand individuals, either solitary or in small clusters. Upon emerging in the spring (late March or early April) reproductive females move to warmer sections of the cave, or disperse to different caves, forming maternity colonies where they give birth to a single young in June. The maternity sites may be large limestone caves or small sandstone caves but they must be caves with high domed ceilings that trap warm air. Males occur singly or in small groups near the maternity sites. Non-reproductive Virginia big-eared bats use a wide variety of habitats during the summer in addition to caves such as mines, rock-shelters and large fissures in cliffs. In September, they begin to congregate at the hibernacula where they mate and eventually enter hibernation for the winter.



Figure 9 Photo Credit: VBB USFWS ECOS page.

Habitat Description

The Virginia big-eared bat utilize caves or cave-like structures (mines), rock shelters, and large cracks in sandstone cliffs year round, moving seasonally to different portions of these structures, or different locations, to meet specific temperature requirements. Winter hibernacula are located in larger limestone caves while summer maternity caves may be either small sandstone caves or limestone caves. Most of the habitat associated with this species is located in a highly dissected, high relief landscape. Cave entrances may be at or near ground level along steep sided stream valleys, or in the case of many of the smaller sandstone caves, halfway up a cliff face. Large cracks in sandstone cliffs are also used as daytime roosts by foraging bats but not as maternity sites.

These caves or cave-like structures are typically located in regions dominated by oak-hickory or beech-maple-hemlock forests. Virginia big-eared bats forage over fields, streams, forest edges, mountain slopes, cliff faces, and in clearings, sometimes using alternate night roosts in rock shelters during breaks in foraging.

Potential direct impacts associated with transportation projects may include disturbance of winter or summer caves or cave-like habitats. This could occur through the dumping of fill, blasting, excavation, or the diversion of water away from or toward a cave system. Any of these activities could affect cave access, alter the airflow or temperature regimes within the cave, or physically alter cave passages.

Secondary impacts as a result of construction would include: highway construction runoff into a cave system, increased access by humans or natural predators, and increased roof-fall via highway activities (vibration). Any cumulative impacts (changes that are likely to occur in the reasonably foreseeable future) to Virginia big-eared bat habitat, as a result of the project, should be considered as well.

Projects located above or below cave or cave-like habitat (particularly cliffline rock shelters and crevices) can reduce the suitability of these structures as roost sites by removing vegetation and

altering the amount of sun exposure, wind exposure, or noise exposure (i.e. highway noise) they receive. New corridor construction, widening that requires clearing, borrow or fill areas that are located in wooded or partially wooded areas, stream relocations, and drainage changes are all activities that could impact Virginia big-eared bat roost and foraging habitat.



In areas of limestone, cliff-lines should be searched for cave openings that do not always appear on topographic maps.



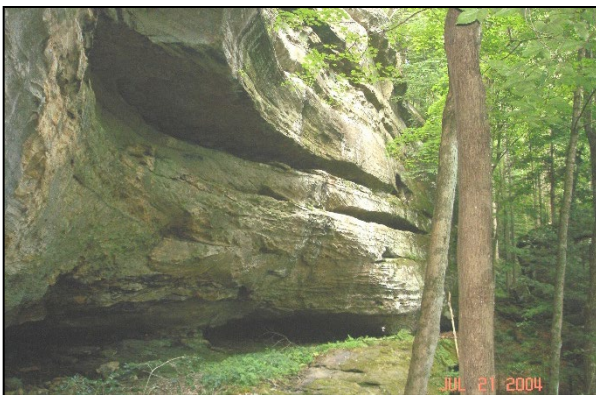
Some cave openings may be hidden from view by vegetation or debris.



Abandoned mines and quarries provide habitat for Virginia big-eared bats. Some wildcat mines do not appear on topographic maps and mine records. Field surveys should be conducted to examine for inconspicuous mine openings – usually located along old roads used to remove the minerals.



Some cave openings are level with the ground.



Cliff-lines can have layers of rock that have eroded horizontally creating caves, rock shelters, and crevices.



Rock shelters form because a rock stratum such as sandstone that's resistant to erosion and weathering has a softer stratum underneath, which is eroded horizontally creating an overhanging rock ledge ceiling.



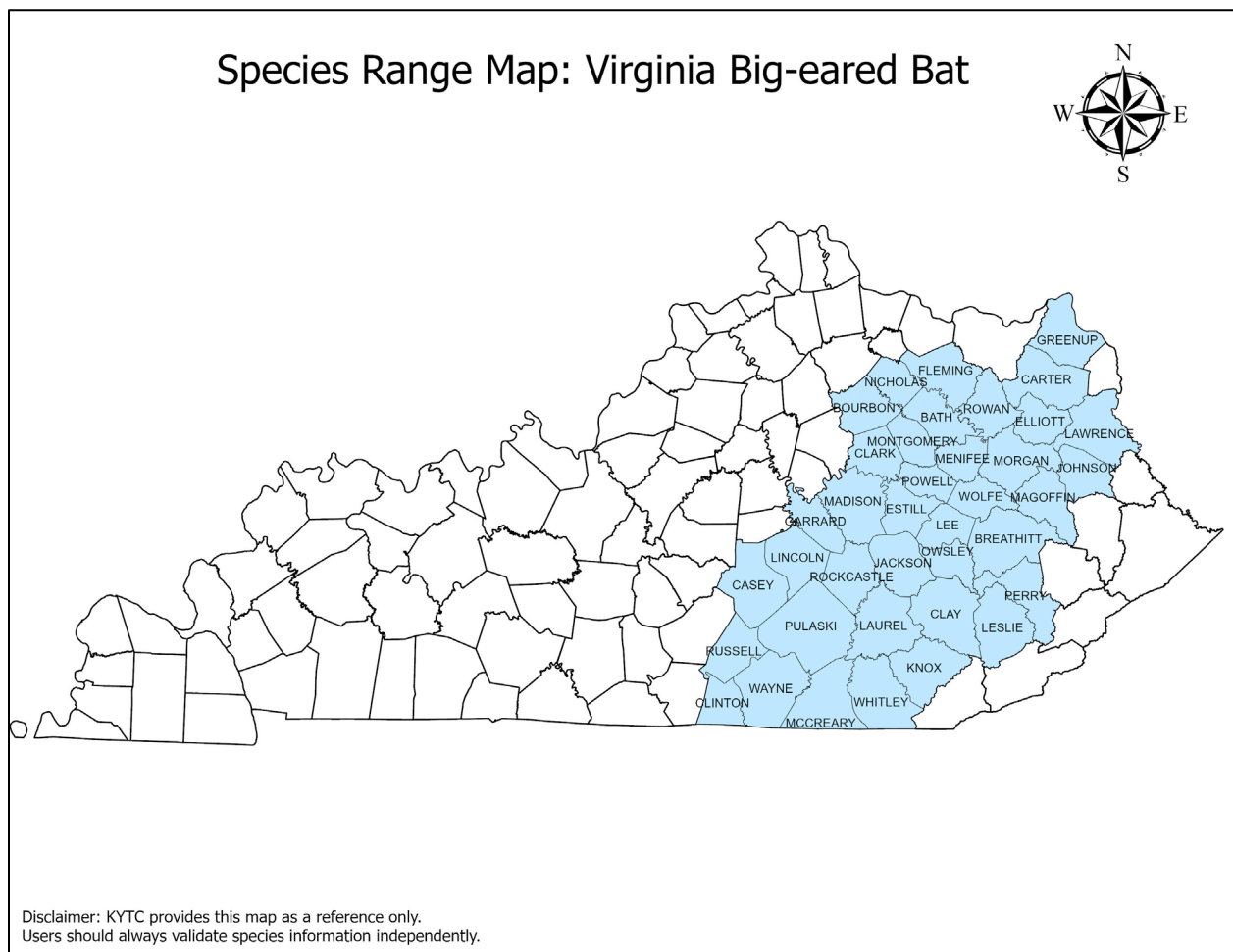
Cliff-lines, sometimes called bluff-lines, are exposed rock strata that have a prominent and almost vertical front.

Critical Habitat

Yes – but none located in KY.

Range

The range of the Virginia big-eared bat is the Appalachian Mountains of Virginia, West Virginia, North Carolina, and eastern Kentucky. The Kentucky range is a nineteen-county strip that lies along the dissected edge of the Western Allegheny Plateau.



Habitat Assessment Methods

Office Assessment:

Review geologic and topographic quad maps for caves or the presence of cave bearing strata exposed in deeply dissected stream valleys (Ordovician and Mississippian age limestone), underground quarry sites, mine adits, and cliff-lines (usually sandstone). Reference mine layer on ArcGIS to identify the location of abandoned deep mines or limestone mines if you have reason to believe mining may have occurred in the project area. Coal mining in the range of the Virginia big-eared bat is uncommon. Current and former landowners are also a good source of information, as well as local spelunking groups.

Field Assessment:

Based on the office review, walk those areas within 1 km of the project disturbed limits that may contain known openings and confirm their presence or absence. Verify the presence of cliff-lines which may have cave openings, and limestone or sandstone rock outcrops on mountain sides that may have rock shelters or deep cracks.

Decision Key

- 1) Do any of the following occur within or within 1 km of the project area:
 - Deeply dissected stream valleys with limestone strata
 - Areas of inactive underground mining (coal, limestone)
 - Karst features
 - Cliff-lines
 - Railroad tunnels (abandoned)
 - Rock shelters
 - a. Yes: Contact SME
 - b. No: Prepare a No Effect finding

Basic Introduction to Freshwater Mussels



Photo Credit: <https://www.toledoblade.com/StevePollick/2006/05/16/Freshwater-mussels-sought-by-poachers.html>

Conservation and History

North America holds the greatest amount of freshwater mollusk biodiversity in the world, particularly in the southeastern region. There are more species of freshwater mussels in the Southeast than anywhere else on the planet. However, since the settlement of European explorers, freshwater mussel numbers have drastically declined. Practices such as stream channelization, dredging, wetland drainage, landscape pollution, farming, mining, industrialization, silvicultural practices, dam building, and other practices have altered the waterways. Such actions have aided in the reduction and ultimate destruction of many mussel populations.

Freshwater mussels are the most endangered group of organisms in North America. Nearly 300 mussel species have been recorded to occur in the United States. Of these, 104 species have been considered historically present in Kentucky; however, some species populations have been

reduced over time. Currently, 20 mussel species are considered extinct or extirpated within Kentucky and another 30 are listed as federally threatened, endangered, or are candidate for listing under the Endangered Species Act.

Habitat protection and the restocking of streams and rivers are key factors to long-term, successful mussel conservation. Several species are extremely rare and inhabit only small stretches of specific rivers. Through maintenance and improvement of the integrity of Kentucky's waterways, quality mussel habitat that may promote mussel survival into the future can be preserved. Mussel habitat varies by species and by watershed; however, all mussels must have suitable habitat for burrowing, anchoring, filtration/feeding, and breeding. Adequate substrate and water quality must be present depending on the certain species needs, along with presence of appropriate host species for mussel reproduction. Conservation measures are essential for the protection of these species, including minimization and mitigation measures performed by the Transportation Cabinet. The long-term goal of conservation is to establish reproductive and genetically viable populations so that these species ultimately may be sufficiently established to warrant removal from federal protection under the Endangered Species Act.

Biology and Life History

In freshwater mussels, individual specimens are gonochoristic, (i.e. – individuals are either male or female with only rare hermaphroditic individuals). Species in the subfamily *Lampsilinae* are the only mussels to exhibit distinct sexual dimorphism (i.e. – there are obvious differences between the male and female of the species such as morphology, size, and ornamentation). Males release sperm into the water, which enters the female via the incurrent siphon. The eggs are then fertilized internally. The fertilized eggs develop into an intermediate larval stage termed glochidia (singular = glochidium). The glochidia are stored in the female's gills, which function as a brood chamber, as well as a means for obtaining oxygen. Some species breed in the fall and hold onto their glochidia internally until the following spring. These are long-term breeders (bradytic). Other species breed in the spring, and release their glochidia later that year, usually at the end of summer. These are short-term breeders (tachytic).

In the spring or summer, the glochidia are expelled into the water in order to begin the parasitic phase of their life cycle. Some species possess a lure, which attract potential host. The glochidia attach to an appropriate host, usually a fish, and form a cyst. Depending on the species of mussel, the glochidia can either be internal parasites on the gills, or external on the fins. Some mussel species are host specific, while others can use a wide variety of species to rear their glochidia. The glochidia grow on the host for a period ranging from 1 to 25 weeks, depending on several factors including mussel species, water temperature, and efficiency of nutrient transfer from the host. They eventually drop off and begin their life in the stream's substrate as infant, fully-formed mussels (Figure 1 - Cicerello and Schuster 2003).

Freshwater mussels continuously pump water through their bodies. Water enters via the incurrent or branchial siphon and exists through the excurrent or anal siphon. During this process, the mussel filters food from the water. This food consists of diatoms, detritus, plankton, and other organic sources of microscopic plants and animals.

Freshwater mussels are an ecologically important organism for Kentucky's creeks and rivers. They filter the water, provide a food source for other animals, and are biological indicators of water quality. They provide an important source of food for other animals such as muskrats, minks, otters, fish, and birds. Mussels are considered to be long-lived species with most species tending to live more than 10 years. Some mussel species even live longer than 100 years, although longevity is still unknown for various species.

Field Identification

Habitat preferences of mussels can vary considerably by species. Some species are restricted to certain habitat types (e.g. – small creeks), while others can be found in almost any permanent body of water. Knowing characteristics of water features preferred by some mussels is only the beginning. Considerations also include variation in substrate composition and available microhabitat positions within the water body. However, like most things in nature, there are always exceptions. Even a big river mussel species can be found in smaller creeks (e.g. purple catpaw pearlymussel – *Epioblasma obliquata*). These instances make overall

dismissal of mussel species from some bodies of water difficult. In some cases, not enough is known about the life history of a particular species and it could possibly range in a greater variety of habitat types than is currently expected; or historic surveys were not exhaustive efforts for a difficult to locate mussel, and its distribution may currently be underestimated (e.g. – rayed bean – *Leaunio fabilis*). Unfortunately, mussel habitat evaluation is not always a simple or straightforward process.

Given the vast number of mussel species in southeastern North America and the great degree of morphological variation that mussel species exhibit throughout their habitat types, identification of freshwater mussel species may prove difficult, even for experts. Even within species, shell variation is great and can be quite an obstacle to overcome for identification. The body of a freshwater mussel consists of the “soft parts” and the shell. The soft parts of a mussel refer to its foot, gills, mantle and other body system structures. These parts decompose and remove from the hard shell shortly after death; therefore, the majority of mussel identification relies solely on the shell. Even with the soft parts intact, this does not lend to easier identification in most cases, and identification still relies largely on shell characteristics. This can be problematic because the shells of some common species can appear nearly identical to more rare species. Species can have typical morphological features to aid in their identification (Figure 2 – Cicerello and Schuster 2003), but biologists may have to rely more on experience when identifying some specimens.

Stream/ River Descriptions

Throughout the HAM, descriptors of water bodies such as “small streams” or “large rivers” are used. Unfortunately, these ambiguous terms can only be clarified to a certain degree. What looks like a medium sized river to some, may appear to be a large stream to others, and neither may be wrong. Stream order (Strahler classification) can be a means of establishing water bodies’ size, but again is not 100% clear cut. A 3rd order stream in eastern Kentucky would likely have a different volume of water than a 3rd order in western Kentucky. Stream order is based on topography and how the water drains from the land. Typically, small rivers are considered to be approximately 3rd to 5th order, but a set definition is not axiomatic.

The following photographs provide visualizations of the multiple sizes of water bodies that some might consider belonging to a certain size class (photos courtesy of KYTC and Third Rock Consultants, Ltd.). These photos are included merely to depict the variety of water bodies and the terms to which they may belong, and are not all-encompassing or meant for use as a pass/fail assessment. Unfortunately, things in nature are not always clear or straightforward, so we must make the best, most educated decisions and actions that we can.

Small/Medium Streams



Medium/Large Streams



Large Streams/Small Rivers



Small/Medium Rivers



Medium/Large Rivers



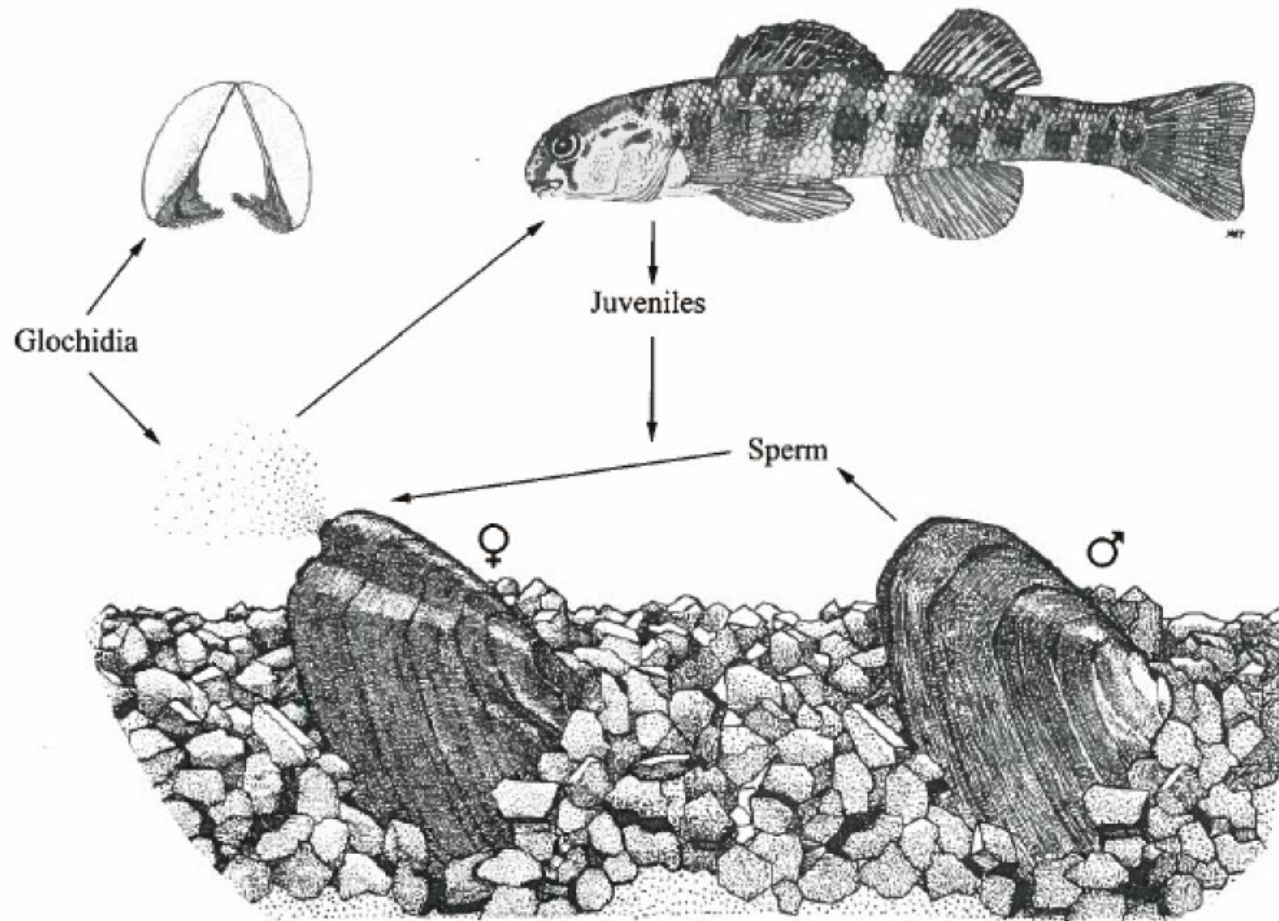


Figure 1. Generalized life cycle of freshwater mussels, as exemplified by the littlewing pearlymussel (*Pegias fabula*) and a host fish, the emerald darter (*Etheostoma baileyi*). Following the fertilization of eggs within the female, parasitic larval mussels called glochidia develop. The glochidia are released into the water, attach to a host fish, and encyst. The glochidia transform into juvenile mussels after a few weeks, drop from the fish, and fall to the bottom.

Cicerello, R.R. and G.A. Schuster. 2003. A guide to the freshwater mussels of Kentucky. Kentucky State Nature Preserves Commission Scientific and Technical Series, 7:1-62.

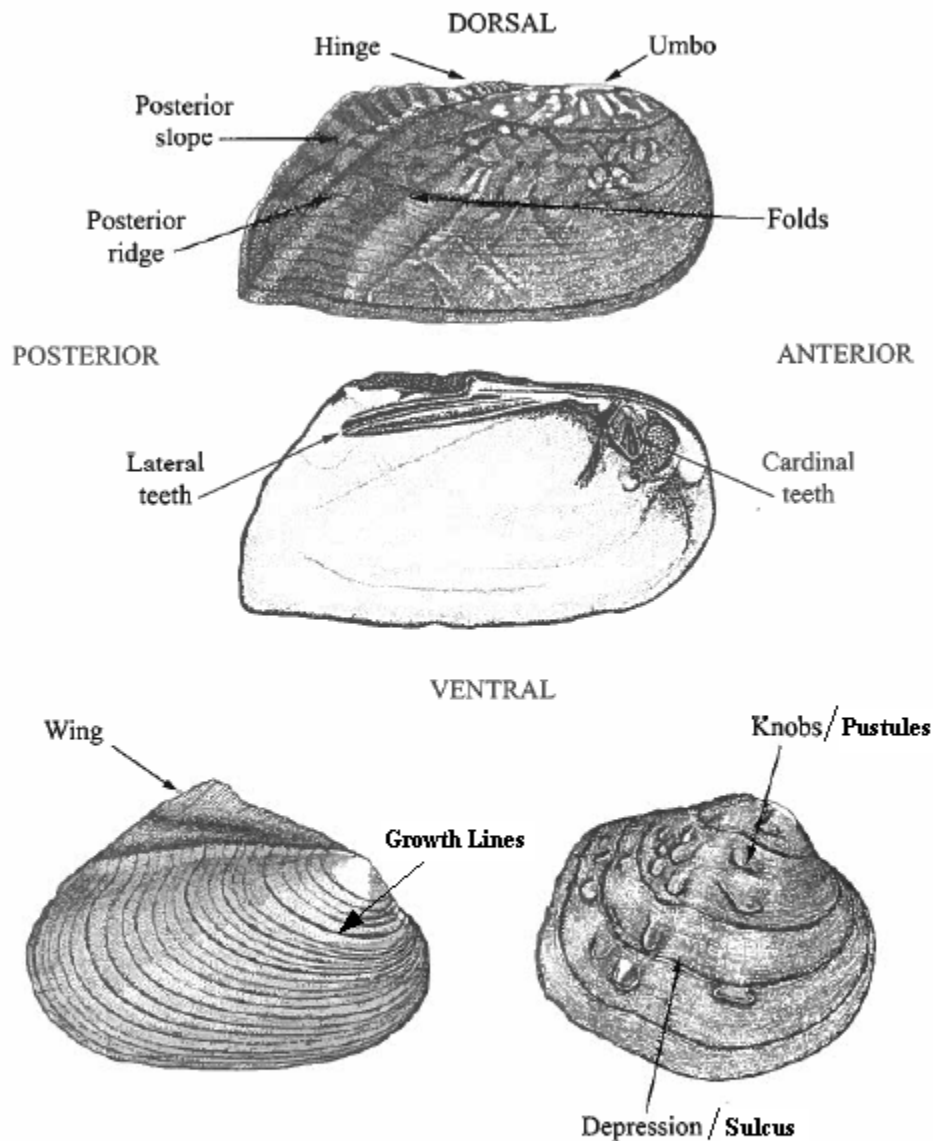


Figure 2. Major features of freshwater mussel shells, as exemplified by the bankclimber (*Plectomerus dombejanus*), pink heelsplitter (*Potamilus alatus*), and mapleleaf (*Quadrula quadrula*). The drawings show the exterior of the right valve (top) and interior of the left valve (middle) of the bankclimber, and the exterior of the right valves of the pink heelsplitter (bottom left) and mapleleaf (bottom right).

Cicerello, R.R. and G.A. Schuster. 2003. A guide to the freshwater mussels of Kentucky. Kentucky State Nature Preserves Commission Scientific and Technical Series, 7:1-62.

Glossary

Anterior – the shell end nearest the umbo; the front end.

Cardinal Teeth – teeth-like structures inside the shell at the hinge at the anterior dorsal margin.

Compressed – the shell is flattened from side to side.

Dorsal – the top of the shell where the hinge is located.

Endemic – restricted to a particular locality (region, drainage, or political boundary).

Growth Lines – darkened lines on the surface of the shell indicating periods of rest during growth.

Hinge – the elastic dorsal margin that joins the shell.

Inflated – the shell is swollen or expanded from side to side.

Lateral Teeth – the elongate teeth inside the shell along the hinged margin.

Nacre – the variously colored interior layer of the shell.

Periostracum – the outside covering of the shell.

Posterior – the end of the shell farthest from the umbo; the back end.

Posterior ridge – a ridge extending from the umbo to the posterior-ventral margin.

Pustules/ knobs – bumps on the shell's exterior.

Ray – solid or broken colored lines on the shell's exterior.

Serrated – notched or jagged.

Sulcus – a shallow depression on the outside surface of the shell.

Umbo – the raised or inflated part of the anterior-dorsal margin of the shell; also called the beak.

Ventral – the bottom edge of the shell.

Wing – flattened fin-like shell extension located dorsally and usually posterior but sometimes anterior of the umbo.

Clubshell Mussel (*Pleurobema clava*)

Species Description

The clubshell mussel (*Pleurobema clava*) was listed as an **endangered** species on January 22, 1993.

The shell is an elongate triangle, compressed, and thick. Umbo extends above hinge line and projects anteriorly. Posterior ridge and slope rounded, occasionally

bordered ventrally by a shallow depression. Shell smooth, brown or yellowish-brown, with broken green rays nearer the umbo. Cardinal teeth are large and serrated; lateral teeth are thick and straight or curved. Nacre white, iridescent posterior. Length 2-3 inches.



Figure 1 Photo Credit:
<http://www.inhs.illinois.edu/collections/mollusk/publications/guide/index/56/>

Habitat Description

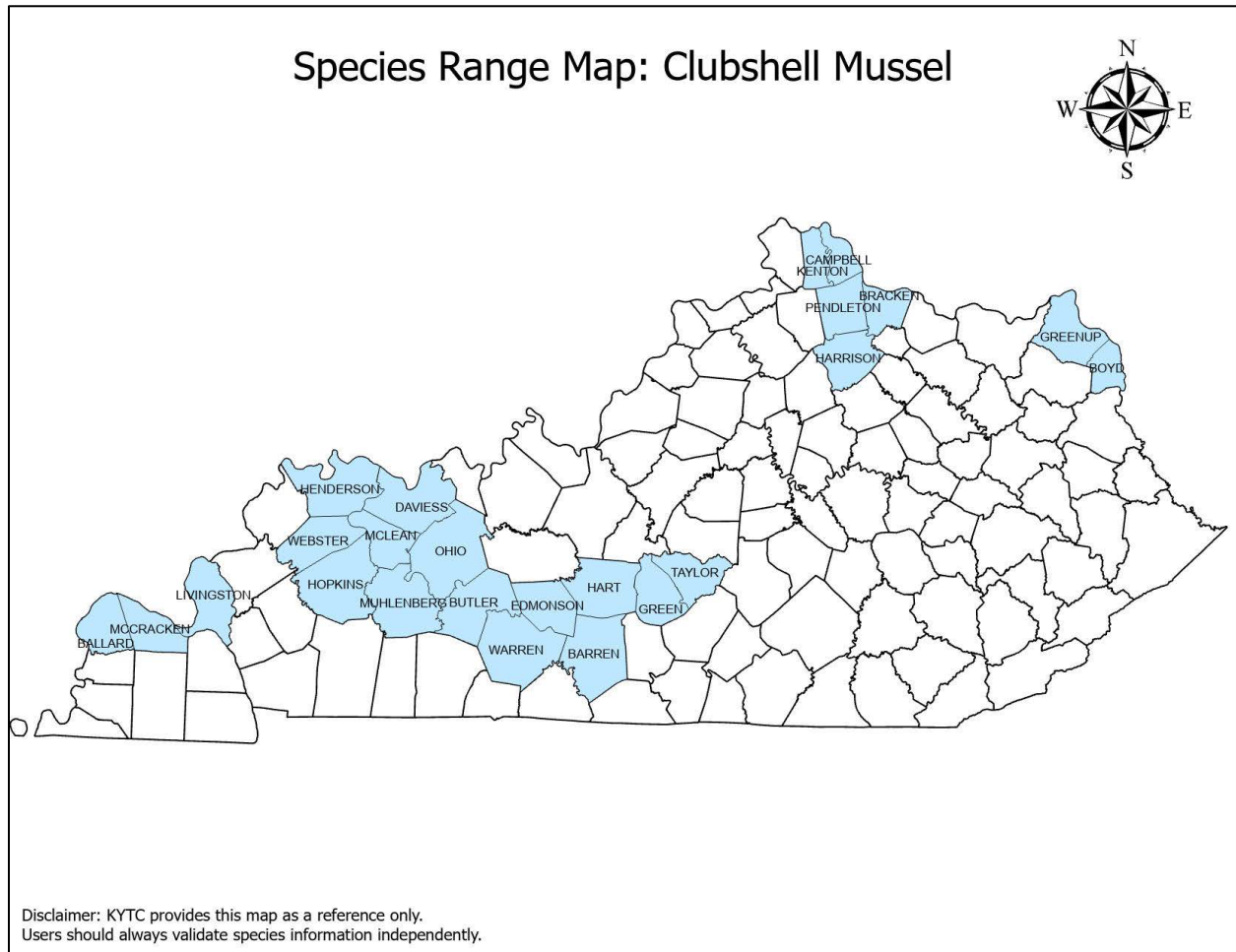
The clubshell occurs in **small streams to large rivers** in clean, coarse sand and cobble mixes with a current. It is most common just downstream of riffles and islands. It may live several inches beneath the surface. In general, it cannot tolerate mud or slack-water conditions and is very susceptible to siltation.

Critical Habitat

None

Range

The clubshell inhabits watersheds in Kentucky which include the Ohio River, Kentucky River, Salt River, Licking River, Tennessee River, Cumberland River, and Rockcastle River. A non-essential, experimental population has also been established in Alabama.



Decision Key

- 1) Does the project include any direct or indirect effects to **perennial streams or their nearby tributaries?** (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)
 - a. Yes: Go to #2
 - b. No: Prepare NE finding

- 2) Does the stream have obvious layers of mud or silt covering the top of the stream's substrate? If you cannot discern the stream's substrate, contact your SME.
 - a. Yes: Prepare NE finding
 - b. No: Contact SME

Cumberland Bean Pearlymussel (*Venustaconcha troostensis*)

IPaC lists: *Villosa trabalis*



Figure 2 Photo Credit: <http://www.arkive.org/cumberland-bean-pearly-mussel/villosa-trabalis/>

Species Description

The Cumberland bean was listed as federally **endangered** in 1976.

Shells of the Cumberland bean are solid and elongate with inflated, inequilateral, and irregularly oval valves. The ventral margin is evenly curved. Female shells reach a slightly larger size than males. The periostracum is olive green with numerous faint wavy green rays, whereas the nacre is a bluish white or white, with a bluish iridescence posterior. Umbos even with or extend above hinge line. Cardinal teeth and large and serrated; lateral teeth thick and slightly curved. Length 2-2.5 inches.

Habitat Description

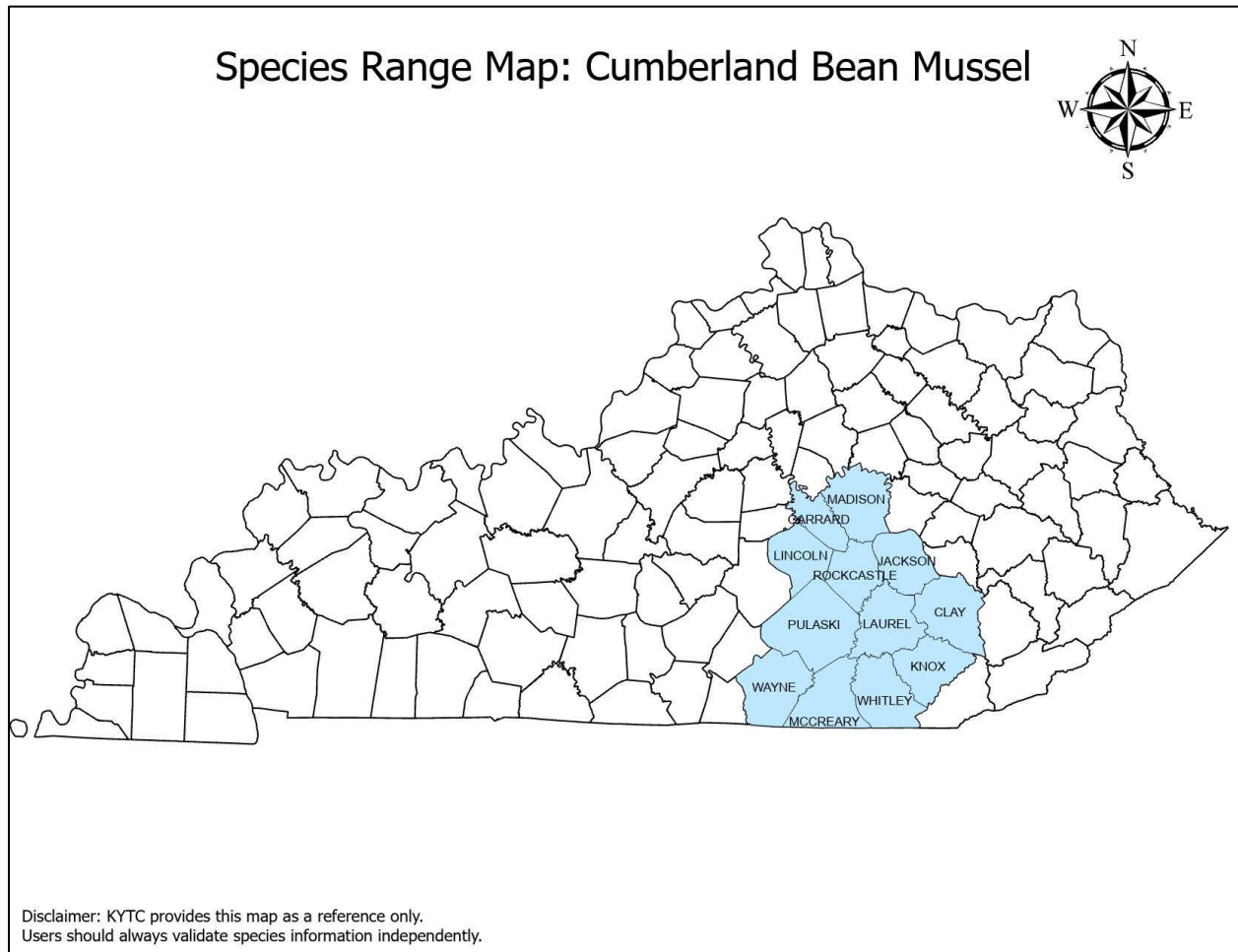
The Cumberland bean occurs in **small streams to medium sized rivers**. They can be found in substrates of sand, gravel, and cobble in moderate to swift currents and depths less than 3 feet. They are often associated with vegetated islands in stream channels (e.g. – *Justicia spp.* and *Valisneria spp.*). They can be found buried, or on top of, the consolidated substrate at these vegetated islands.

Critical Habitat

None

Range

Historically the Cumberland bean was reported in several locations in both the Cumberland and Tennessee River systems. The Cumberland bean is still associated with the upper Cumberland River system and Rockcastle River in Kentucky. A non-essential experimental population has been established in the Tennessee River below Wilson Dam in Alabama, and in the Lower French Broad River in Tennessee.



Decision Key

- 1) Does the project include any direct or indirect effects to **perennial streams or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)
 - a. Yes: Contact SME
 - b. No: Prepare NE finding

Cumberland Elktoe (*Alasmidonta atropurpurea*)

Species Description

The Cumberland elktoe was listed as an **endangered** species on January 10, 1997.

The Cumberland elktoe has a thin, but not fragile, shell. The periostracum is smooth, somewhat shiny, and covered with greenish rays. Young specimens have a yellowish brown periostracum, while specimens of adults are generally much darker. The nacre is shiny, with the color being white, bluish white, or sometimes



Figure 3 Photo Credit:
<http://www.flickr.com/photos/ttravisbrownphotos/8696376556/>

peach or salmon. Cardinal teeth are variable and can range from small, knob like and smooth to a well developed, single, elongated, thickened tooth in the right valve, which is more pronounced than the usually two less distinct teeth in the left valve; lateral teeth are hardly more than the thickening of the hinge line. Length 3-4 inches.

Habitat Description

The Cumberland elktoe inhabits **small streams to medium-sized rivers** and may extend into headwater streams where it is often the only mussel present. It has been reported that the species appears to be most abundant in flats, which can be described as shallow pool areas lacking the bottom contour development of typical pools, with sand and scattered cobble/boulder material, relatively shallow depths, and slow (almost imperceptible) currents. This species is also reported from swifter currents and in areas with mud, sand, and gravel substrates. It can even be found living in cracks of bedrock ledges.

The Cumberland elktoe has shown some affinity for soft waters, or at least a tolerance of varying water hardness levels. This may also be another reason that sometimes the Cumberland elktoe is the only mussel found in certain stretches of water, particularly above the Cumberland Falls.

Critical Habitat

Yes - (see additional maps and detailed descriptions provided after the decision key)

Critical habitat for the Cumberland elktoe was designated on August 31, 2004.

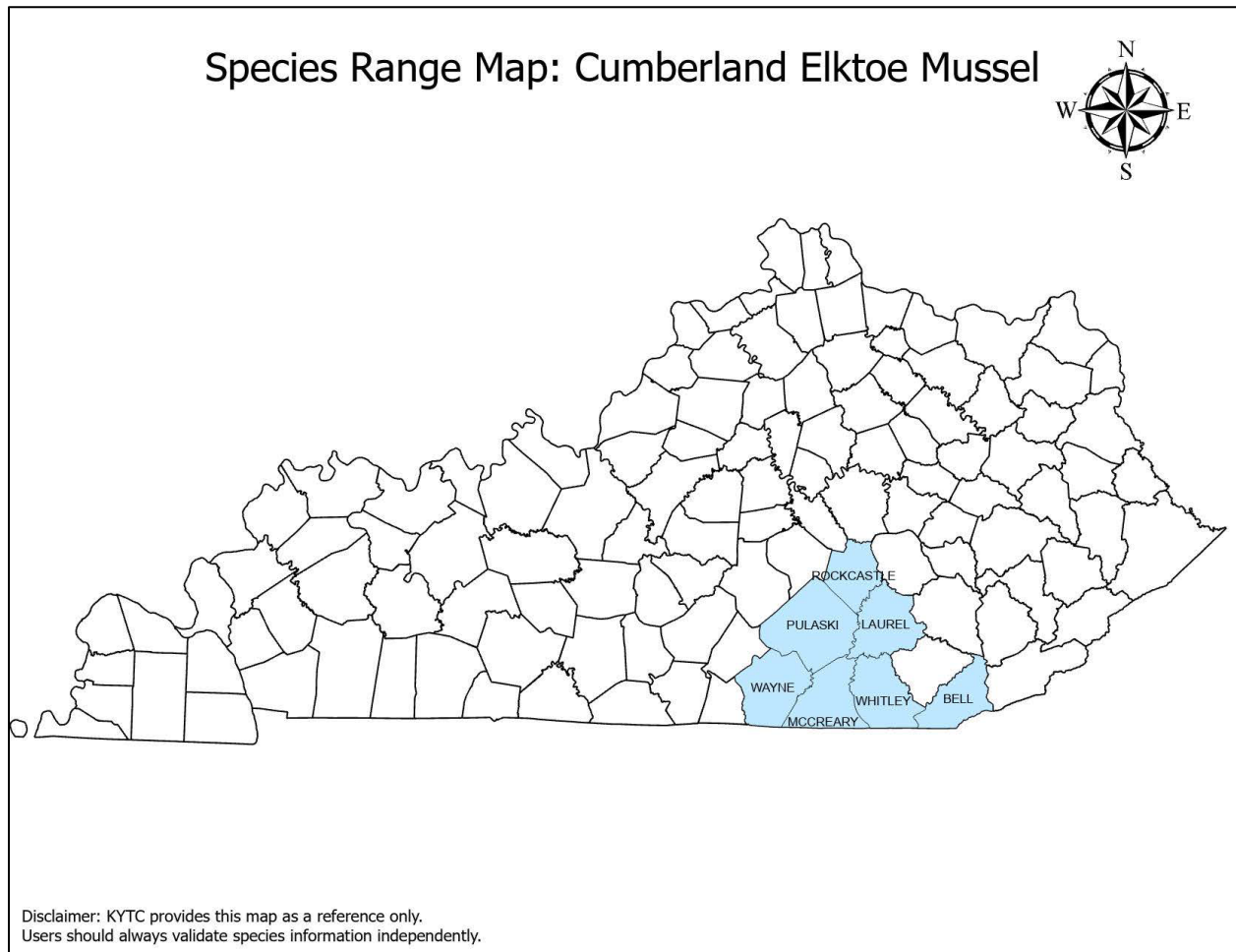
Primary constituent elements of critical habitat for this species include:

1. Permanent, flowing stream reaches with a flow regime (*i.e.*, the magnitude, frequency, duration, and seasonality of discharge over time) necessary for normal behavior, growth, and survival of all life stages of the five mussels and their host fish.
2. Geomorphically stable stream and river channels and banks (structurally stable stream cross section).
3. Stable substrates, consisting of mud, sand, gravel, and/or cobble/ boulder, with low amounts of fine sediments or attached filamentous algae.
4. Water quality (including temperature, turbidity, oxygen content, and other characteristics) necessary for the normal behavior, growth, and survival of all life stages of the mussels and their host fish.
5. Fish hosts with adequate living, foraging, and spawning areas.

Species, Stream (unit), and State	Currently Occupied			Currently Unoccupied		
	River Miles			River Miles		
Cumberland Elktoe						
Rock Creek (Unit 8), KY		11			.....	
Big South Fork (Unit 9), TN, KY		27			.....	
North Fork White Oak Creek (Unit 9), TN		7			.....	
New River (Unit 9), TN		9			.....	
Clear Fork (Unit 9), TN		25			.....	
White Oak Creek (Unit 9), TN		6			.....	
Bone Camp Creek (Unit 9), TN		4			.....	
Crooked Creek (Unit 9), TN		9			.....	
North Prong Clear Fork (Unit 9), TN		9			.....	
Sinking Creek (Unit 11), KY		8			.....	
Marsh Creek (Unit 12), KY		15			.....	
Laurel Fork (Unit 13), TN, KY		5			.....	

Range

The Cumberland elktoe is limited in distribution to the upper Cumberland River system in southeast Kentucky and north-central Tennessee, occupying streams both above and below Cumberland Falls.

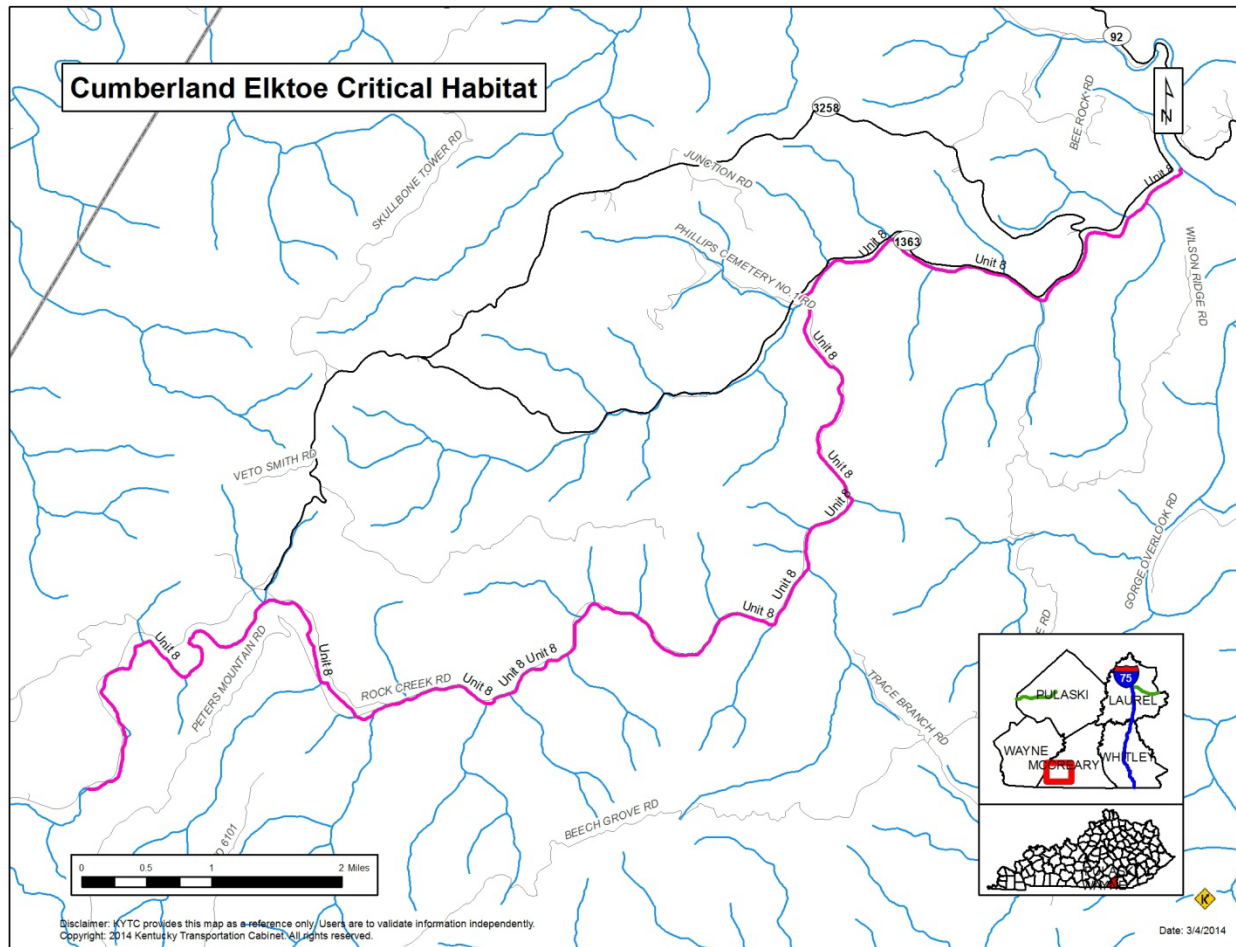


Decision Key

- 1) Does the project include any direct or indirect effects to **perennial streams or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)
 - a. Yes: Contact SME
 - b. No: Prepare NE finding

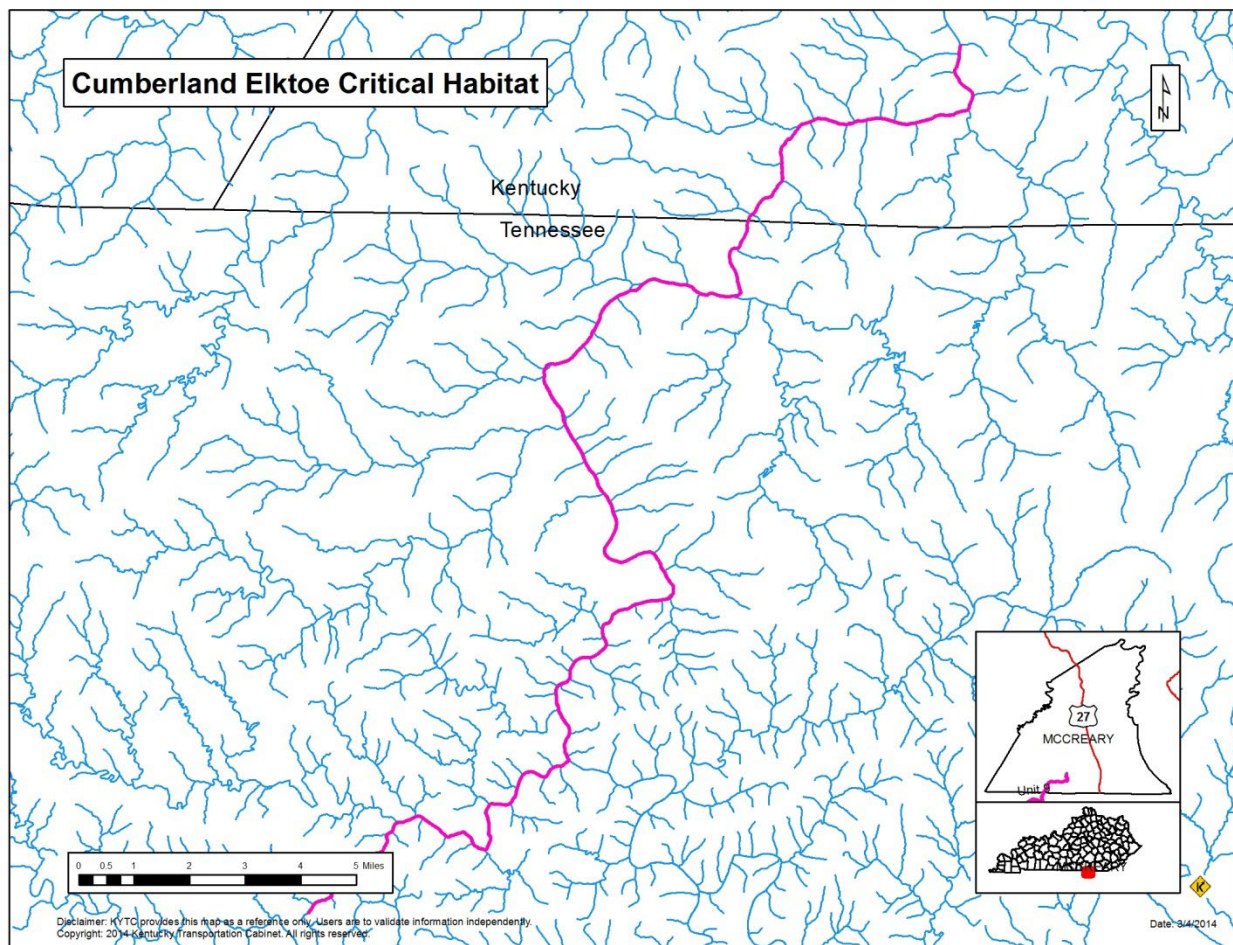
Unit 8. Rock Creek, McCreary County, Kentucky

Unit 8 includes 17.4 rkm (11.0 rmi) of the main stem of Rock Creek and begins at the Rock Creek/White Oak Creek confluence and extends upstream to the low water crossing at rkm 25.6 (rmi 15.9) approximately 2.6 km (1.6 mi) southwest of Bell Farm in McCreary County, Kentucky.



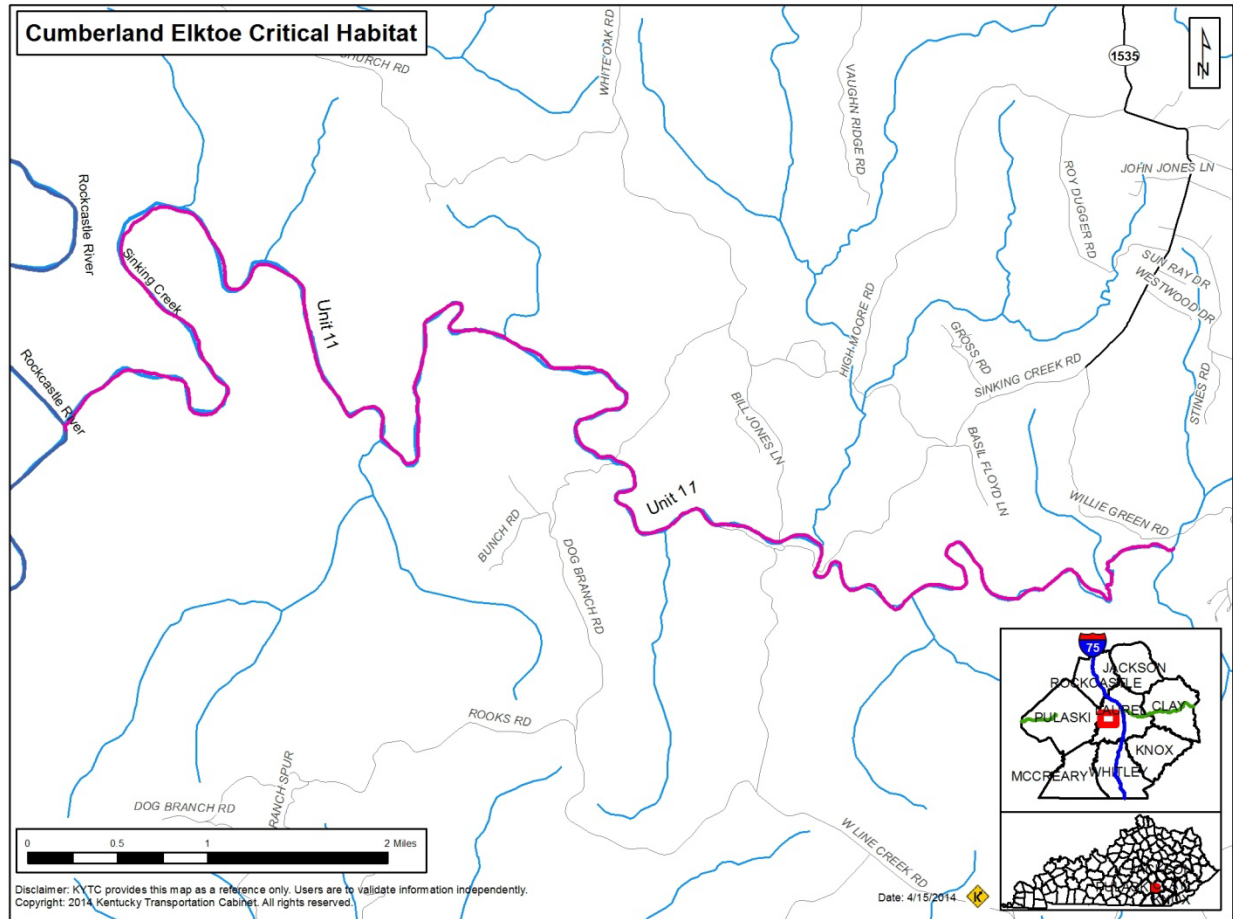
Unit 9. Big South Fork and Tributaries, Fentress, Morgan, and Scott Counties, Tennessee, and McCreary County, Kentucky.

Unit 9 encompasses 153 rkm (95 rmi) and consists of 43 rkm (27 rmi) of the Big South Fork of the Cumberland River main stem from its confluence with Laurel Crossing Branch downstream of Big Shoals, McCreary County, Kentucky, upstream to its confluence with the New River and Clear Fork, Scott County, Tennessee; 11 rkm (7 rmi) of North White Oak Creek from its confluence with the Big South Fork upstream to Panther Branch, Fentress County, Tennessee; 14.5 rkm (9.0 rmi) of the New River from its confluence with Clear Fork upstream to U.S. Highway 27, Scott County, Tennessee; 40 rkm (25 rmi) of Clear Fork from its confluence with the New River upstream to its confluence with North Prong Clear Fork, Morgan and Fentress Counties, Tennessee; 10 rkm (6 rmi) of White Oak Creek from its confluence with Clear Fork upstream to its confluence with Bone Camp Creek, Morgan County, Tennessee; 6 rkm (4 rmi) of Bone Camp Creek from its confluence with White Oak Creek upstream to Massengale Branch, Morgan County, Tennessee; 14.5 rkm (9.0 rmi) of Crooked Creek from its confluence with Clear Fork upstream to Buttermilk Branch, Fentress County, Tennessee; and 14.5 rkm (9 rmi) of North Prong Clear Fork from its confluence with Clear Fork upstream to Shoal Creek, Fentress County, Tennessee.



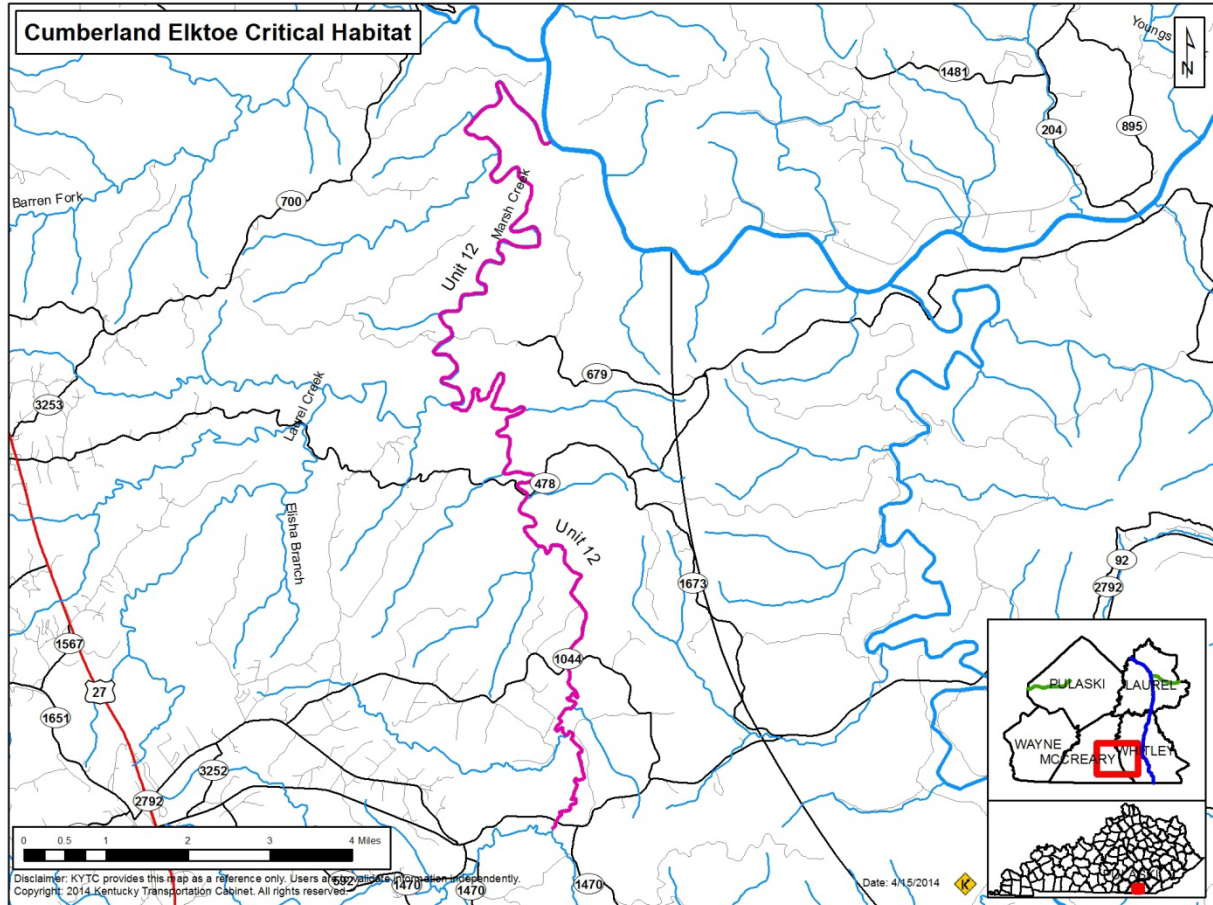
Unit 11. Sinking Creek, Laurel County, Kentucky.

Unit 11 encompasses 13 rkm (8 rmi) and extends from the Sinking Creek/ Rockcastle River confluence upstream to Sinking Creek's confluence with Laurel Branch in Laurel County, Kentucky.



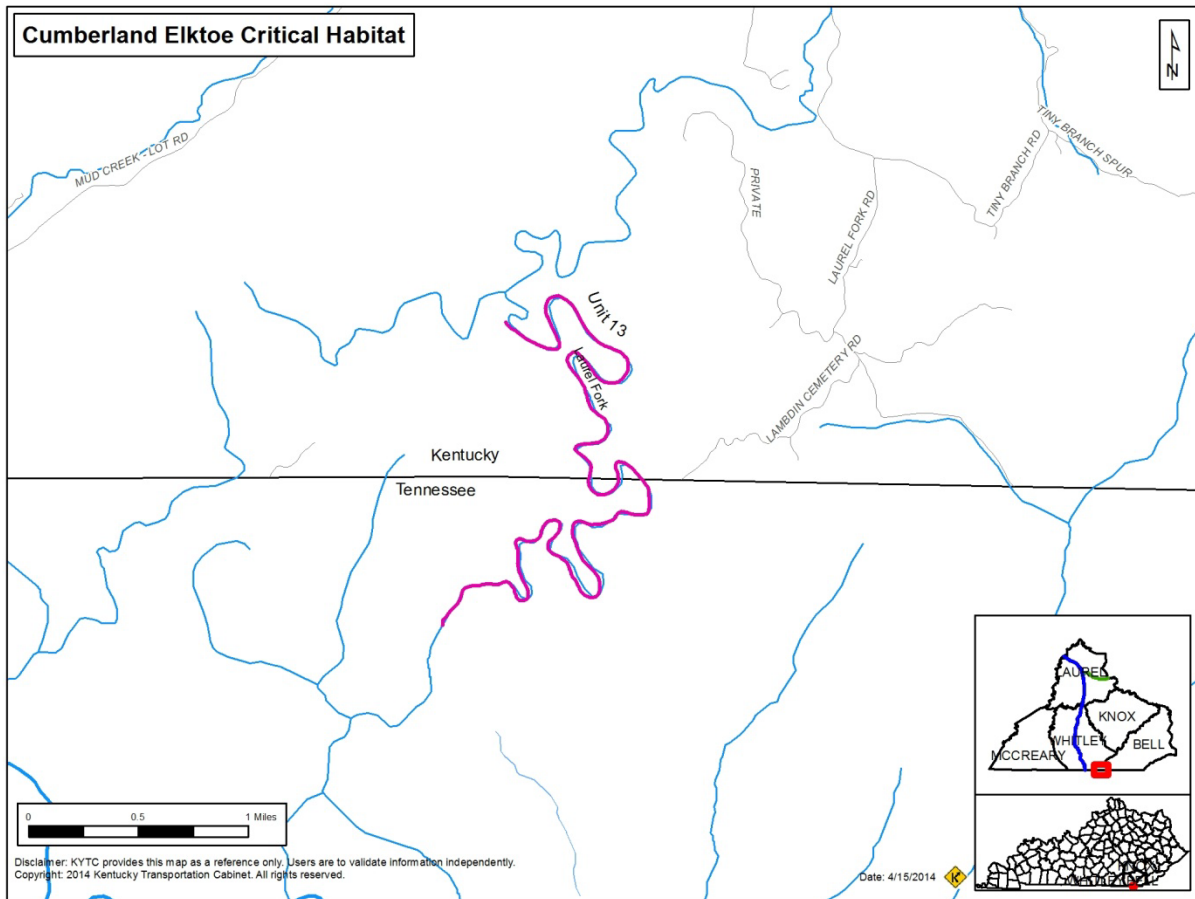
Unit 12. Marsh Creek, McCreary County, Kentucky.

Unit 12 includes 24 rkm (15 rmi) and consists of Marsh Creek from its confluence with the Cumberland River upstream to the State Road 92 Bridge in McCreary County, Kentucky.



Unit 13. Laurel Fork, Claiborne County, Tennessee, and Whitley County, Kentucky.

Unit 13 includes 8 rkm (5 rmi) of Laurel Fork of the Cumberland River from the Campbell/Claiborne County line upstream 11.0 rkm (6.9 rmi) through Claiborne County, Tennessee, to Whitley County, Kentucky. The upstream terminus is 3 rkm (2 rmi) upstream of the Kentucky/Tennessee State line.



Cumberlandian Combshell (*Epioblasma brevidens*)



Figure 4 Photo courtesy: <http://www.dinkinsbiological.com/virginia.html>

Species Description

The Cumberlandian combshell (*Epioblasma brevidens*) was listed as **endangered** in 1997.

The Cumberlandian combshell has a thick solid shell with a smooth to cloth-like periostracum, which is yellow to tawny brown in color with narrow green broken rays. The nacre is white. The shells of females are inflated, with serrated teeth-like structures along a portion of the shell margin. Umbo is even with the hinge line. Cardinal teeth are large and serrated; lateral teeth thick and slightly curved. Length 2-3 inches.

Habitat Description

The Cumberlandian combshell inhabits **large streams to large rivers**. It is often found in water depths of less than 3 feet in clear, clean water of sand, gravel, or rocky substrates. It is absent from smaller tributary type streams.

Critical Habitat

Yes - (see additional maps and detailed descriptions provided after the decision key)

Critical habitat for the Cumberlandian combshell was designated on August 31, 2004.

Primary constituent elements of critical habitat for this species include:

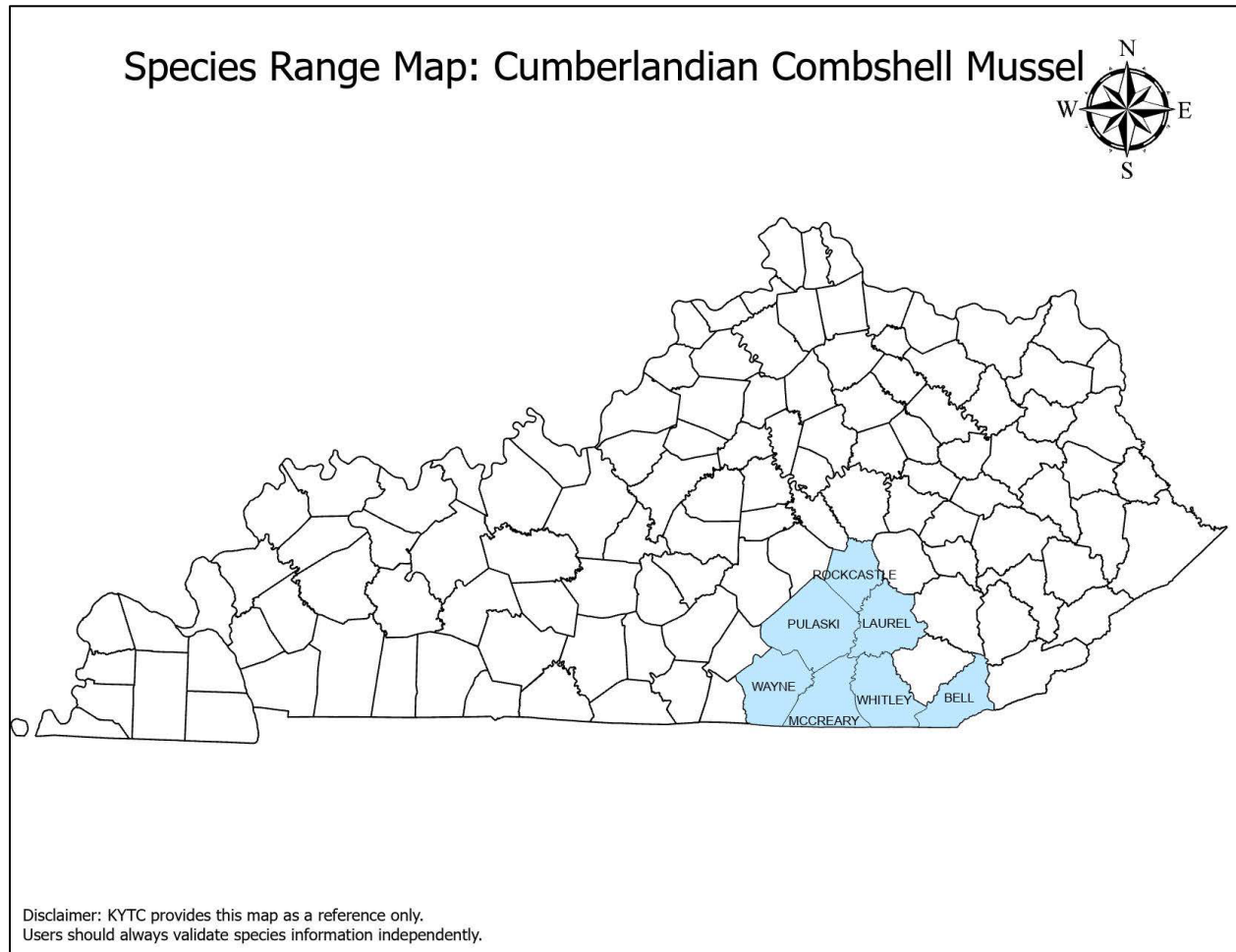
1. Permanent, flowing stream reaches with a flow regime (i.e. the magnitude, frequency, duration, and seasonality of discharge over time) necessary for normal behavior, growth, and survival of all life stages of the five mussels and their host fish.
2. Geomorphically stable stream and river channels and banks (structurally stable stream cross section).
3. Stable substrates, consisting of mud, sand, gravel, and/or cobble/ boulder, with low amounts of fine sediments or attached filamentous algae.
4. Water quality (including temperature, turbidity, oxygen content, and other characteristics) necessary for the normal behavior, growth, and survival of all life stages of the mussels and their host fish.
5. Fish hosts with adequate living, foraging, and spawning areas.

Species, Stream (unit), and State	Currently Occupied			Currently Unoccupied		
	River Miles			River Miles		
Cumberlandian Combshell						
Duck River (Unit 1), TN	.....			46		
Bear Creek (Unit 2), AL, MS	25			.....		
Powell River (Unit 4), TN, VA	94			.....		
Clinch River (Unit 5), TN, VA	148			.....		
Nolichucky River (Unit 6), TN	.....			5		
Big South Fork (Unit 9), TN, KY	27			.....		
Buck Creek (Unit 10), KY	36			.....		

Range

The Cumberlandian combshell has been extirpated from a large percentage of its former range. Main-stem populations in both the Cumberland and Tennessee Rivers are now considered extirpated. This species has apparently also been largely eliminated from numerous tributaries in the Cumberland River system (e.g., Rockcastle River, Beaver Creek, Obey River, Caney Fork, Stones River, Red River) and the Tennessee River system (e.g., Station Creek, Wallen Creek, Holston River, Nolichucky River, West Prong Little Pigeon River, Little Tennessee River, Paint Rock River, Elk River, Little Bear Creek, Cedar Creek, Duck River).

The Cumberlandian combshell has also been extirpated from large portions of additional tributaries in the Cumberland Region (e.g., Clinch River, Powell River, North Fork Holston River, Bear Creek). Extant Cumberland River system populations occur in Buck Creek, Pulaski County, Kentucky; and Big South Fork, Scott County, Tennessee, and McCreary County, Kentucky. In the Tennessee River system, populations are thought to remain in the Clinch River, Scott County, Virginia, and Hancock County, Tennessee; Powell River, Lee County, Virginia, and Claiborne and Hancock Counties, Tennessee; and Bear Creek, Colbert County, Alabama, and Tishomingo County, Mississippi. Non-essential, experimental populations have been established in the Tennessee River in Alabama, and in portions of the French Broad and Holston Rivers in Tennessee.

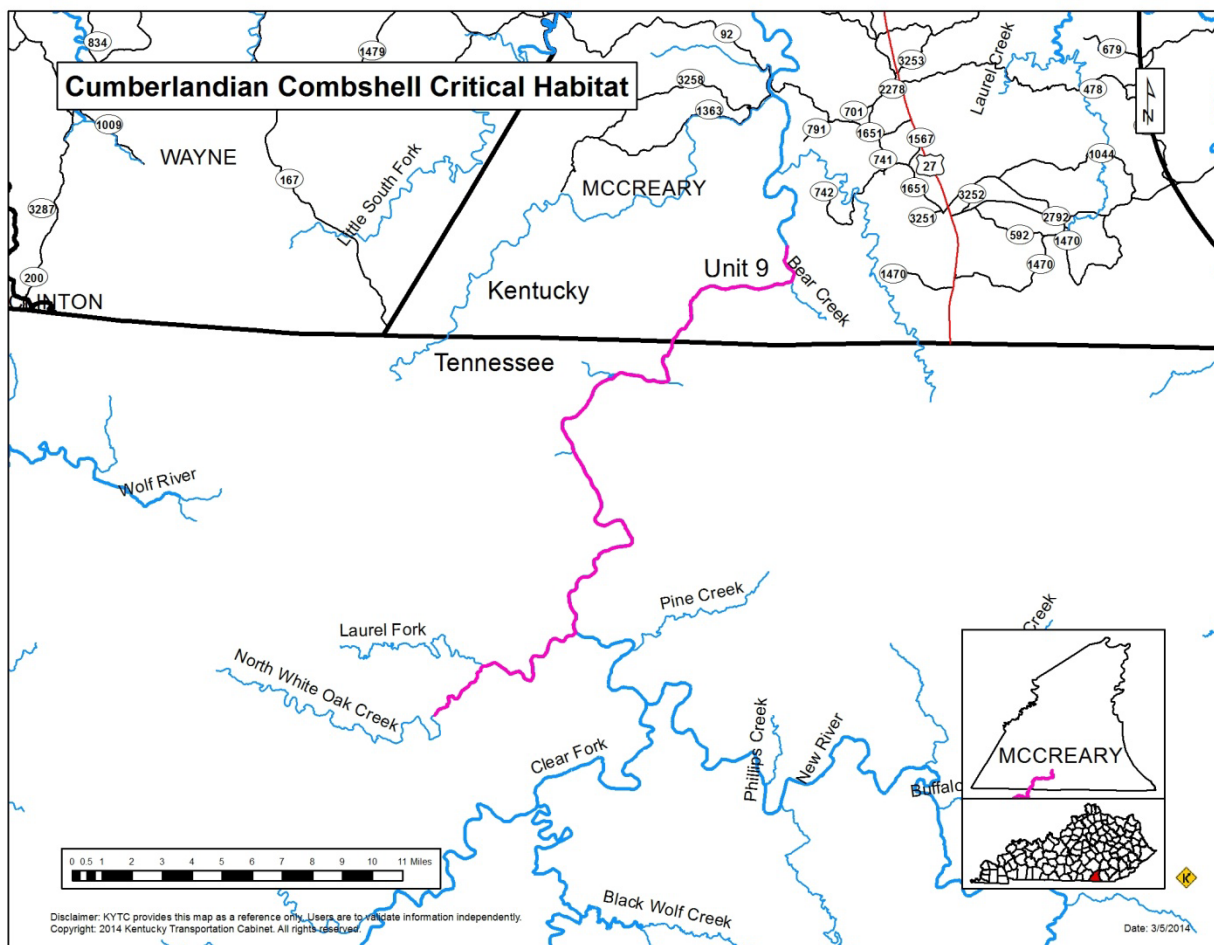


Decision Key

- 1) Does the project include any direct or indirect effects to **large streams, to large rivers or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)
 - a. Yes: Contact SME
 - b. No: Prepare NE finding

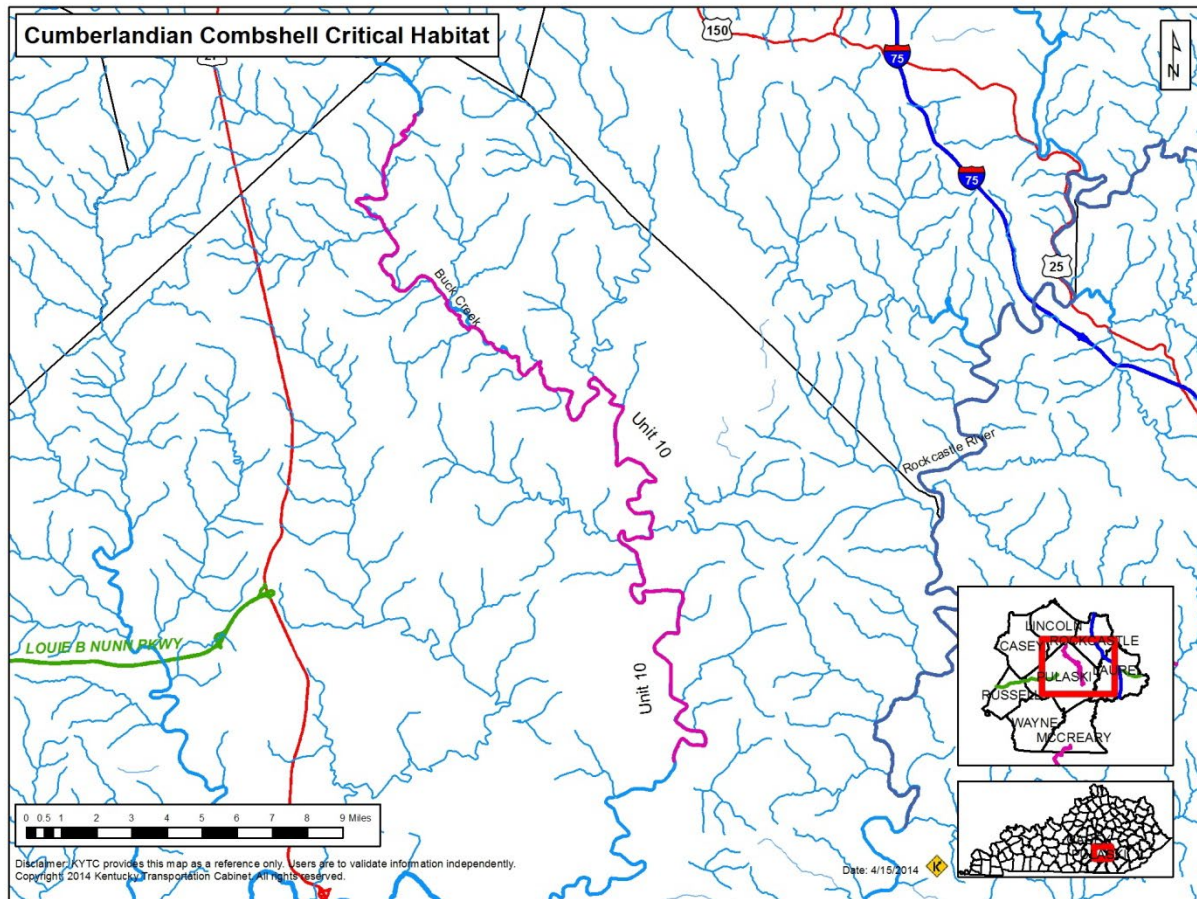
Unit 9. Big South Fork and Tributaries, Fentress, Morgan, and Scott Counties, Tennessee, and McCreary County, Kentucky.

Unit 9 encompasses 153 rkm (95 rmi) and consists of 43 rkm (27 rmi) of the Big South Fork of the Cumberland River main stem from its confluence with Laurel Crossing Branch downstream of Big Shoals, McCreary County, Kentucky, upstream to its confluence with the New River and Clear Fork, Scott County, Tennessee; 11 rkm (7 rmi) of North White Oak Creek from its confluence with the Big South Fork upstream to Panther Branch, Fentress County, Tennessee; 14.5 rkm (9.0 rmi) of the New River from its confluence with Clear Fork upstream to U.S. Highway 27, Scott County, Tennessee; 40 rkm (25 rmi) of Clear Fork from its confluence with the New River upstream to its confluence with North Prong Clear Fork, Morgan and Fentress Counties, Tennessee; 10 rkm (6 rmi) of White Oak Creek from its confluence with Clear Fork upstream to its confluence with Bone Camp Creek, Morgan County, Tennessee; 6 rkm (4 rmi) of Bone Camp Creek from its confluence with White Oak Creek upstream to Massengale Branch, Morgan County, Tennessee; 14.5 rkm (9.0 rmi) of Crooked Creek from its confluence with Clear Fork upstream to Buttermilk Branch, Fentress County, Tennessee; and 14.5 rkm (9 rmi) of North Prong Clear Fork from its confluence with Clear Fork upstream to Shoal Creek, Fentress County, Tennessee.



Unit 10. Buck Creek, Pulaski County, Kentucky.

Unit 10 encompasses 58 rkm (36 rmi) and includes Buck Creek from the State Route 192 Bridge upstream to the State Route 328 Bridge in Pulaski County, Kentucky. Buck Creek is considered currently occupied by the Cumberlandian combshell.



Cumberland Moccasinshell (*Medionidus conradicus*)



Figure 5 Photo Credit: <https://conchology.be/?t=68&u=684067&g=>

Species Description

The Cumberland moccasinshell was listed as **proposed endangered** species in August of 2023.

The Cumberland moccasinshell is elongate and elliptical in shape and can reach up to ~2.5 inches in length. It is a relatively thin-shelled

mussel and moderately inflated. The anterior margin is broadly rounded, while the posterior margin is narrowly rounded with the posterior ridge ending in the rounded point of the posterior. Both the ventral and dorsal margins are relatively straight. Ridges/costations are typical in the posterior slope. The mussel is yellow brown to dark green brown. The entire shell is commonly covered in fine green rays. The pseudocardinal teeth are small but sturdy and moderately compressed. The lateral teeth are robust. The beak cavity is shallow and broad, and the nacre is a distinctive grey to bluish green.

Habitat Description

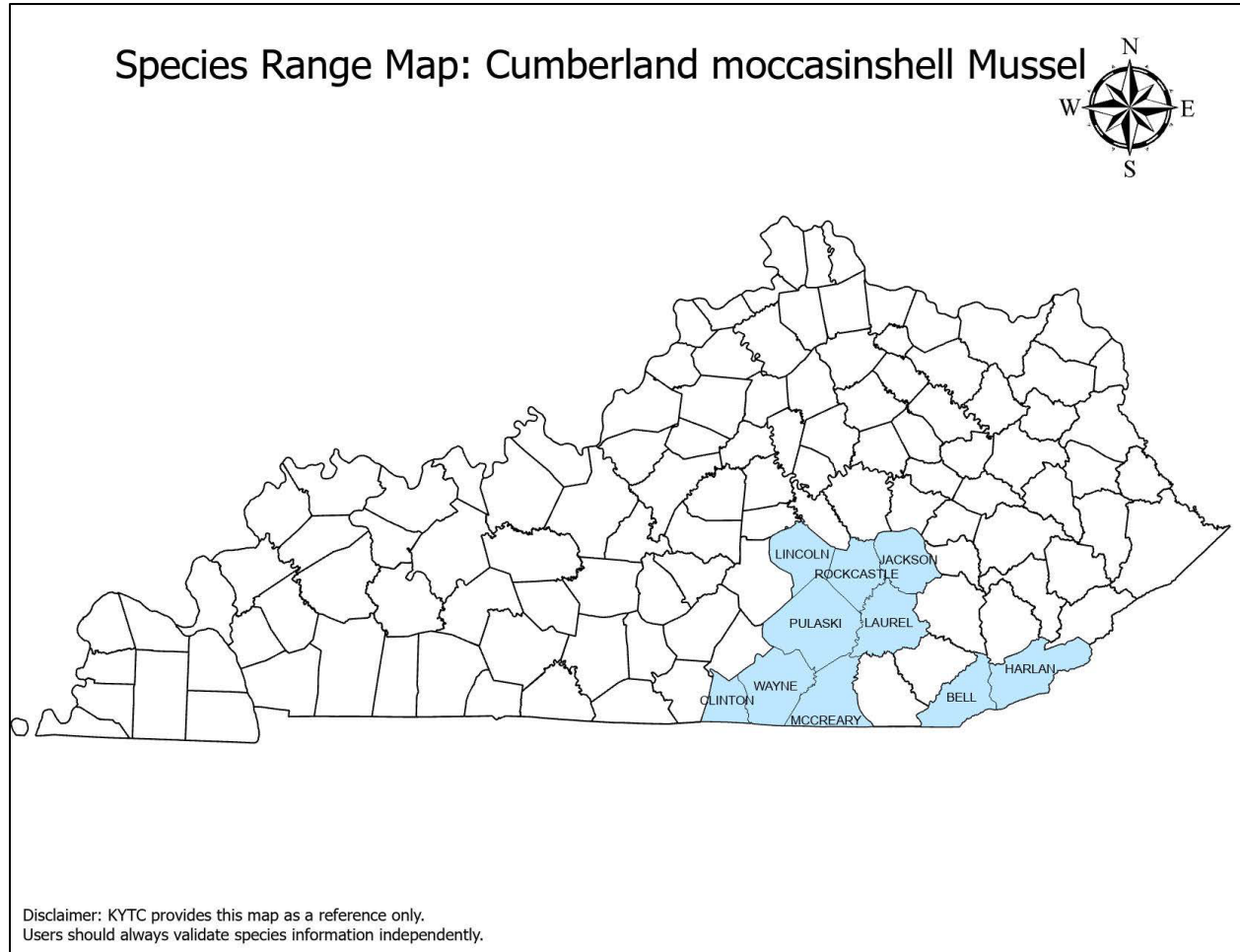
The Cumberland moccasinshell inhabits small streams to medium-sized rivers in substrates dominated by sand and gravel. It can also be found in cracks of bedrock or under flat rocks.

Critical Habitat

None

Range

The Cumberland moccasinshell is limited in distribution to the tributaries, but not the mainstem, of the upper and lower Cumberland River.



Decision Key

- 1) Does the project include any direct or indirect effects to **perennial streams or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)
 - a. Yes: Contact SME
 - b. No: Prepare NE finding

Dromedary Pearlymussel (*Dromus dromas*)

Species Description

The dromedary pearlymussel was listed as **endangered** in 1976.

The species is commonly known as the dromedary mussel, or the camel mussel, because of a distinct hump present near the umbo on big river specimens, which is morphologically different from the headwater form.



Figure 6 Photo Credit: <http://www.joelsartore.com/stock/ESA002-00352/>

The dromedary pearlymussel is a medium-sized species, rounded to sub-triangular in outline with full, high beaks set forward. Valves are usually solid and inflated. Beak sculpture consists of a series of fine ridges running parallel with growth lines. The outer surface of the shell near the median line has a strong concentric ridge or hump with a curved row of smaller knobs near the midline extending from the umbo area near the ventral margin. The outer covering of the shell is generally yellowish-green in color with broken green rays covering the shell. Further, numerous smaller rays of dots or broken lines mixed with wider green rays or blotches cover the surface of the shell. Cardinal teeth are large and serrated; lateral teeth are thick and short. Length 3-4 inches.

Habitat Description

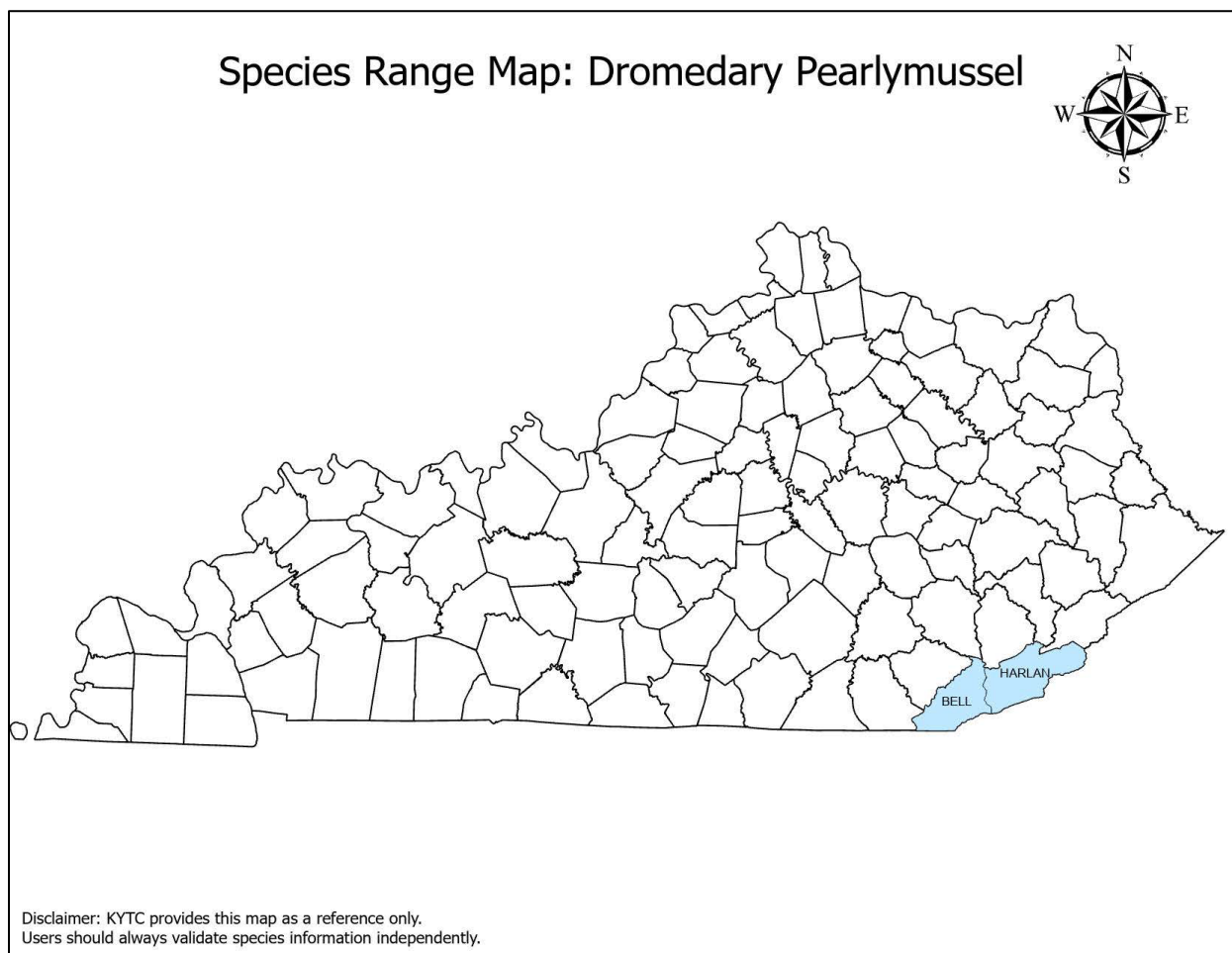
These mussels are usually found in clean, fast-flowing water in substrates that contain relatively firm rubble, gravel, and sand swept free from siltation. These mussels are usually found buried in the substrate in shallow riffle and shoal areas. It can occur from **small, headwater streams to large rivers**.

Critical Habitat

None

Range

The dromedary pearlymussel is restricted to the Cumberland and Tennessee Rivers from the major headwater tributary streams as far as Muscle Shoals in northern Alabama. Non-essential, experimental populations have been established in the Tennessee River in Alabama, and in portions of the French Broad and Holston Rivers in Tennessee.



Decision Key

- 1) Does the project include any direct or indirect effects to **perennial streams or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)
 - a. Yes: Contact SME
 - b. No: Prepare NE finding

Fanshell Mussel (*Cyprogenia stegaria*)

Species Description

The fanshell mussel was listed as **endangered** in 1990.

The fanshell has a rounded shell that is moderately inflated and thick. The umbo is wide and prominent, and slightly above hinge line. The periostracum is dull, not shiny, with a base color of yellowish to tan, patterned with radiating rows of green rays composed of microscopic flecks. The shell has coarse, concentric growth ridges overlain by numerous small pustules, particularly on the posterior half. These characteristics can vary greatly between individuals. Nacre is white. Cardinal teeth are large and serrated; lateral teeth are thick and short. Length 3-4 inches.



Figure 7 Photo Credit:
<http://www.flickr.com/photos/ttravisbrownphotos/8695252379/>

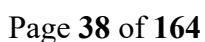
Habitat Description

These mussels are most often associated with stable substrates of sand, gravel, and cobble. They are usually found at depths of less than three feet in strongly flowing water in **large streams to large rivers**.

Critical Habitat

None

The fanshell was historically widely distributed in the Ohio, Wabash, Cumberland, and Tennessee Rivers and their larger tributaries in Pennsylvania, Ohio, West Virginia, Illinois, Indiana, Kentucky, Tennessee, Alabama, and Virginia. In Kentucky, they are still considered to be potentially occurring in the Ohio, Salt, Licking, Little Sandy, Tygarts, Kentucky, Red, Cumberland, Tennessee, Green, Barren, and Clarks River systems. They are fairly ubiquitous statewide, but populations are distributed sporadically. The Green and Licking River populations remain two of the best in the nation for this species. Non-essential, experimental populations have been established in portions of the French Broad and Holston Rivers in Tennessee.



Decision Key

- 1) Does the project include any direct or indirect effects to **large streams, to large rivers or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)
 - a. Yes: Contact SME
 - b. No: Prepare NE finding

Fat Pocketbook Mussel (*Potamilus capax*)

Species Description

The fat pocketbook was listed as **endangered** in 1976.

The shell of the fat pocketbook is round to oval, greatly inflated, and moderately thin. Anterior and posterior margins are rounded. Umbos are greatly inflated and elevated above the hinge line.

There are small wings anterior and posterior to the umbo. The

shell is smooth, shiny, rayless, and yellow, tan, olive, or dark brown in color. Cardinal teeth are thin and blade like; later teeth are thin and curved. The nacre is white, sometimes with a tinge of pink. Length 4-5 inches.



Figure 8 Photo Credit:
<http://www.inhs.illinois.edu/collections/mollusk/publications/guide/index/128>

Habitat Description

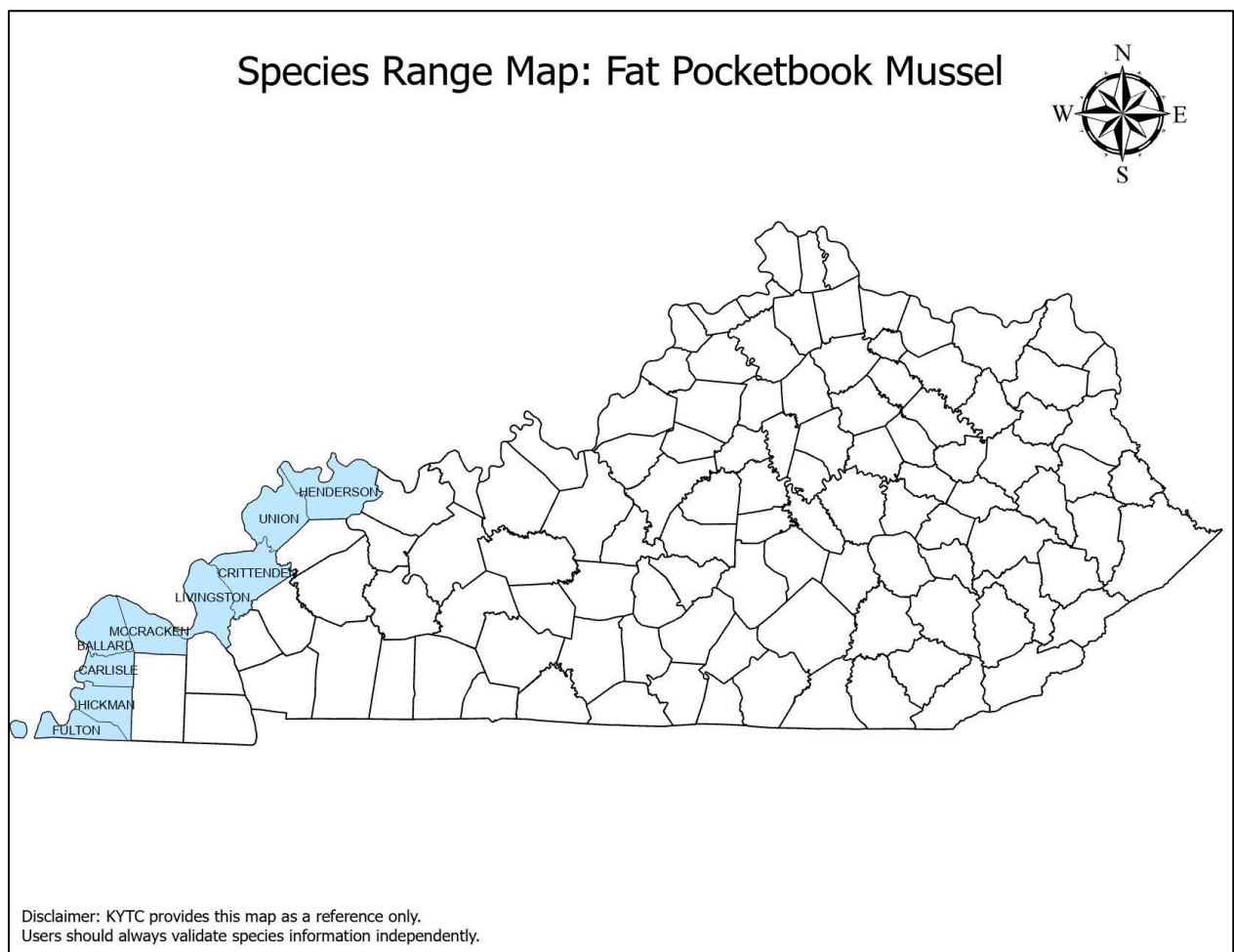
The fat pocketbook is most commonly found in a mixture of sand, clay, and silt, which is referred to as “sticky mud.” This “sticky mud” substrate can be 100cm deep and virtually impossible to walk through. Because of its very thin and globose shell, fat pocketbook tolerates deep deposits of fine-grained silt substratum and would not survive in gravel substratum with erosive flows--habitats usually dominated by heavy, thick-shelled bivalves. Historically, the fat pocketbook was probably most common in large river sloughs and oxbows with silt substratum, which were more common at the mouths of rivers before developments such as locks, dams, levees, and bank protection measures. The fat pocketbook can still be common in deep deposits of fine-grained sediments in man-made ditches or in slow moving rivers, streams, sloughs, and bayous.

Critical Habitat

None

Range

Although range maps depict this species along the Ohio and Wabash Rivers, large numbers of this species have not been reported outside the St. Francis watershed (Missouri and Arkansas). However, it is likely that the fat pocketbook can still be found in waters adjacent to the Ohio River in Kentucky.



Decision Key

- 1) Does the project include any direct or indirect effects to any **slow moving or stagnant streams/rivers/waterbodies or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)
 - a. Yes: Contact SME
 - b. No: Prepare NE finding

Fluted Kidneyshell (*Ptychobranchus subtentus*)

Species Description

The fluted kidneyshell was listed as **endangered** in September of 2013.

The shape of the shell is roughly oval elongate, and the solid, relatively heavy valves (shells) are moderately inflated.



Figure 9 Photo Credit:
http://marcelomarks50.blogspot.com/2013_04_28_archive.html

A series of flutings (parallel ridges or grooves) characterizes the posterior slope of each valve. The shell is typically greenish, or brownish-yellow with broad, broken green rays. Cardinal teeth are moderately large; lateral teeth thick and relatively short. Length 3-4 inches.

Habitat Description

The fluted kidneyshell occurs in **small streams to medium-sized rivers**, inhabiting sand and gravel substrates in relatively shallow riffles and shoals with moderate to swift current. In comparison to some co-occurring species, the fluted kidneyshell demonstrates strong habitat specificity by being associated with faster flows, greater shear stress (force of water pressure and velocity on the substrate), and low substrate embeddedness, usually at depths of less than 2 feet.

Critical Habitat

Yes - (*see additional maps and detailed descriptions provided after the decision key*)

Critical habitat was designated for the fluted kidneyshell on September 26, 2013.

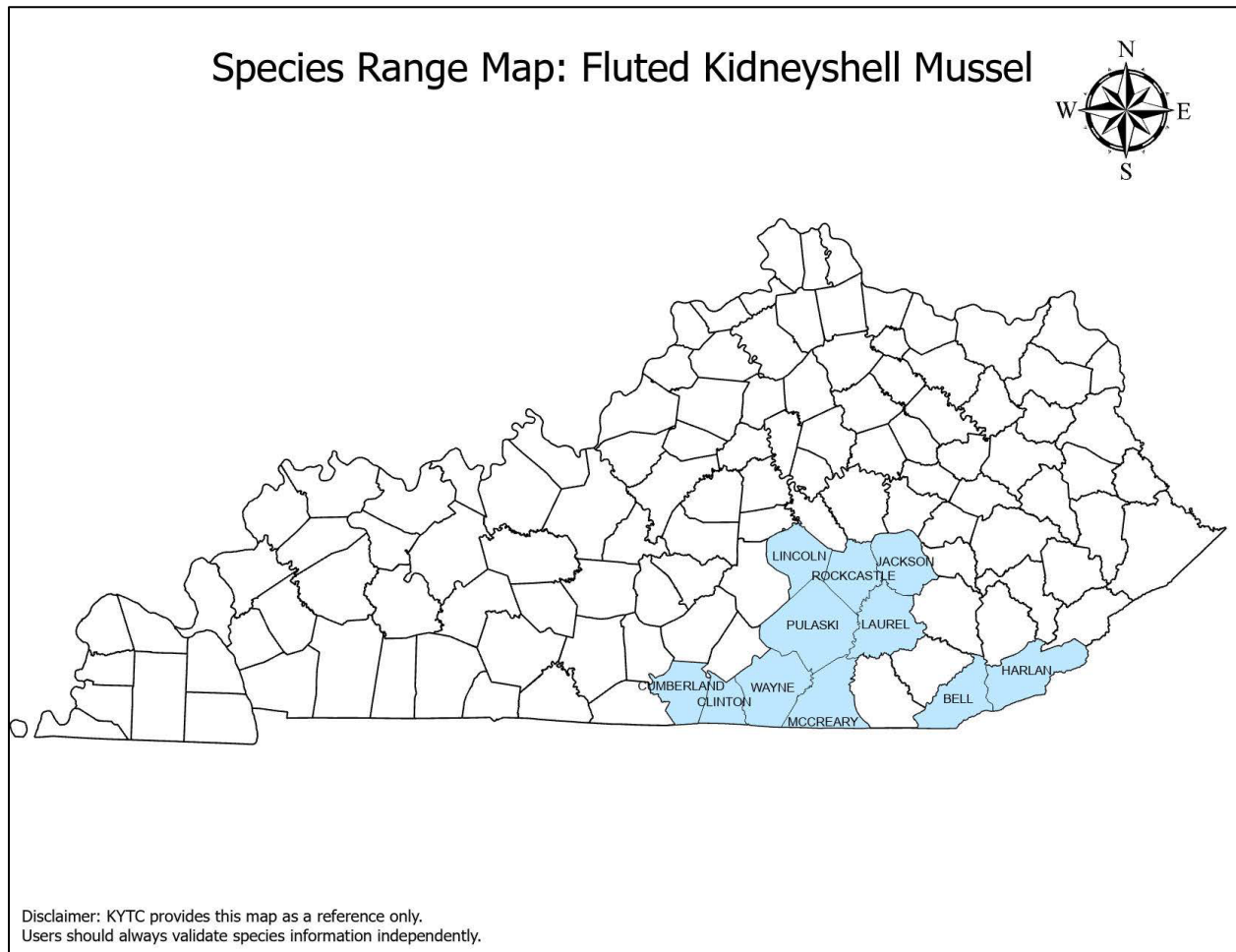
Primary constituent elements for the fluted kidneyshell include:

1. Riffle habitats within large, geomorphically stable stream channels (channels that maintain lateral dimensions, longitudinal profiles, and sinuosity patterns over time without an aggrading or degrading bed elevation).
2. Stable substrates of sand, gravel, and cobble with low to moderate amounts of fine sediment and containing flow refugia with low shear stress.
3. A natural hydrologic flow regime (the magnitude, frequency, duration, and seasonality of discharge over time) necessary to maintain benthic habitats where the species are found, and connectivity of rivers with the floodplain, allowing the exchange of nutrients and sediment for habitat maintenance, food availability for all life stages, and spawning habitat for native fishes.
4. Water quality with low levels of pollutants and including a natural temperature regime, pH (between 6.0 and 8.5), oxygen content (not less than 5.0 milligrams per liter (mg/L)), hardness, and turbidity necessary for normal behavior, growth, and viability of all life stages.
5. The presence of abundant fish hosts, which may include the barcheck darter, fantail darter, rainbow darter, redline darter, bluebreast darter, dusky darter and banded sculpin, necessary for recruitment of the fluted kidneyshell.

Species, Stream (unit), and State		Currently Occupied			Currently Unoccupied		
		River Miles			River Miles		
	Fluted Kidneyshell						
	Horse Lick Creek (FK1), KY		12.4			.....	
	Middle Fork Rockcastle River (FK2), KY		7.7			.....	
	Rockcastle River (FK3), KY		.....			43.5	
	Buck Creek (FK4), KY		37.9			.....	
	Rock Creek (FK5), KY		11.9			.....	
	Little South Fork Cumberland River (FK6), KY		40.7			.....	
	Big South Fork Cumberland River (FK7), KY		56.9			.....	
	* Units FK8 - FK24 are not in KY						

Range

The fluted kidneyshell is a Cumberlandian Region mussel, meaning it is restricted to the Cumberland (in Kentucky and Tennessee) and Tennessee (in Alabama, Kentucky, Tennessee, and Virginia) River systems.

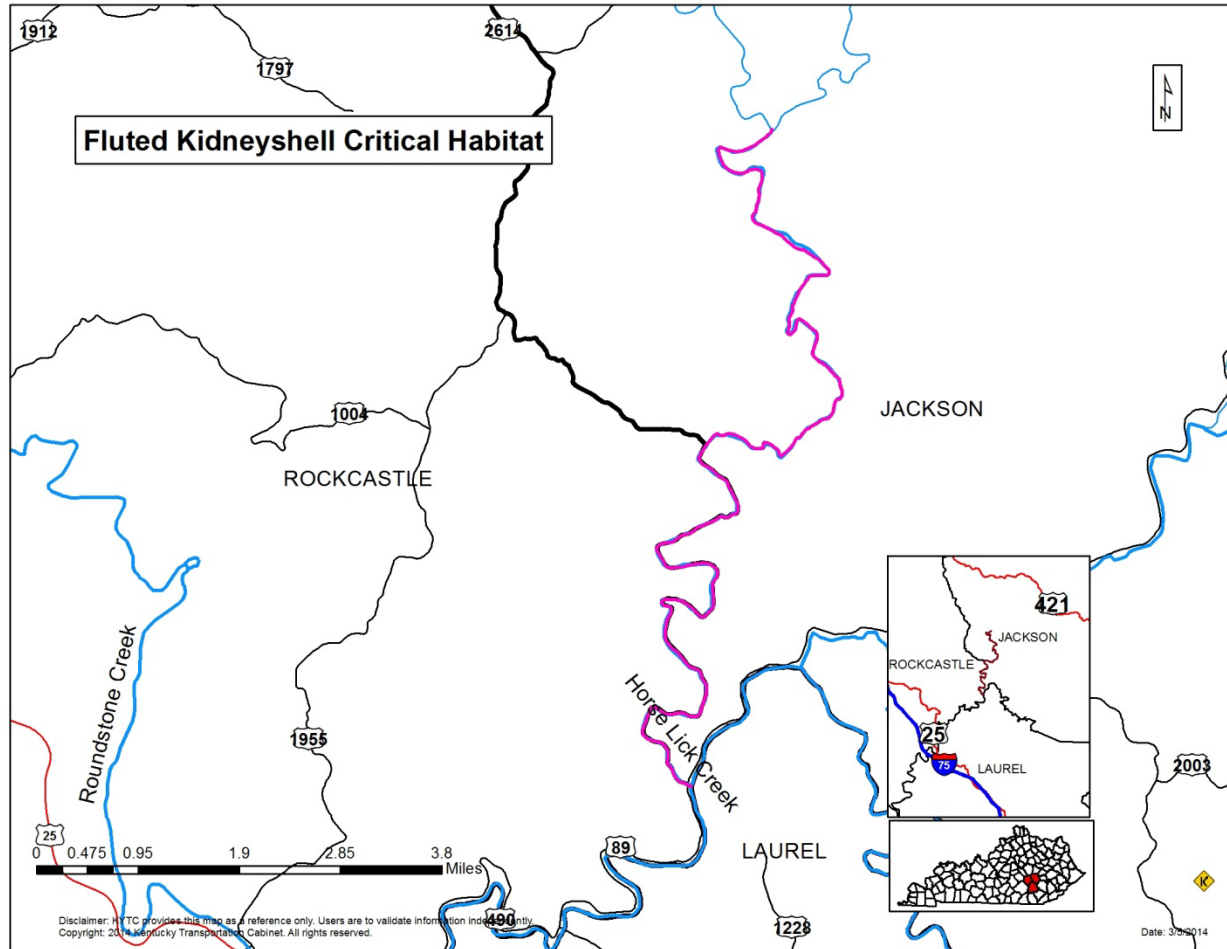


Decision Key

- 1) Does the project include any direct or indirect effects to **perennial streams or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)
 - a. Yes: Contact SME
 - b. No: Prepare NE finding

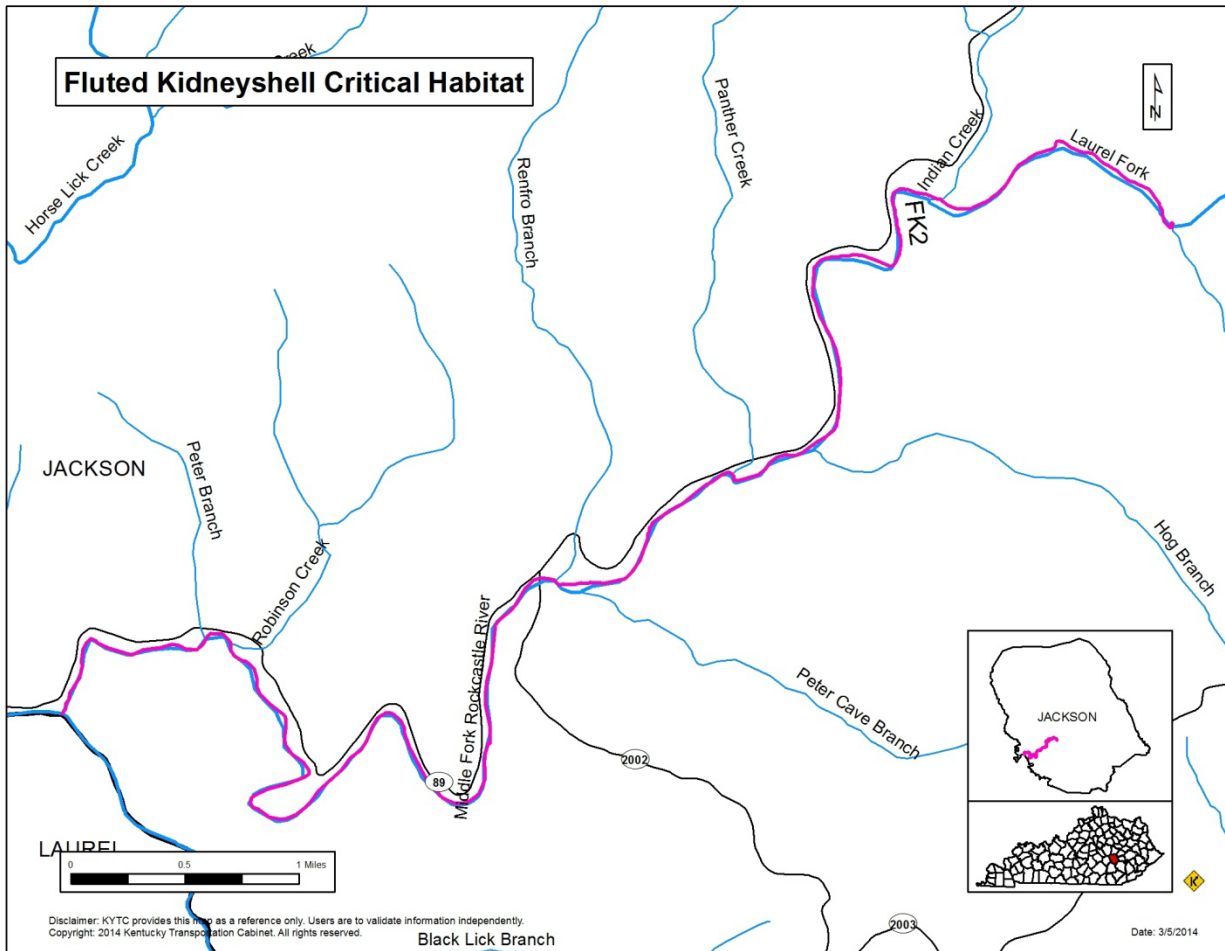
Unit FK1: Horse Lick Creek, Rockcastle and Jackson Counties, Kentucky.

Unit FK1 encompasses approximately 19 rkm (12 rmi) of Horse Lick Creek, in Rockcastle and Jackson Counties, KY. It includes the mainstem of Horse Lick Creek from its confluence with the Rockcastle River upstream to Clover Bottom Creek.



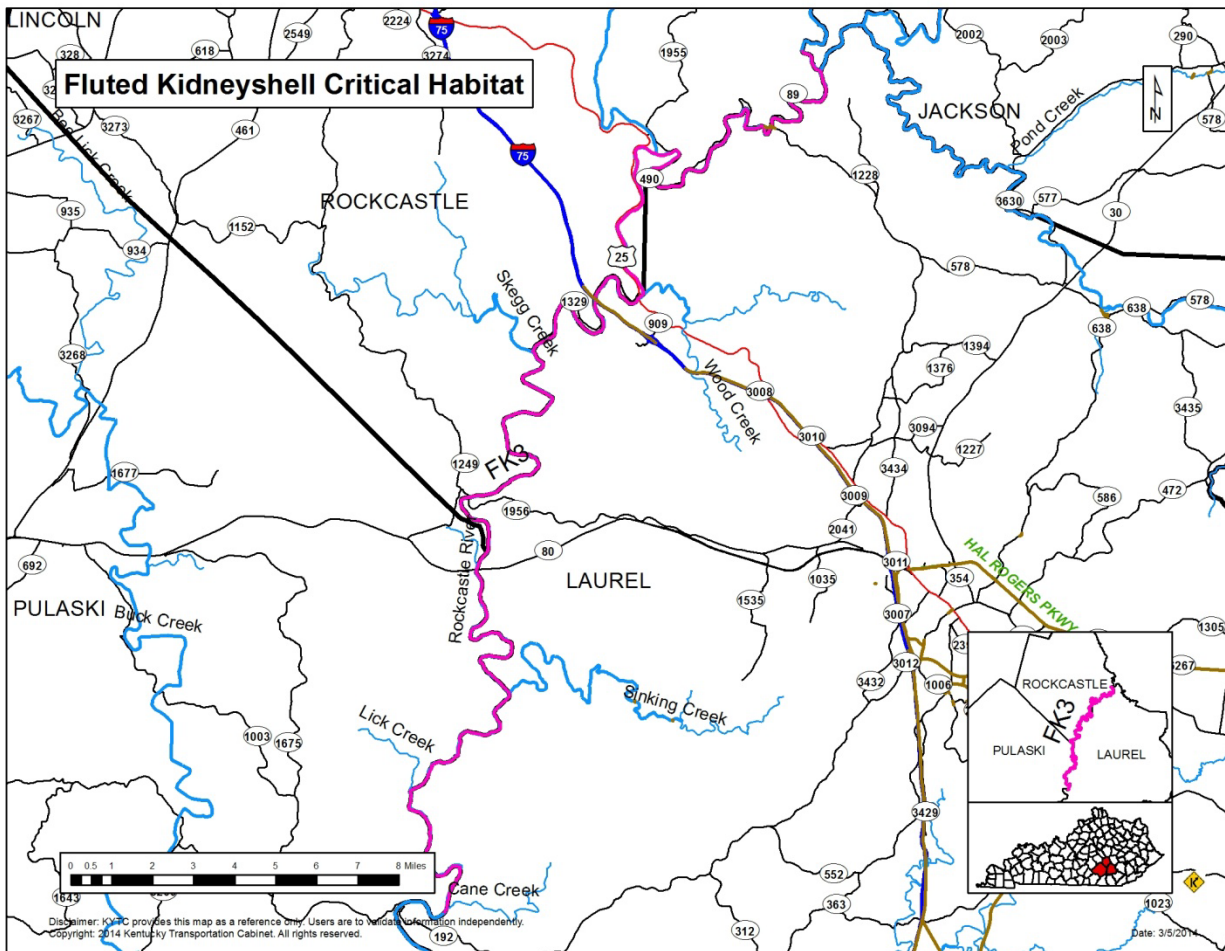
Unit FK2: Middle Fork Rockcastle River, Jackson County, Kentucky.

Unit FK2 includes 12.5 rkm (7.7 rmi) of the Middle Fork Rockcastle River from its confluence with the Rockcastle River upstream to its confluence with Indian Creek and Laurel Fork in Jackson County, KY.



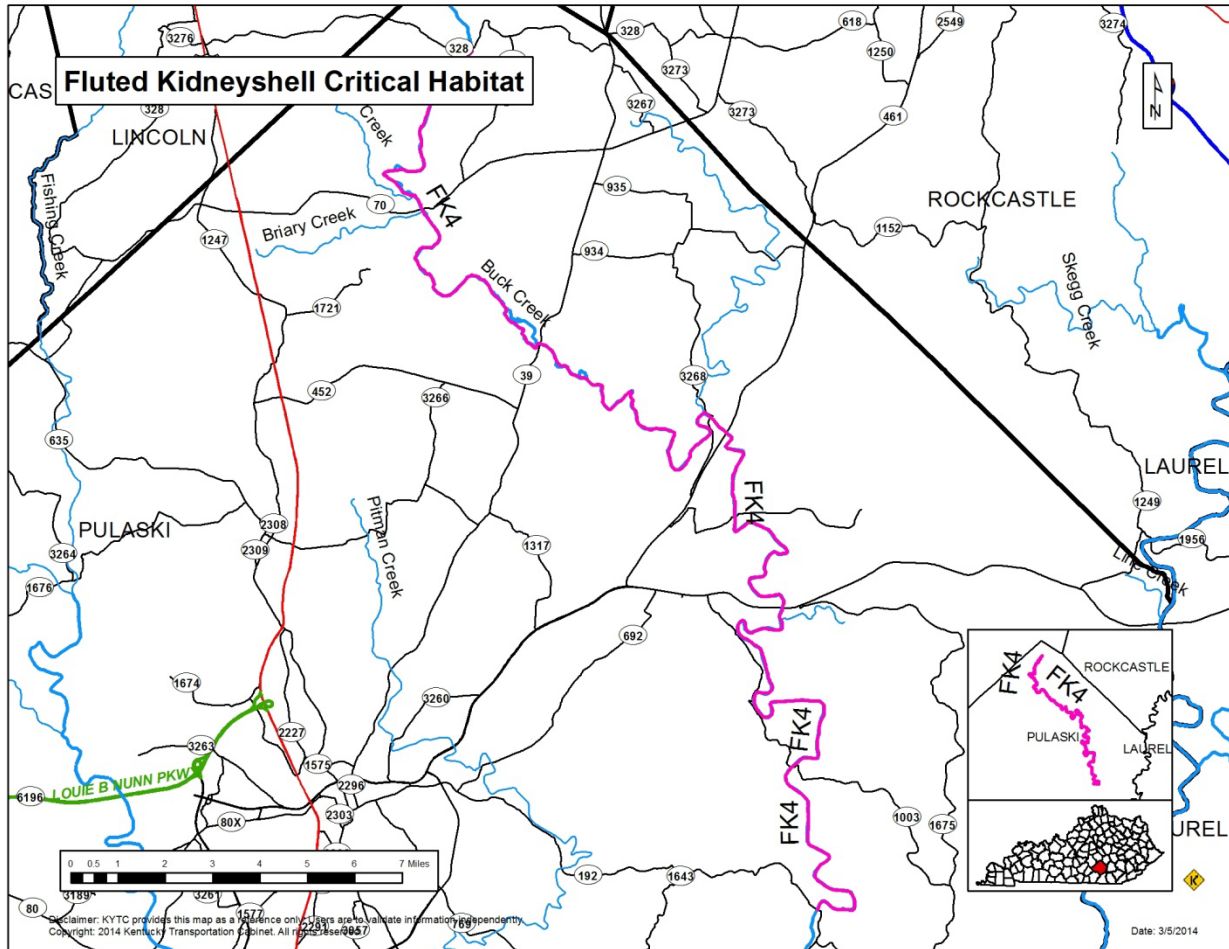
Unit FK3: Rockcastle River, Pulaski, Laurel, and Rockcastle Counties, Kentucky.

Unit FK3 includes approximately 70 rkm (43 rmi) of the Rockcastle River from the backwaters of Lake Cumberland near its confluence with Cane Creek along the Laurel and Pulaski County line, KY, upstream to its confluence with Horse Lick Creek along the Laurel and Rockcastle County line, KY.



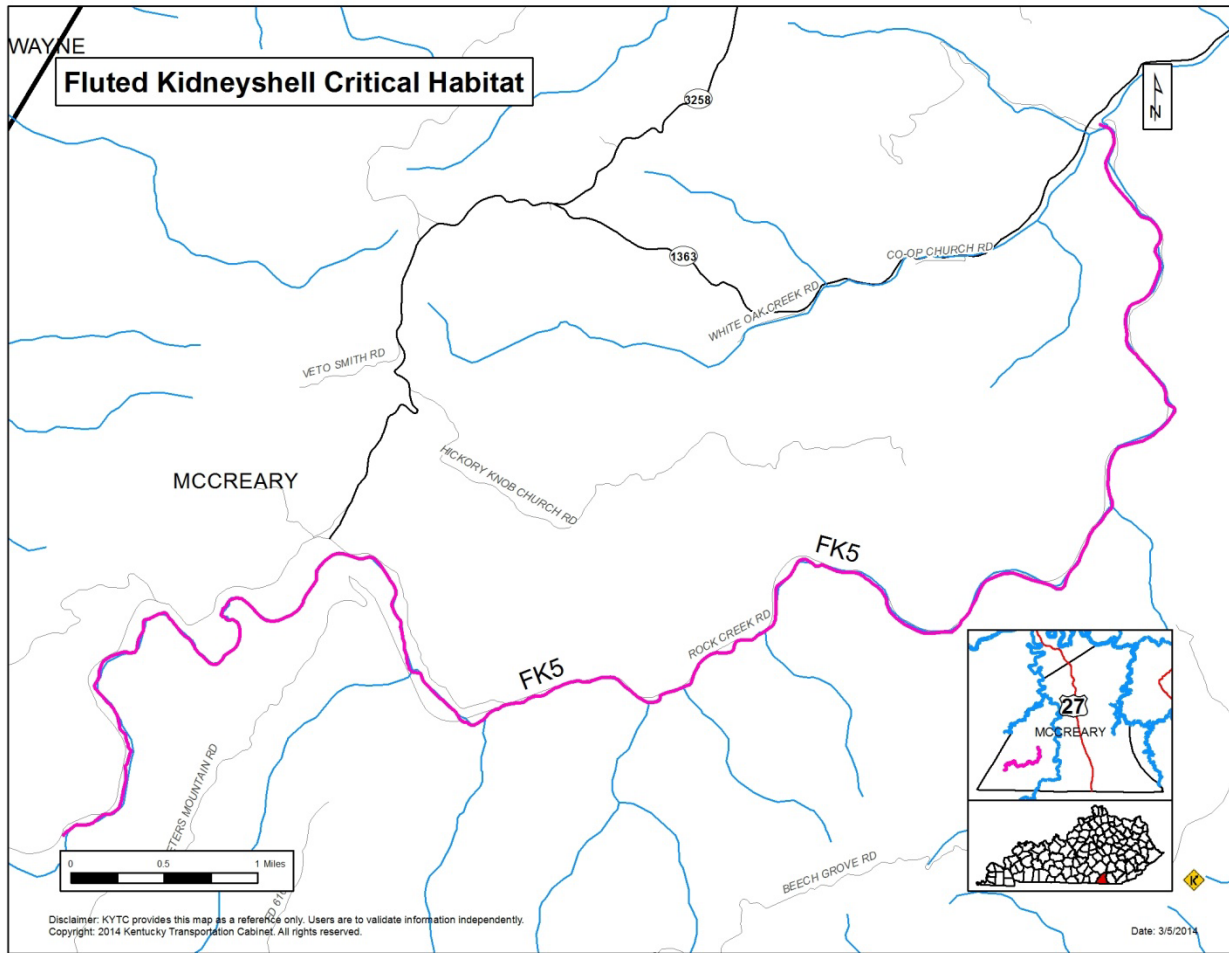
Unit FK4: Buck Creek, Pulaski County, Kentucky.

Unit FK4 includes approximately 61 rkm (38 rmi) of Buck Creek from State Route 192 upstream to Route 328, Pulaski County, KY.



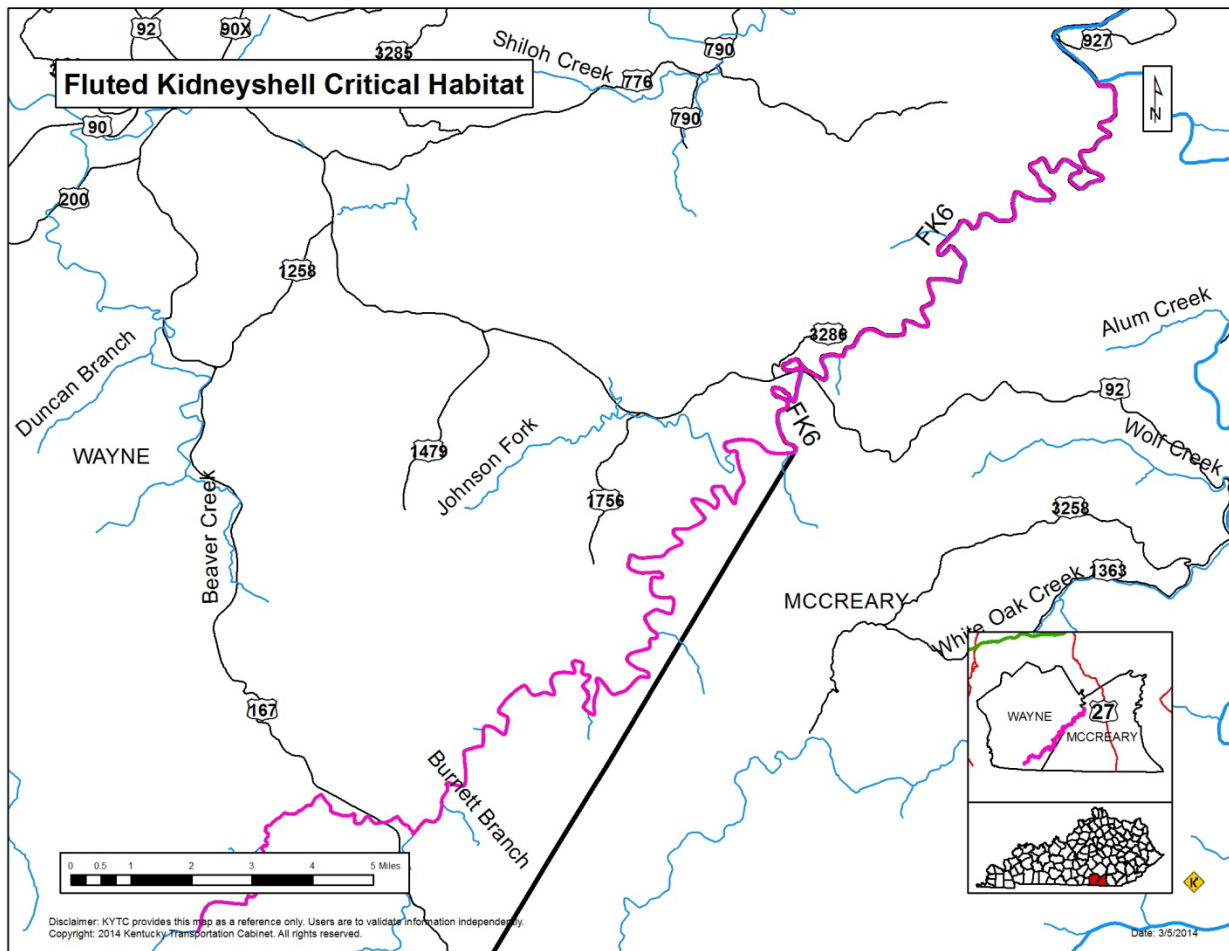
Unit FK5: Rock Creek, McCreary County, Kentucky.

Unit FK5 includes approximately 19 rkm (12 rmi) of Rock Creek from its confluence with White Oak Creek upstream to the low water crossing at rkm 25.6 (rmi 15.9) in McCreary County, KY.



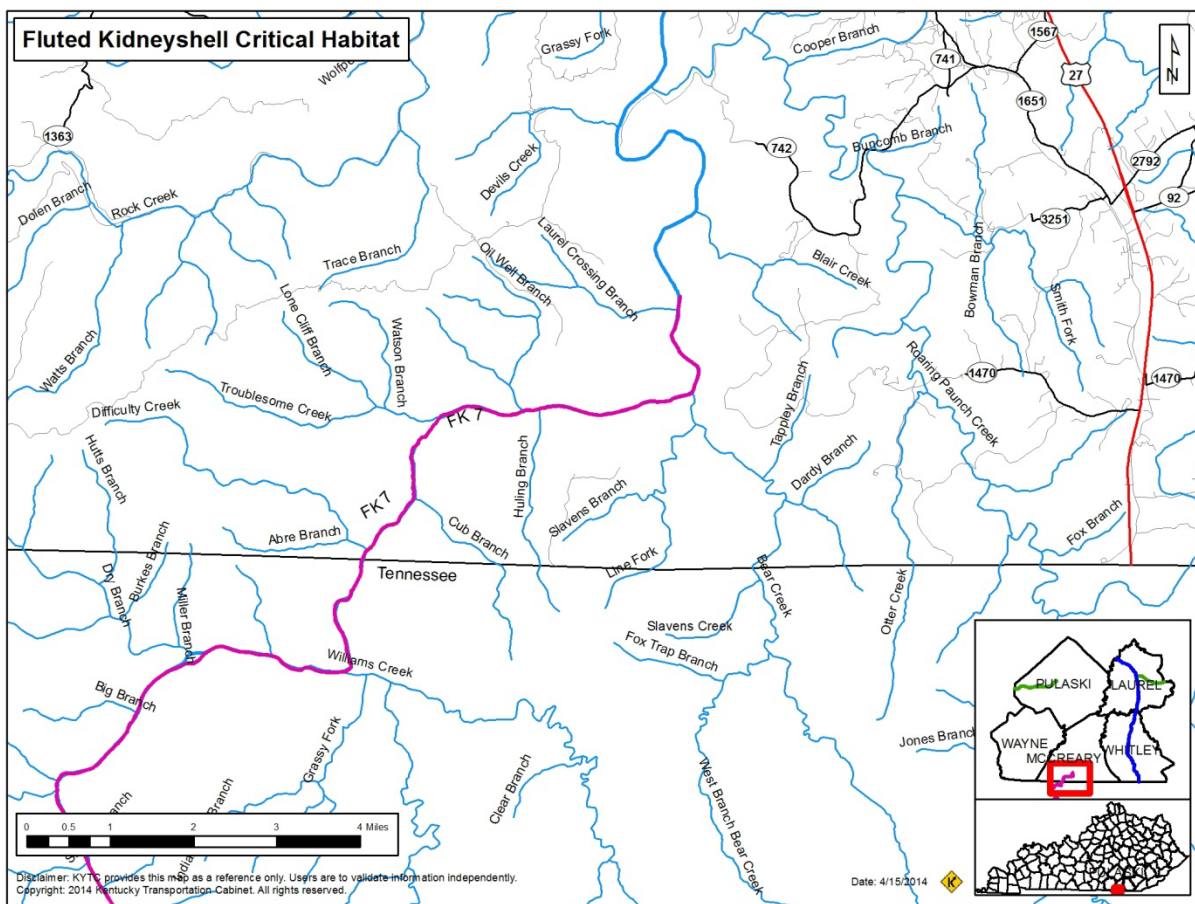
Unit FK6: Little South Fork Cumberland River, McCreary and Wayne Counties, Kentucky.

Unit FK6 includes 65.5 rkm (40.7 rmi) of the Little South Fork Cumberland River from its confluence with the Big South Fork Cumberland River, where it is the dividing line between Wayne and McCreary Counties, upstream to its confluence with Dobbs Creek in Wayne County, KY.



Unit FK7: Big South Fork Cumberland River, Fentress, Morgan, and Scott Counties, Tennessee, and McCreary County, Kentucky.

Unit FK7 includes a combined total of approximately 92 rkm (57 rmi) of the Big South Fork of the Cumberland River, Clear Fork of the New River, and the New River in Tennessee and Kentucky. Unit FK7 includes approximately 45 rkm (28 rmi) of the Big South Fork Cumberland River from its confluence with Laurel Crossing Branch downstream of Big Shoals, McCreary County, KY, upstream to its confluence with Clear Fork and of the New River, Scott County, TN. This unit also includes 32.3 rkm (20.0 rmi) of Clear Fork from its confluence with the Big South Fork and New River in Scott County, TN, upstream to its confluence with Crooked Creek along the Fentress and Morgan County line, TN. This unit also includes 14.7 rkm (9.1 rmi) of the New River from its confluence with the Big South Fork upstream to the Highway 27 Bridge crossing in Scott County, TN.



Kentucky Creekshell (*Leaunio ortmanni*)

Species Description

The Kentucky creekshell was listed as **proposed endangered** on September 17, 2024.

Kentucky creekshells are 2-3 inches in length with a greenish-yellow to tan coloration with numerous, fine green rays mostly located on the posterior end of the shell (Watters 2018, p. 42). The shell is elongated oval, moderately inflated and thick. This species exhibits sexual dimorphism with the males having a posterior margin bluntly pointed while the females are square (Cicerello and Schuster 2003, p. 56). The umbo is placed in the anterior third of the shell and has numerous fine ‘V’ shaped ribs (Watters 2018, p. 42). The nacre (the lustrous interior layer of the shell) is purple, salmon-colored, or rarely white. The cardinal teeth are large and serrated, and the lateral teeth are thick and slightly curved (Cicerello and Schuster 2003, p. 56).

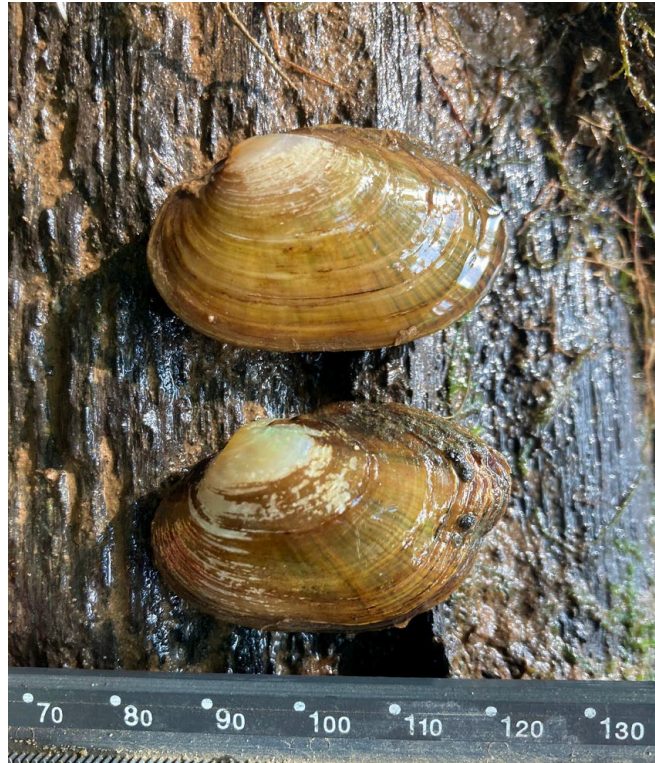


Figure 10 https://www.inaturalist.org/guide_taxa/2454932

Habitat Description

The Kentucky creekshell occurs in medium-sized rivers to small streams and spring runs. The species can be found in riffles comprised of sand and gravel or found in adjacent depositional areas near shore (Haag and Cicerello 2016, p. 261). The species is often found near spring influxes likely due to its host fish, the banded sculpin (*Cottus carolinae*), which is associated with springs or spring-influenced habitats.

Critical Habitat

Yes, proposed - (*see additional maps and detailed descriptions provided after the decision key*)

Critical habitat was proposed to be designated for the Kentucky creekshell on September 17, 2024.

Primary constituent elements for the Kentucky creekshell include:

1. Water quantity and quality necessary to sustain natural physiological processes for normal behavior, growth, and viability of all life stages, including (but not limited to): water conditions in the stream that are cool; are well-oxygenated with no evidence of excessive sediments or suspended solids, salinity, ammonia, nutrients, pesticides, or herbicides; and have a stream flow and pattern consistent with natural flow regimes. Spring-influenced river sections are important habitat types for this species as most Kentucky creekshell populations are associated with this habitat type, and this is also the preferred habitat type for the host fish, the banded sculpin.
2. Suitable substrates and connected instream habitats characterized by geomorphically stable stream channels and banks (i.e., channels that maintain lateral dimensions, longitudinal profiles, and sinuosity patterns over time without an aggrading or degrading bed elevation) and stable riffle-run-pool habitats that provide flow refuges consisting of predominantly silt-free, stable coarse sand, gravel, and cobble substrates.
3. Adequate food availability for Kentucky creekshell including (but not limited to): suspended phytoplankton, zooplankton, rotifers, protozoans, detritus, and dissolved organic matter from the water column or sediments.
4. Habitat conditions that support the presence and abundance of banded sculpin, the host fish necessary for Kentucky creekshell recruitment, as well as the actual presence and abundance of the banded sculpin in the habitat.
5. Connected instream habitats without barriers such as dams and perched or undersized culverts to provide suitable lotic rather than lentic habitat; access to quality habitat for multiple life stages of Kentucky creekshell; access for host fish movement, which in turn,

may influence Kentucky creekshell distribution and provide genetic exchange for both species and recolonization of Kentucky creekshell.

6. Appropriate abundance, density, and distribution of mussel beds (aggregations of freshwater mussels) such that local stochastic events do not necessarily eliminate the bed(s), allowing the mussel beds and the overall local population within a stream reach to recover from any single event and for resilient populations.

Species, Stream (unit), and State	Currently Occupied River Miles	Currently Unoccupied River Miles
Kentucky creekshell Mussel		
Green River (1), KY	73	57.7
Barren River (2), KY		79.9
Gaspar River (3), KY	52.8	
Drakes Creek (4), KY	55.1	
Trammel Creek (5), KY	15.9	
Salt Lick Creek (6), KY	19.1	
Russell Creek (7), KY	53.7	
Middle Nolin River (8), KY	64.4	9.9
Upper Nolin River (9), KY	23.9	
Rough River (10), KY	37.5	11.6

Range

The Kentucky creekshell is endemic to the Green River basin. Historically, the species occurred in the Clifty Creek– Rough River, Ugly Creek–Green River, Lower Nolin River, Bays Fork– Barren River, Skaggs Creek, Little Muddy Creek–Barren River, Middle Nolin River, Upper Nolin River, Russell Creek, East Fork Barren River–Barren River, Trammel Creek, Drakes Creek, and Gaspar River basins (figure 1). The Kentucky creekshell is presumed extirpated from the historically occupied Lower Nolin River, Bays Fork– Barren River, Skaggs Creek, and Little Muddy Creek–Barren River basins, with no observations of the species since 1973 (a 50-year absence).

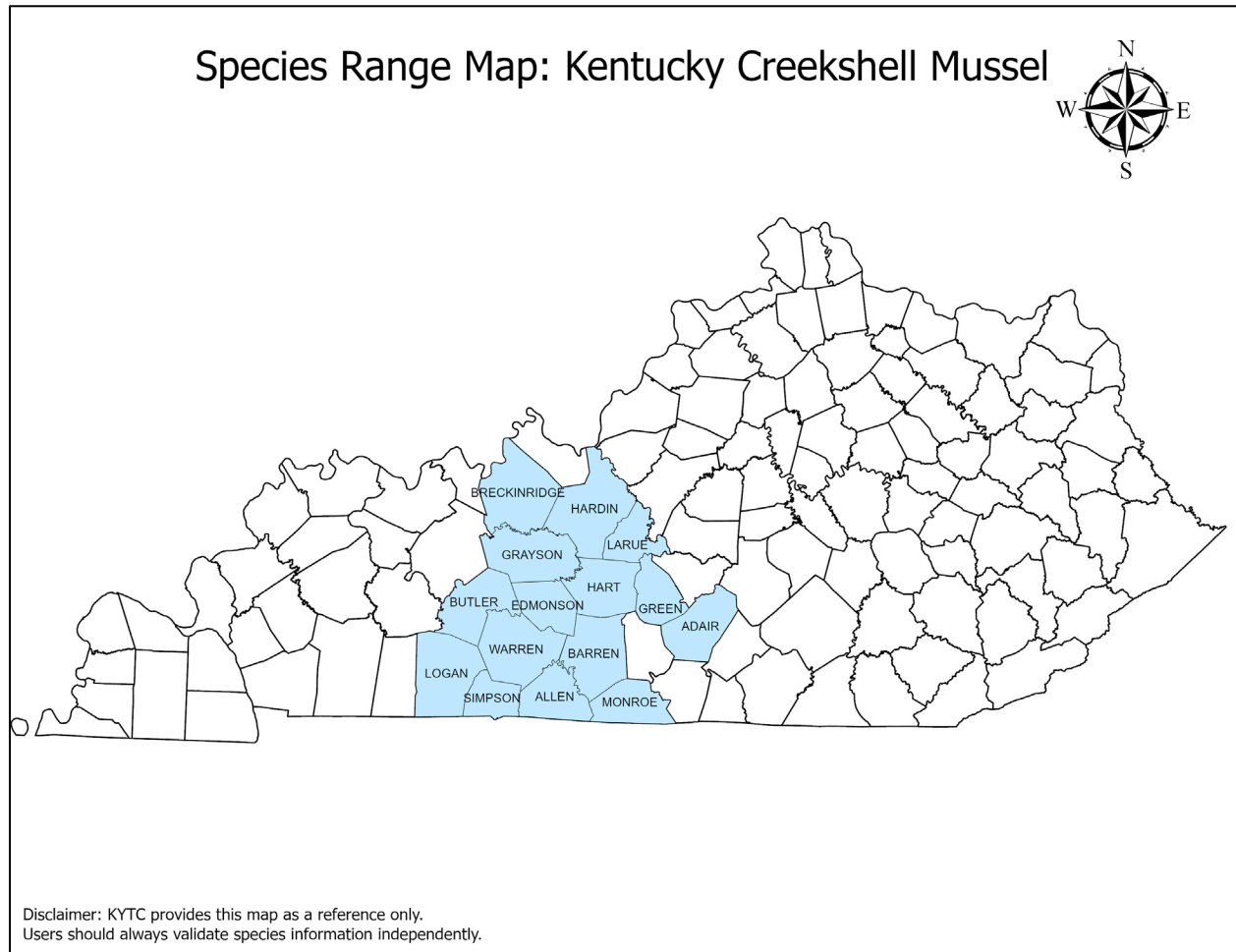


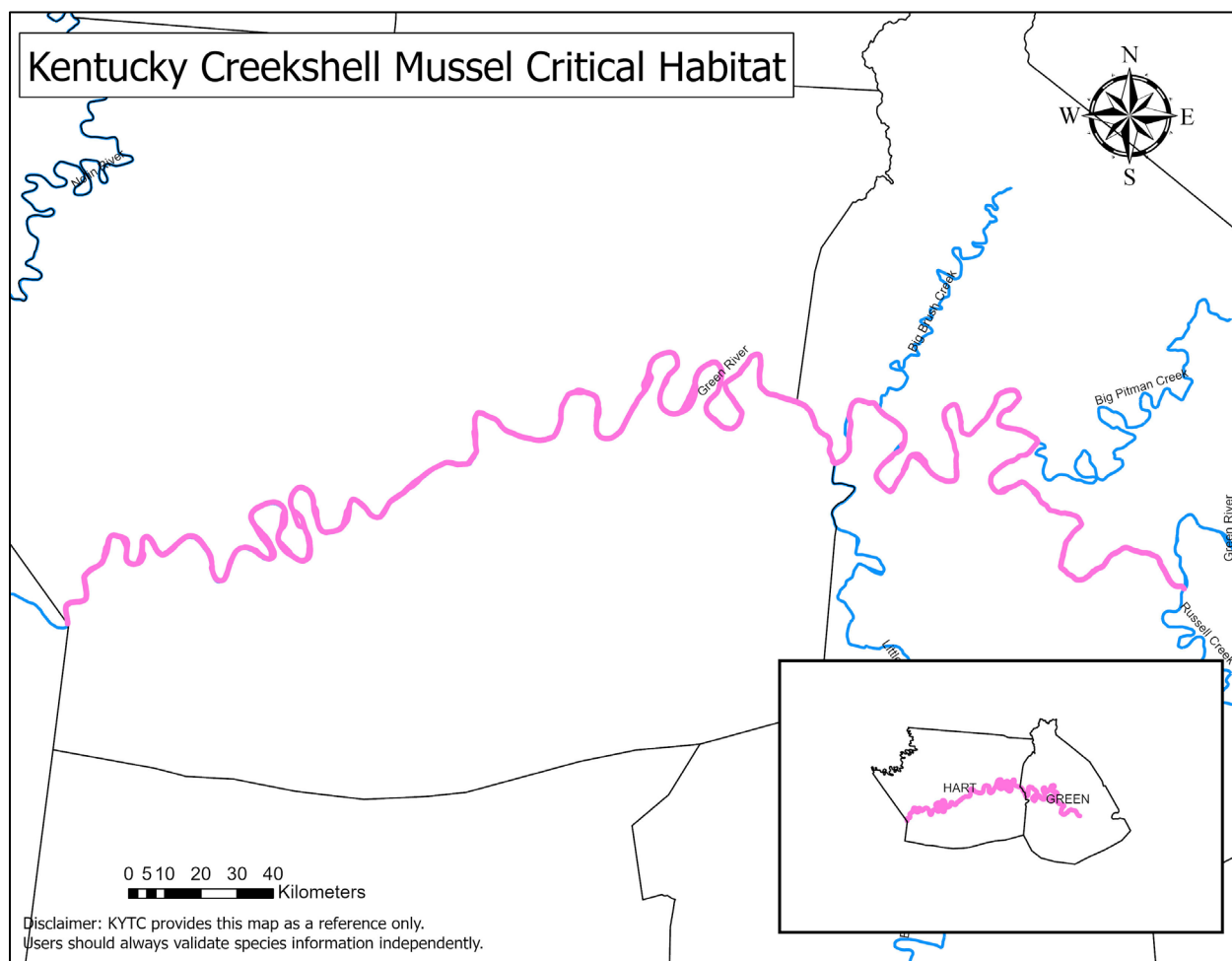
Figure 11 County list from ECOS is currently unavailable, so the range map is subject to change as any point is not all inclusive of expected counties to be listed.

Decision Key

- 1) Does the project include any direct or indirect effects to **perennial streams or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)
 - a. Yes: Contact SME
 - b. No: Prepare NE finding

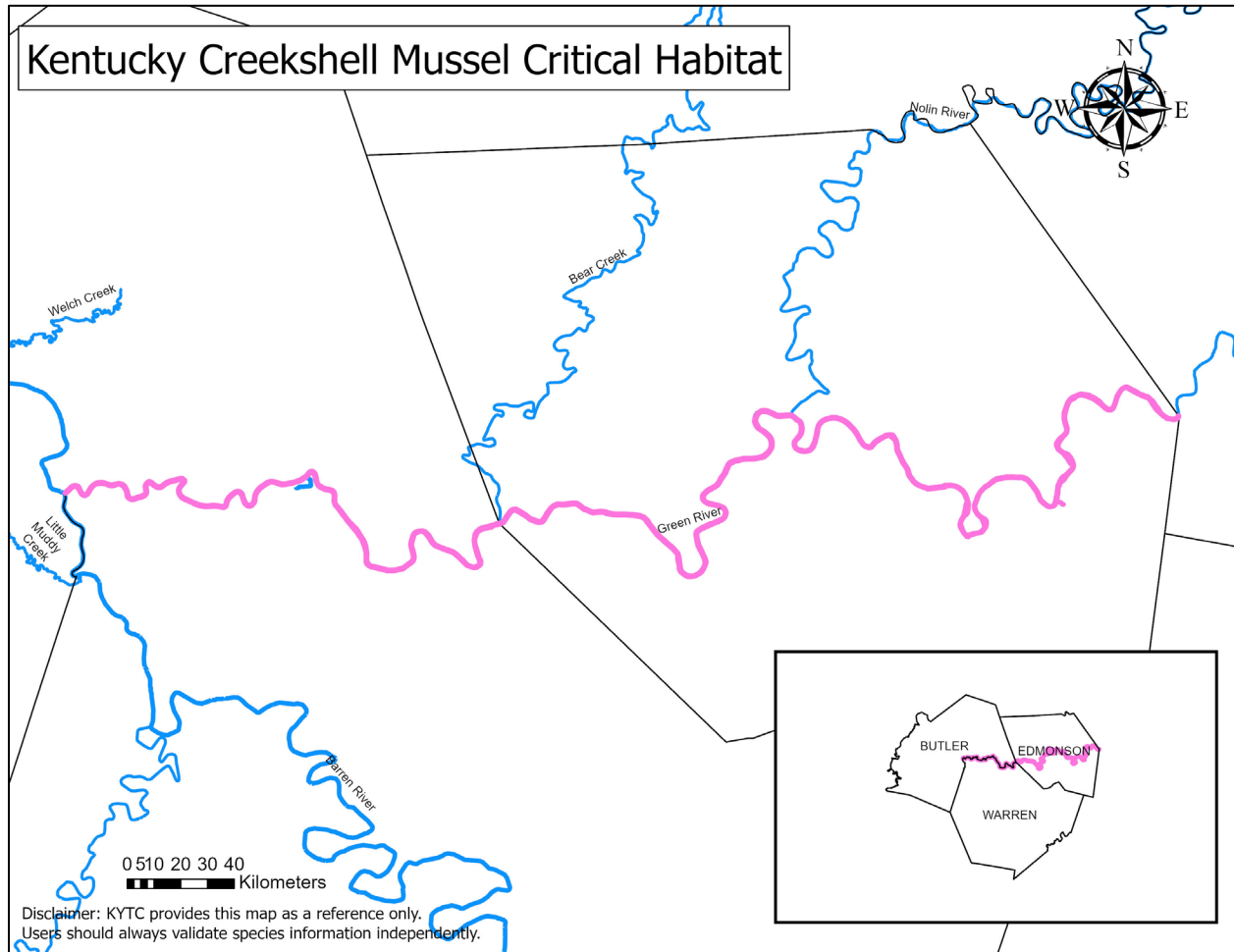
Subunit 1a (Green River) – Green and Hart Counties, KY.

Subunit 1a consists of 73.0 river miles of Green and Hart Counties, Kentucky, from the confluence of Russell Creek near Greensburg, Kentucky, downstream to the Edmonson County line in Mammoth Cave National Park. Nearly all (approximately 99 percent) of the lands adjacent to Subunit 1a are privately owned including lands managed under the Green River Watershed conservation easement by The Nature Conservancy. The remaining lands adjacent to this subunit (one percent) include parts of the Mammoth Cave National Park, managed by the National Park Service, and Western Kentucky University's Upper Green River Biological Preserve, which is managed by the State of Kentucky. Subunit 1a is considered occupied.



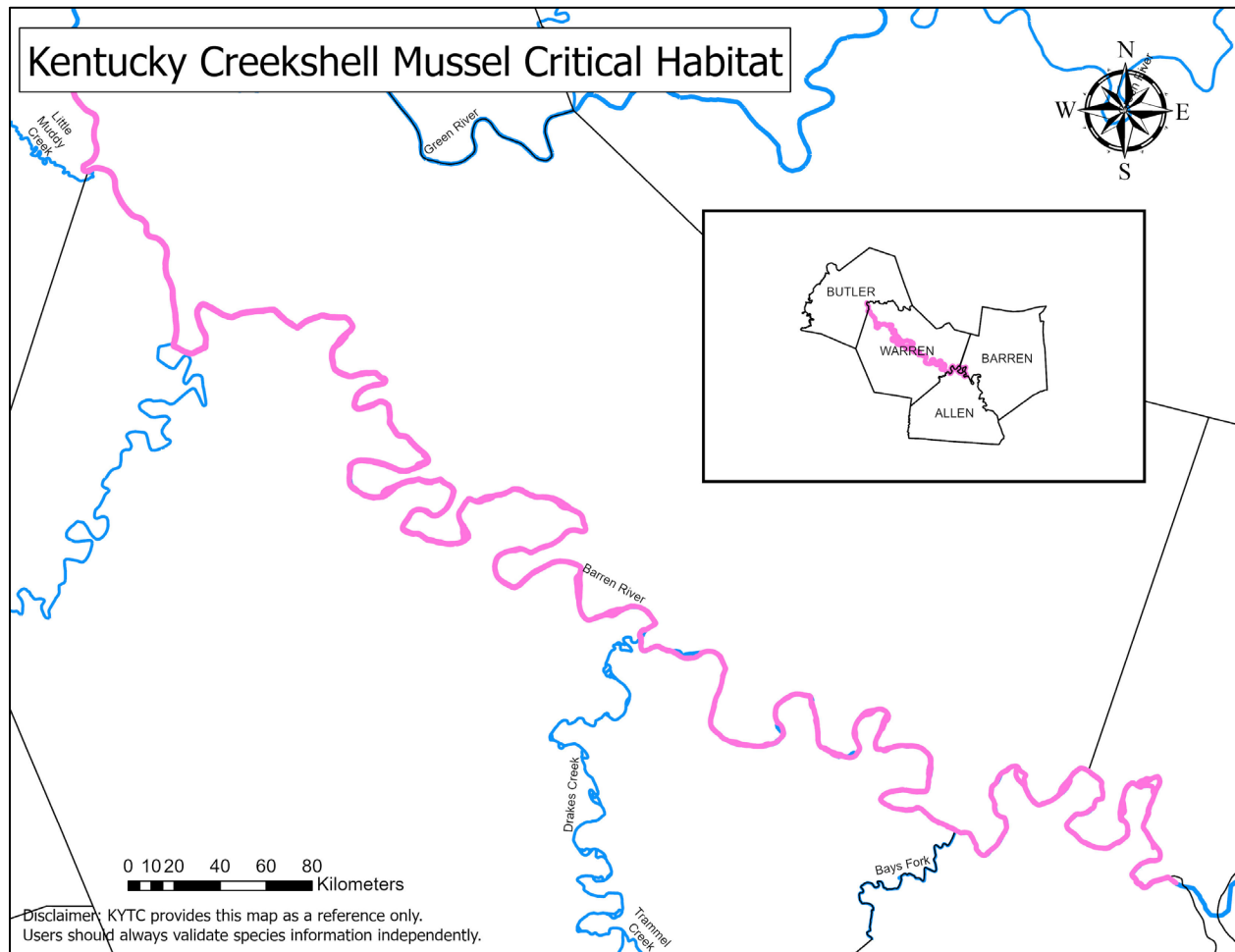
Subunit 1b (Green River) – Edmonson, Butler, and Warren Counties, KY.

Subunit 1b consists of 57.7 river miles of Edmonson, Butler, and Warren Counties, Kentucky. The unit is located from the Edmonson County line in Mammoth Cave National Park to the confluence with the Barren River in Woodbury, Kentucky. Approximately 87 percent of the lands adjacent to Subunit 1b are owned by private entities, and the remaining 13 percent is managed by the National Park Service for the Mammoth Cave National Park. Subunit 1b is currently unoccupied by the species.



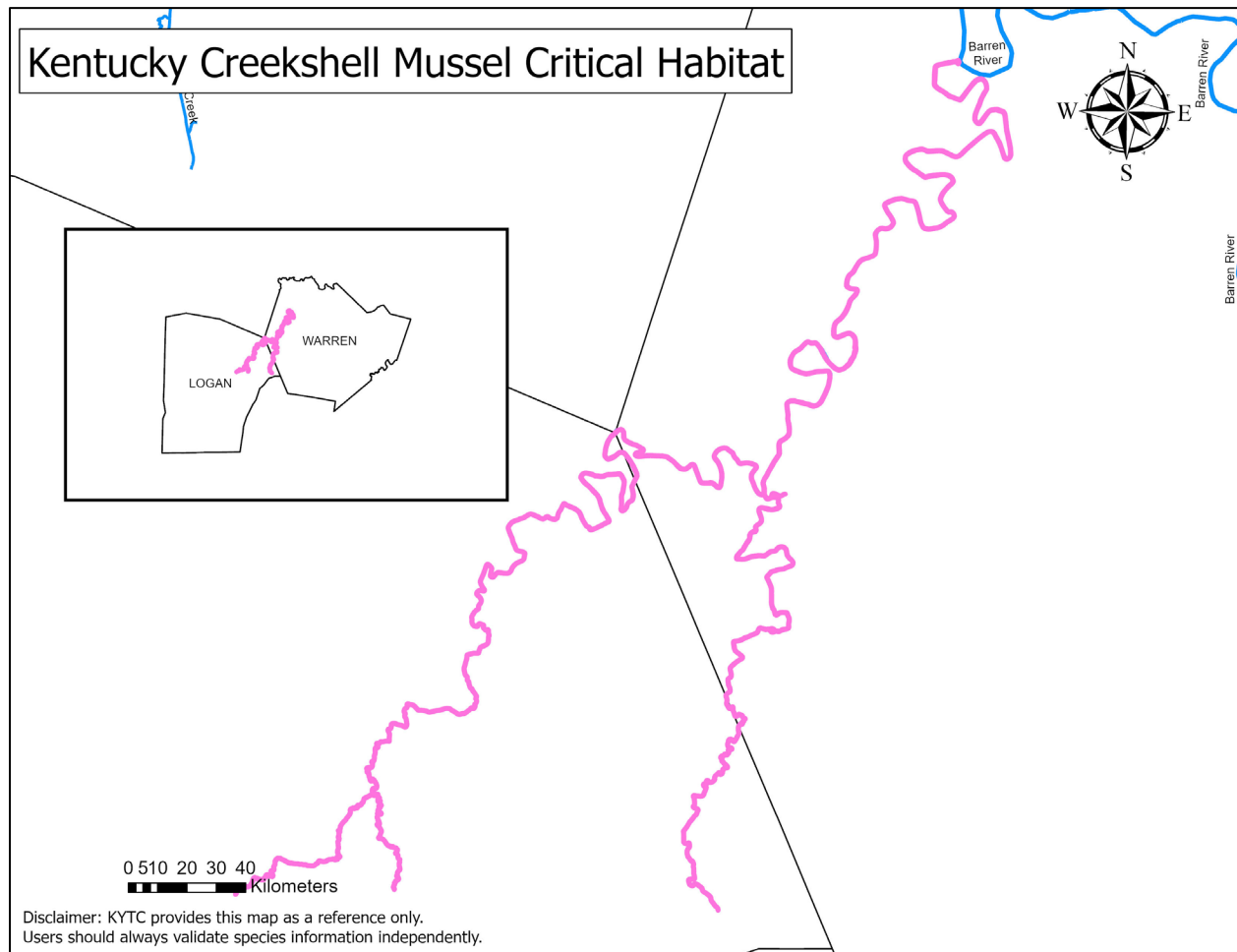
Unit 2: Barren River – Butler, Warren, Allen, and Barren Counties, KY.

Unit 2 consists of 79.9 river miles of Barren River in Butler, Warren, Allen, and Barren Counties, Kentucky, from the Barren River Lake dam in Barren and Allen Counties to the confluence of the Green River in Butler and Warren Counties. Approximately 79.4 river miles (127.8 km; 99 percent) of riparian lands that border the unit are in private ownership, and 0.46 stream mile (0.74 km; less than 1 percent) is in Federal (Barren River Lake; USACE) ownership. Unit 2 is considered currently unoccupied by the species.



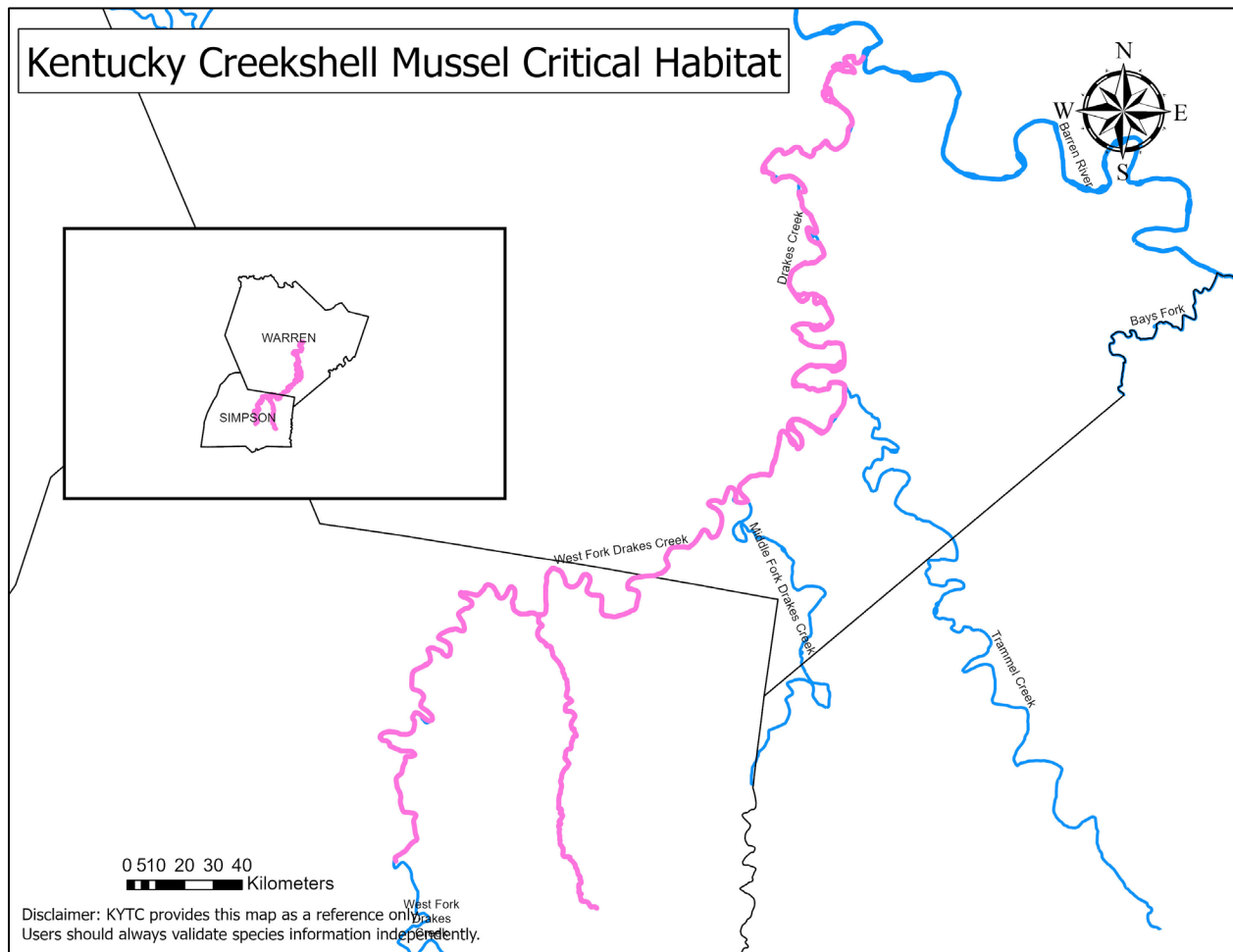
Unit 3: Gasper River – Warren and Logan Counties, KY.

Unit 3 consists of 52.8 river miles of the Gasper River, Wigginton Creek, and Clear Fork Creek in Warren and Logan Counties, Kentucky. This unit includes Wigginton Creek from the headwaters near Rogers, Kentucky, to the confluence with Gasper River; Clear Fork Creek from the headwaters near US HWY 68 bridge to the confluence with Gasper River; and the Gasper River from headwaters near Auburn, Kentucky, to the confluence with the Barren River. All riparian lands that border the unit are in private ownership. Unit 3 is considered occupied by the species.



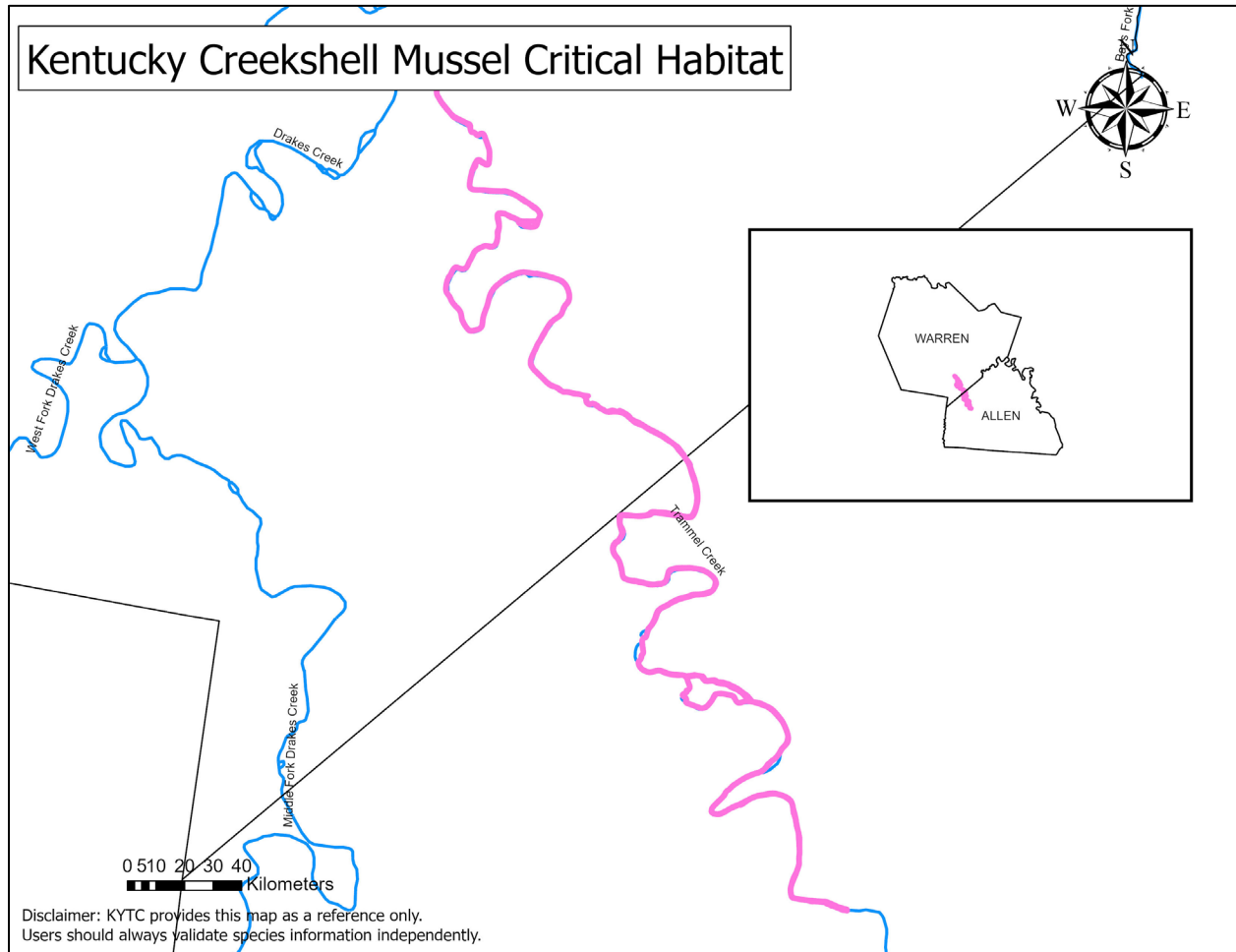
Unit 4: Drakes Creek – Warren and Simpson Counties, KY.

Unit 4 consists of 55.1 river miles of Drakes Creek, West Fork Drakes Creek, and Lick Creek in Warren and Simpson Counties, Kentucky. This unit includes Drakes Creek from the confluence of West Fork Drakes Creek and Middle Fork Drakes Creek downstream to the confluence with the Barren River near Bowling Green, Kentucky; West Fork Drakes Creek from the West Fork Drakes Creek Reservoir in Franklin, Kentucky, downstream to the confluence with Drakes Creek; and Lick Creek from the Scottsville Road bridge to the confluence with West Fork Drakes Creek. All of the riparian lands that border the unit are in private ownership. Unit 4 is considered occupied by the species.



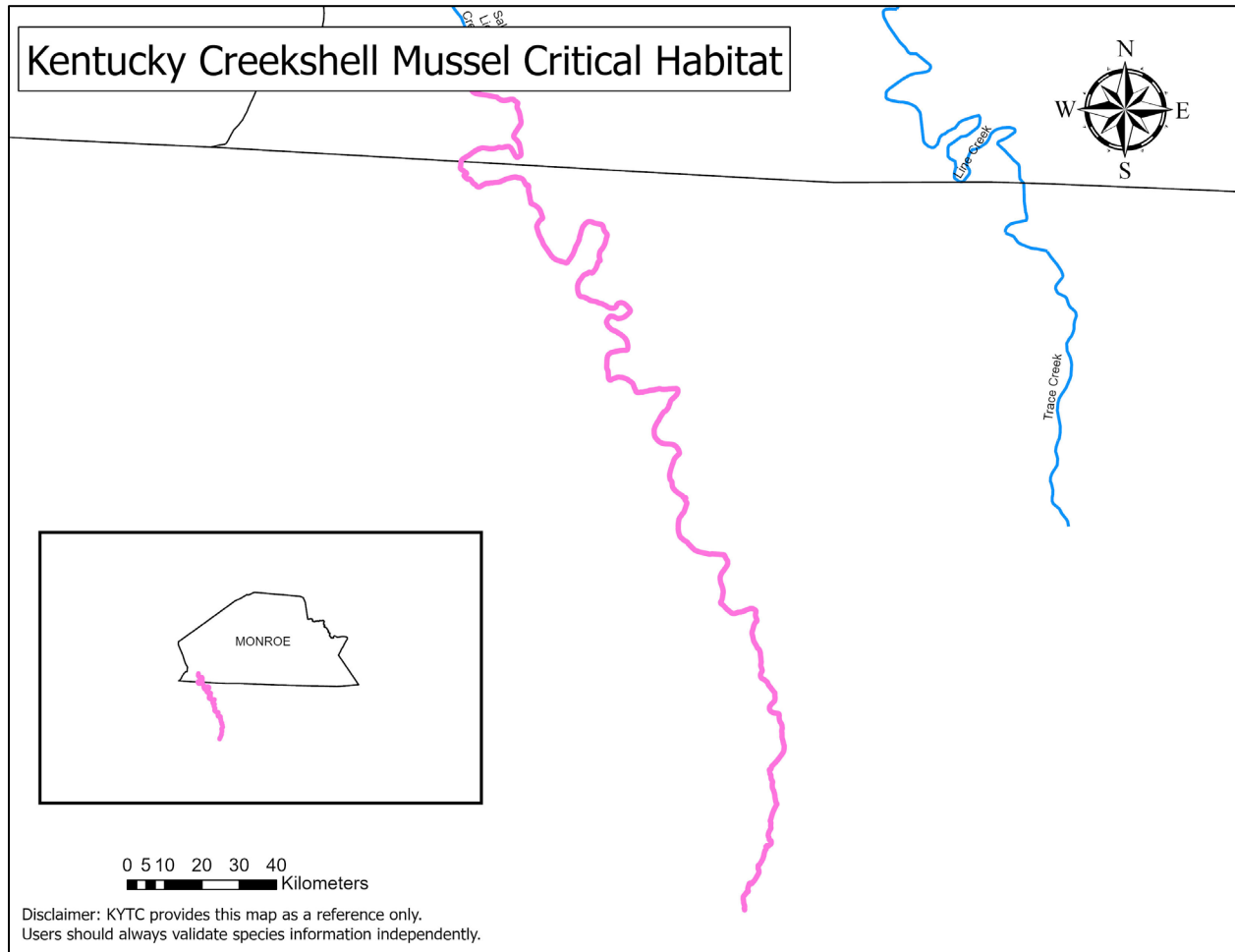
Unit 5: Trammel Creek – Warren and Allen Counties, KY.

Unit 5 consists of 15.9 river miles of Trammel Creek in Warren and Allen Counties, Kentucky, from the confluence with John’s Creek near Butlersville, Kentucky, downstream to its confluence with Drakes Creek. Unit 5 is considered occupied by the species.



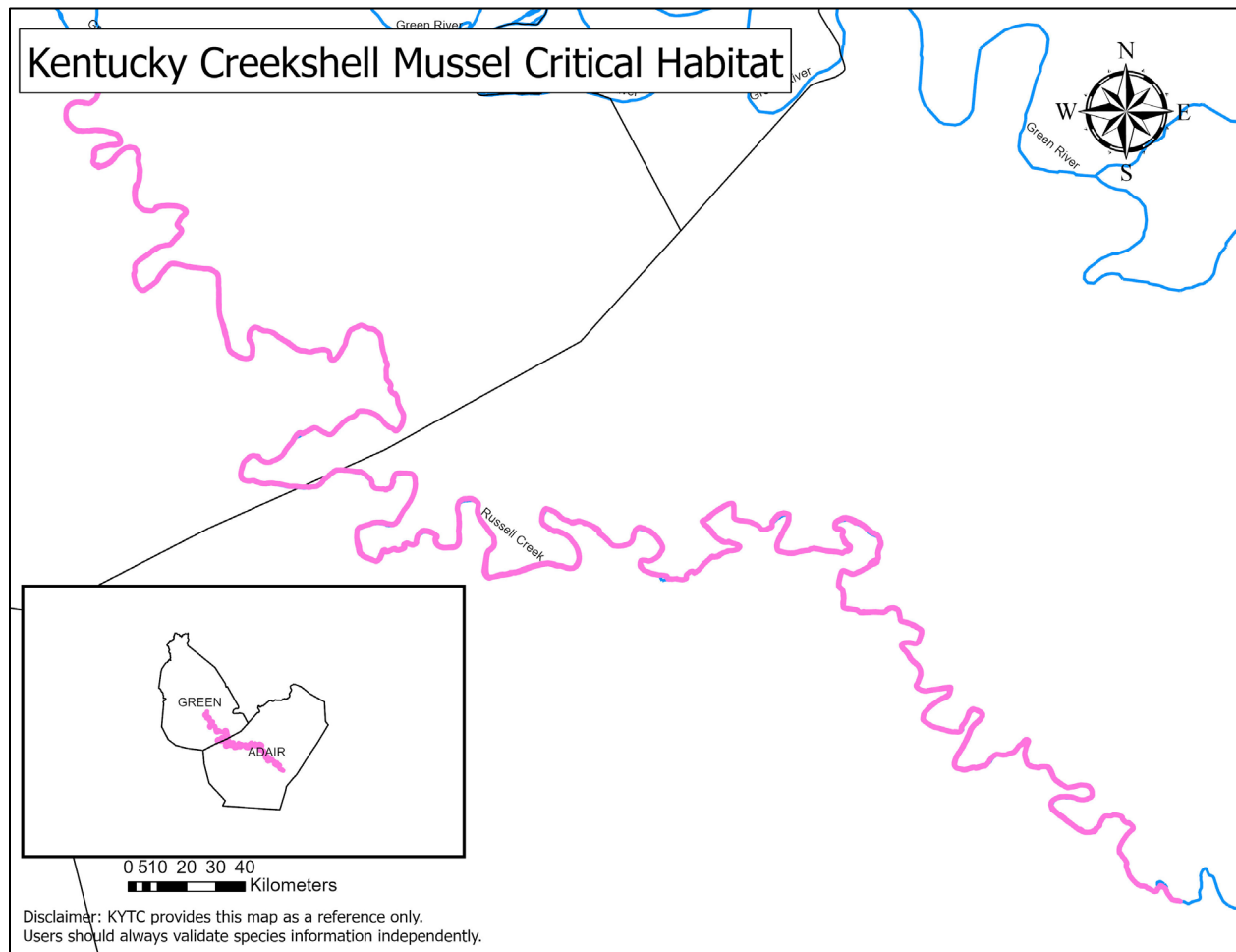
Unit 6: Salt Lick Creek – Monroe County, KY.

Unit 6 consists of 19.1 river miles of Salt Lick Creek in Monroe County, Kentucky, and Macon County, Tennessee, from the headwaters south of Red Boiling Springs, Tennessee, to the confluence with Long Fork, Kentucky. All of the riparian lands that border the unit are in private ownership. Unit 6 is considered occupied by the species.



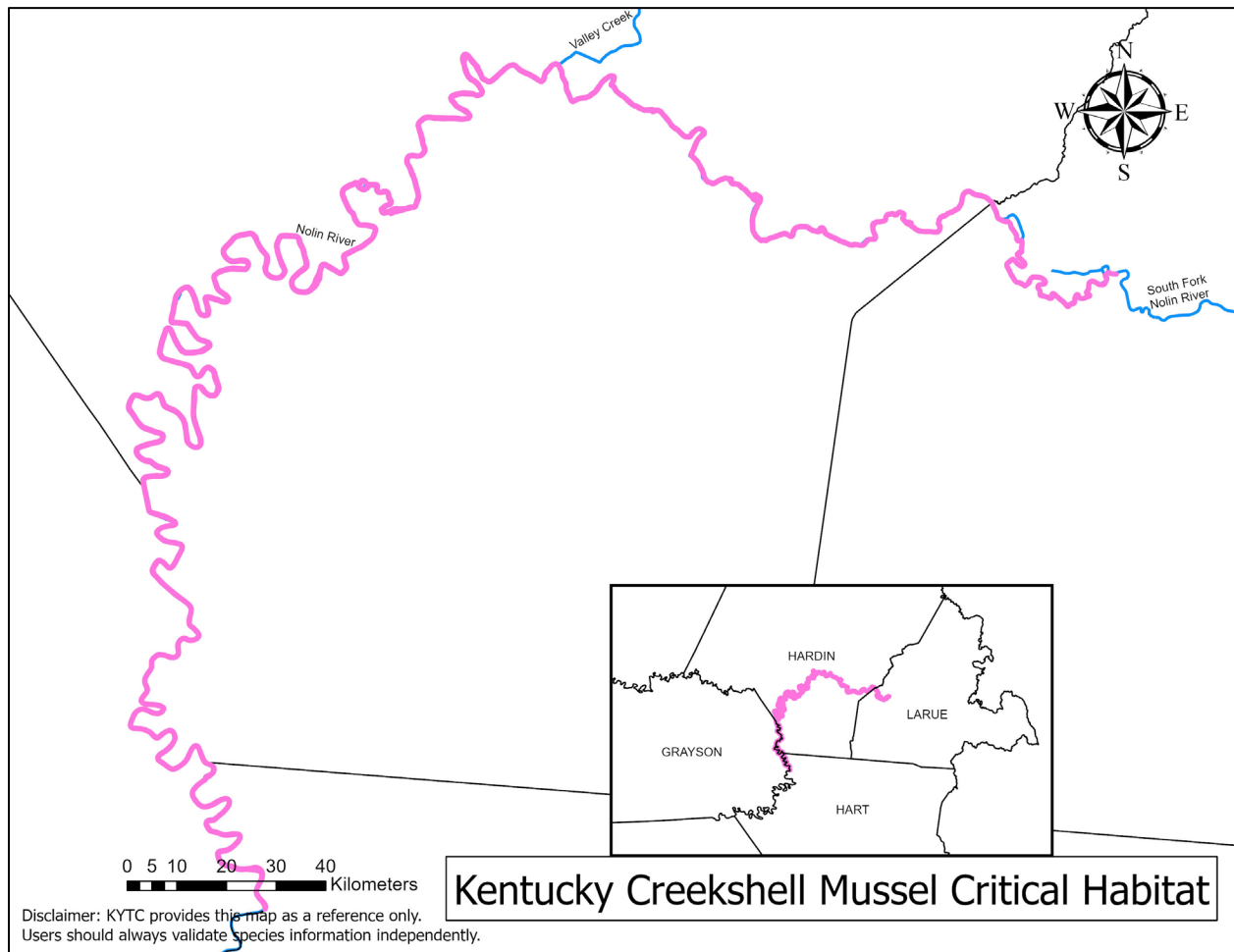
Unit 7: Russell Creek – Green and Adair Counties, KY.

Unit 7 consists of 53.7 river miles of Russell Creek in Green and Adair Counties, Kentucky, from the confluence with Cabin Fork Creek approximately 5 miles southeast of Columbia downstream to the confluence with the Green River south of Greensburg, Kentucky. All the riparian lands that border the unit are in private ownership. Unit 7 is considered occupied by the species.



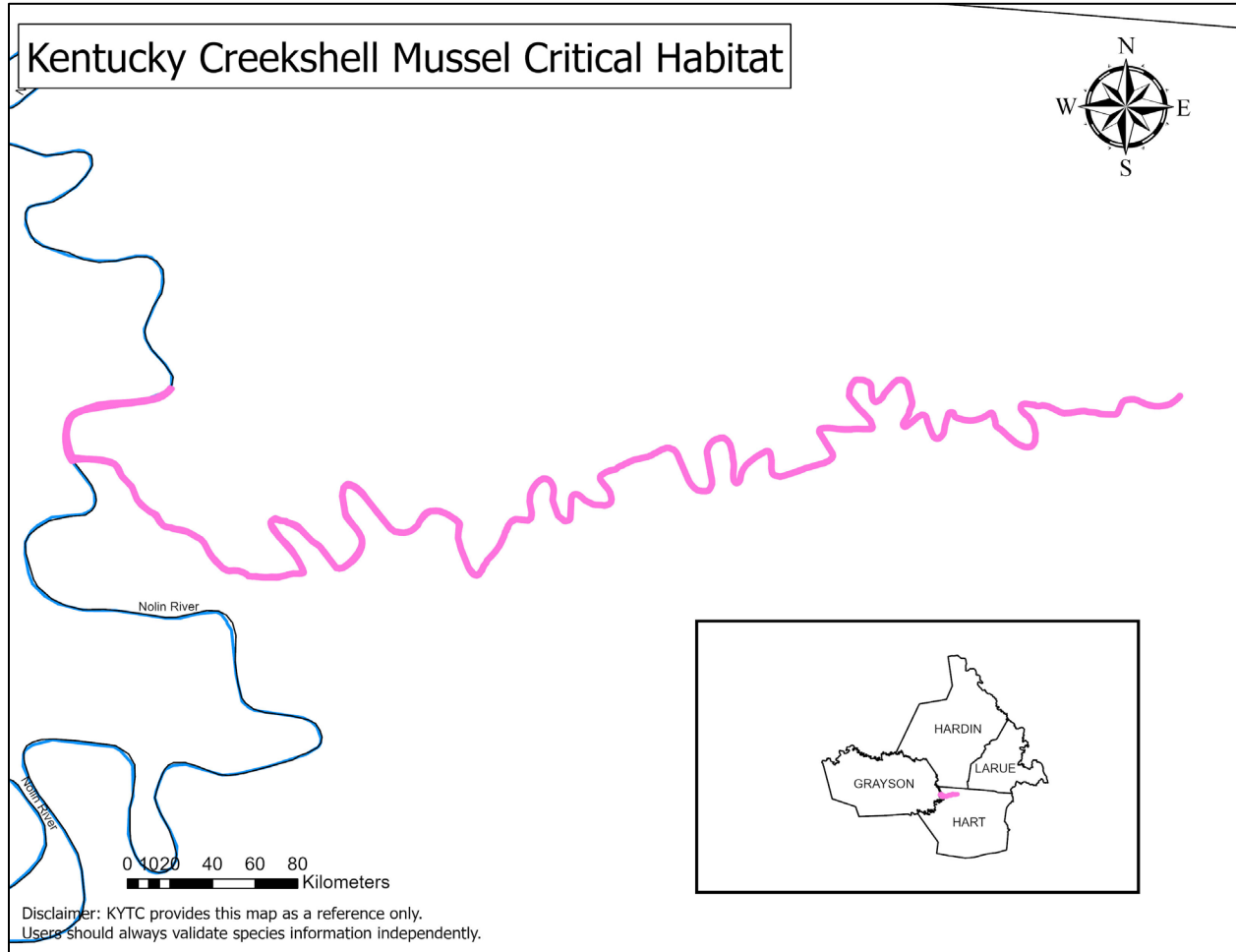
Unit 8: Middle Nolin River – LaRue, Hardin, Grayson, and Hart Counties, KY.

Subunit 8a (Nolin River): Subunit 8a consists of 54.5 river miles of the Nolin River in Larue, Hardin, Grayson, and Hart Counties, Kentucky. Subunit 8a extends from the confluence of the north and south fork of the Nolin River west of Hodgenville, Kentucky, downstream to the confluence of Round Stone Creek south of Millerstown, Kentucky. Approximately 99% of the lands adjacent to subunit 8a are privately owned, and the remaining are Federal lands managed by the USACE for Nolin River Recreation Area and State lands of Kentucky State Department of Natural Resources. Subunit 8a is considered occupied by the species.



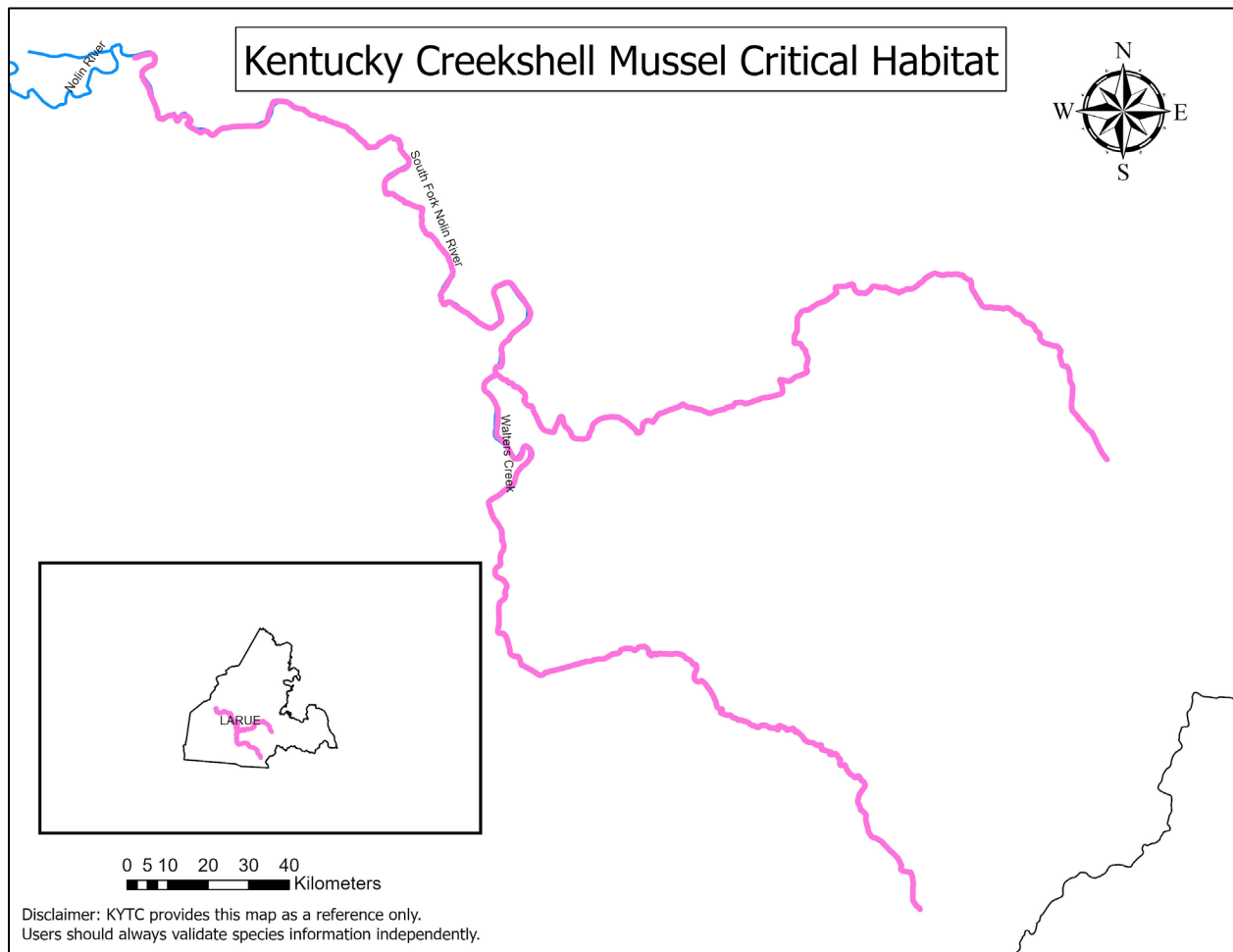
Unit 8: Middle Nolin River – Hart County, KY.

Subunit 8b (Round Stone Creek): Subunit 8b consists of 9.9 river miles of Round Stone Creek in Hart County, Kentucky. Subunit 8b extends from the origins of the stream at Blue Hole Spring to the confluence with the mainstem Nolin River. Approximately 99 percent of riparian lands adjacent to subunit 8b are in private ownership. The rest (less than 0.5 percent) are managed by the USACE in the Nolin River Recreation Area. Subunit 8b is considered unoccupied by the species.



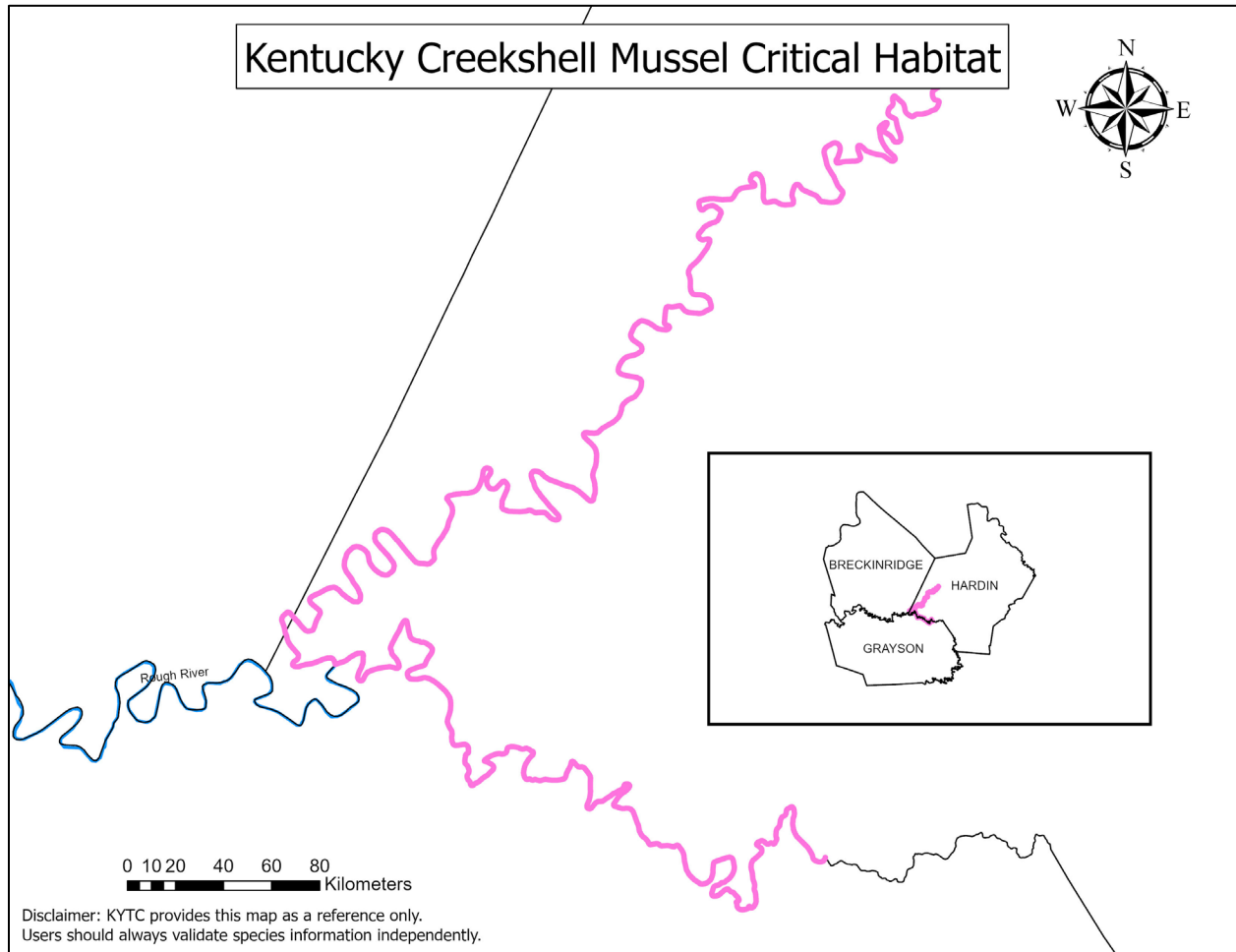
Unit 9: Upper Nolin River – LaRue County, KY.

Unit 9 consists of 23.9 river miles of the Nolin River, South Fork Nolin River, and Walters Creek in Larue County, Kentucky. Approximately 21.3 stream miles (34.3 km; 89 percent) of riparian lands that border the unit are in private ownership, and 2.6 stream miles (4.2 km; 11 percent) are managed by the State Department of Natural Resources for the Kentucky Department of Agriculture. This unit includes the South Fork Nolin River from Buffalo, Kentucky, downstream to its confluence with the North Fork Nolin River and Walters Creek from its headwaters near J.E. Jones Road to its confluence with the South Fork Nolin Creek. Unit 9 is considered occupied by the species.



Unit 10: Rough River – Breckinridge, Hardin, and Grayson Counties, KY.

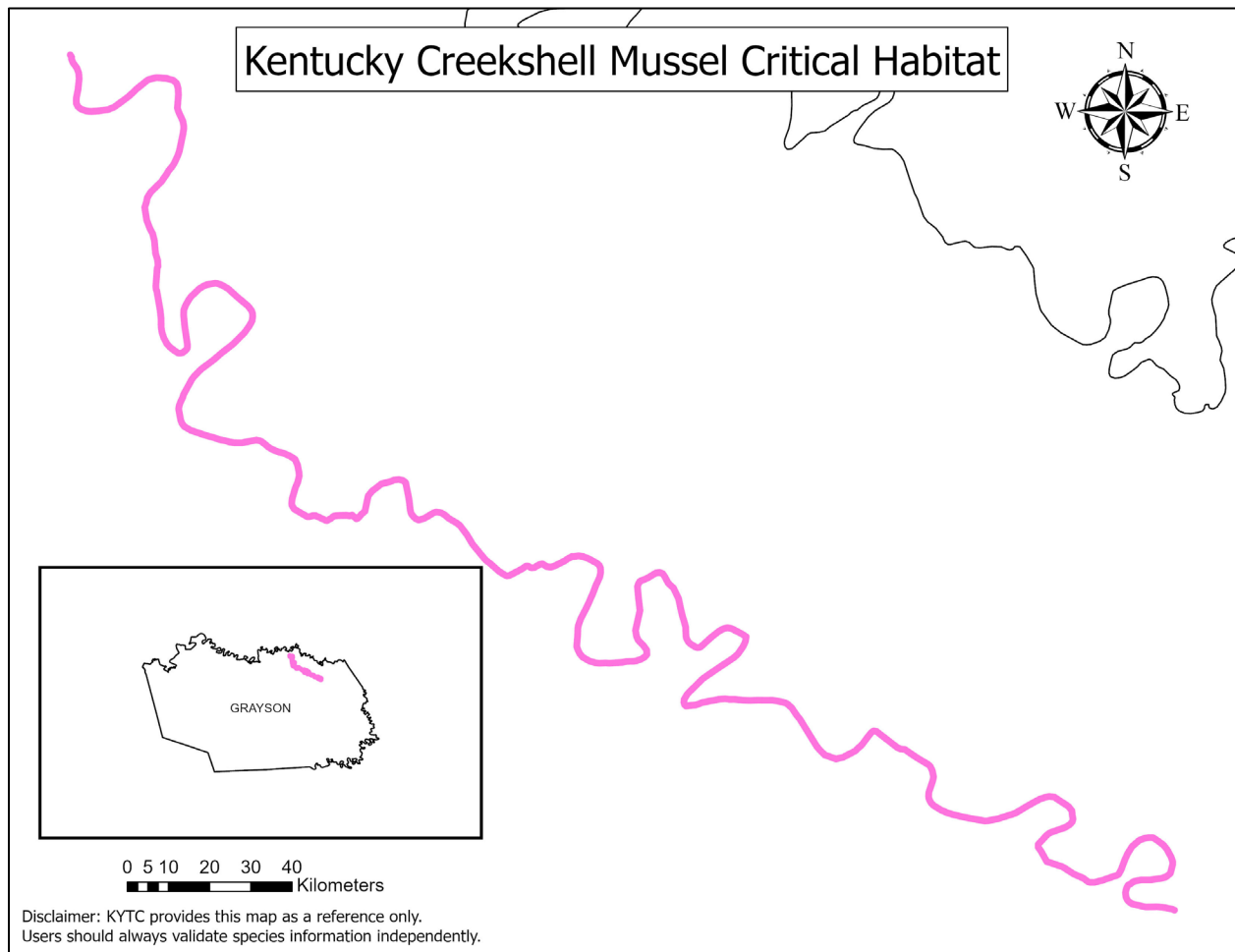
Subunit 10a consists of 37.5 river miles of the Rough River in Breckinridge, Hardin, and Grayson Counties, Kentucky. This subunit includes the Rough River from the Hardinsburg Road bridge downstream to its confluence with Meeting Creek and Meeting Creek from its confluence with Petty Creek downstream to its confluence with Rough River. Approximately 96% of the lands adjacent to subunit 10a are privately owned; the remaining 4 percent are managed by the USACE for Rough River Lake. Subunit 10a is considered occupied by the species.



Unit 10: Rough River – Grayson County, KY.

Subunit 10b (Clifty Creek): Subunit 10b consists of 11.6 river miles of Clifty Creek in Grayson County, Kentucky, from Elizabethtown Road bridge downstream to Rough River Lake.

Approximately 97 percent of the lands adjacent to subunit 10b are owned by private entities, while the remainder is managed by the USACE for Rough River Lake backwaters. Subunit 10b is considered unoccupied by the species.



Littlewing Pearlymussel (*Pegias fabula*)

Species Description

The littlewing pearlymussel was listed as **endangered** on November 14, 1988.

The shell's periostracum is usually eroded, giving the shell a chalky or ashy white appearance. When the periostracum is present, the shell is light green or dark yellowish brown with dark rays of variable width along the shell's anterior surface. It has two posterior ridges separated by a shallow depression, which is diagnostic. Cardinal teeth are large; lateral teeth a thickening of the hinge line.

Length 1-1.5 inches.



Figure 12 Photo Credit:
<http://www.flickr.com/photos/ttravisbrownphotos/8696365126/>

Habitat Description

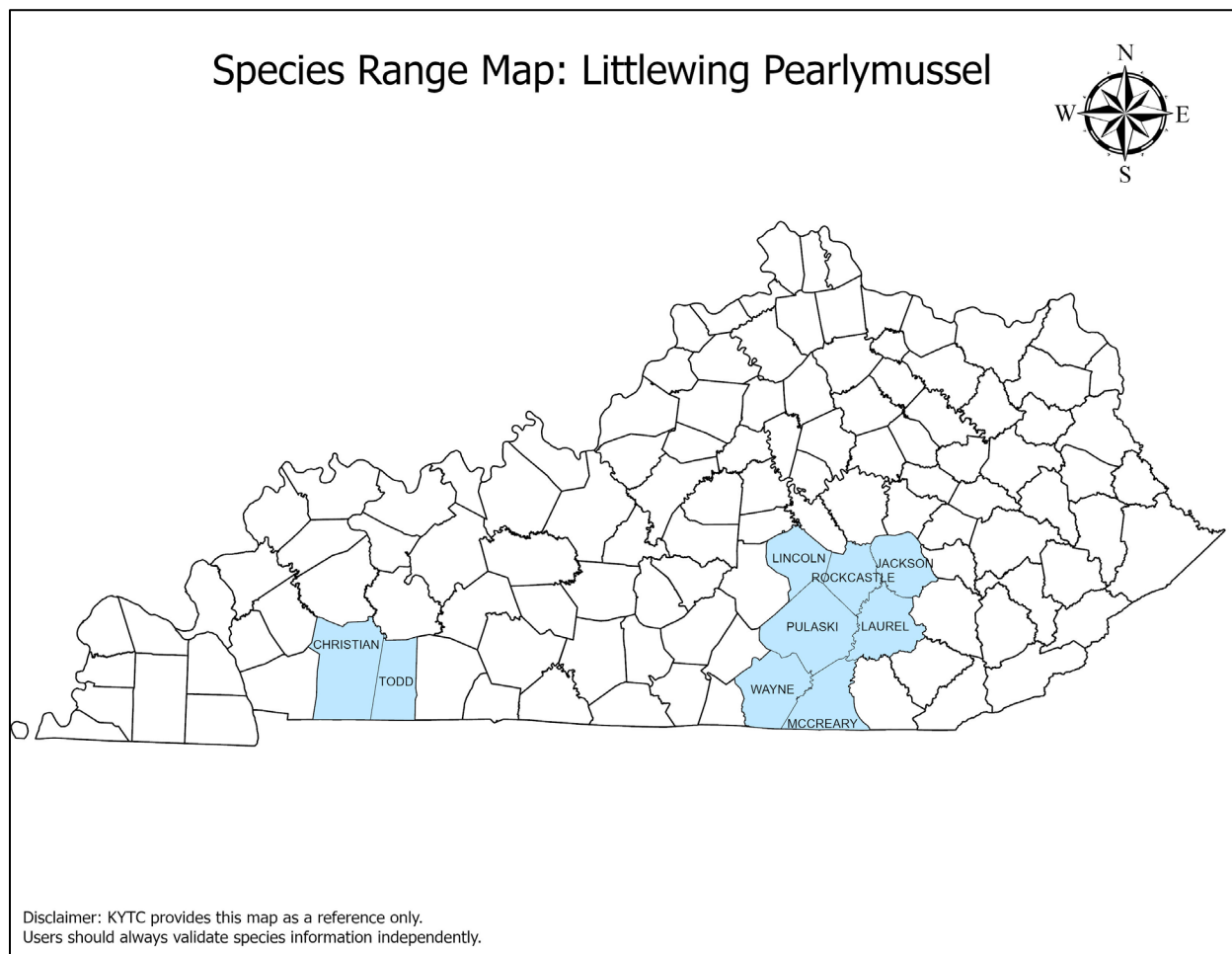
The littlewing pearlymussel inhabits **small to large-sized, low turbidity, cool-water, high to moderate gradient streams** in the Cumberland and Tennessee River basins. They tend to be on top of, or barely buried in the substratum when found during surveys. They can also bury beneath boulders and slab rock in only a small amount of burrowable substrate. Suitable substrate ranges from sand and gravel mixes to areas in between boulders or even cracks in bedrock. It tends to be found in less than one foot of water in or around riffles.

Critical Habitat

None

Range

The littlewing pearlymussel occurs in the Cumberland and Tennessee River basins. Most found populations are close to bridges. This may simply be because that is where the most intensive sampling efforts have occurred. The littlewing pearlymussel is a very small mussel that is difficult to locate, even if they are present. This mussel was historically widespread in the Cumberland and Tennessee River systems, but uncommon. Because they tend to lie on top, or bury shallow, in the substrate, when dead it is likely their shells wash away downstream, making it difficult to ascertain actual stretches of river reaches they inhabit. It is rare indeed to find a live specimen.



Decision Key

- 2) Does the project include any direct or indirect effects to **perennial streams or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)
 - a. Yes: Contact SME
 - b. No: Prepare NE finding

Longsolid (*Fusconaia subrotunda*)

Species Description

The longsolid was listed as **threatened** in 2023 with a 4(d) rule coupled with the round hickorynut mussel. This 4(d) rule will provide for the conservation of the longsolid and round hickorynut by prohibiting the following activities, except as otherwise authorized or permitted: importing or exporting; take; possession and other acts with unlawfully taken specimens; delivering, receiving, carrying, transporting, or shipping in interstate or

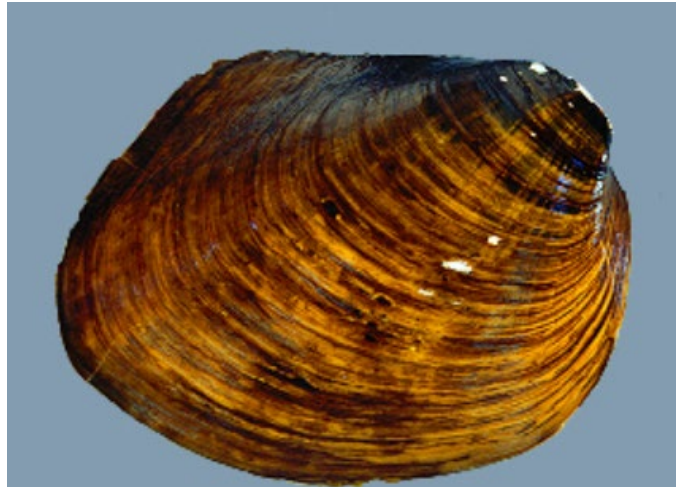


Figure 13 Photo Credit:
<http://www.inhs.illinois.edu/collections/mollusk/publications/guide/index/110>

foreign commerce in the course of commercial activity; or selling or offering for sale in interstate or foreign commerce. This protective regulation includes most of these prohibitions because the longsolid and round hickorynut are at risk of extinction in the foreseeable future and putting these prohibitions in place will help to prevent further declines, preserve the species' remaining populations, slow their rate of decline, and decrease synergistic, negative effects from other ongoing or future threats.

The longsolid's shell oval to elongate oval, becoming more elongate with age. It is a fairly thick-shelled mussel, and ranges from compressed to inflated. Anterior margin is straightish to rounded, while the posterior margin is rounded to bluntly pointed. Ventral margin is broadly to slightly rounded, may have slight concavity near posterior margin in old individuals. Dorsal margin is relatively long, and straight-ish to slightly rounded. Umbo is prominent, elevated, turned somewhat anteriorly and near the anterior margin. The shell is relatively smooth and is yellow to dark brown. Nacre is white. Cardinal teeth are heavy and well-developed; the lateral teeth are long and solid. Length to 5 inches.

Habitat Description

The longsolid occurs in Medium to large rivers in main-channel habitats in substrates of gravel and sand.

Critical Habitat

Yes - *(see additional maps and detailed descriptions provided after the decision key)*

Critical habitat was designated for the longsolid on April 10, 2023.

Primary constituent elements for the longsolid include:

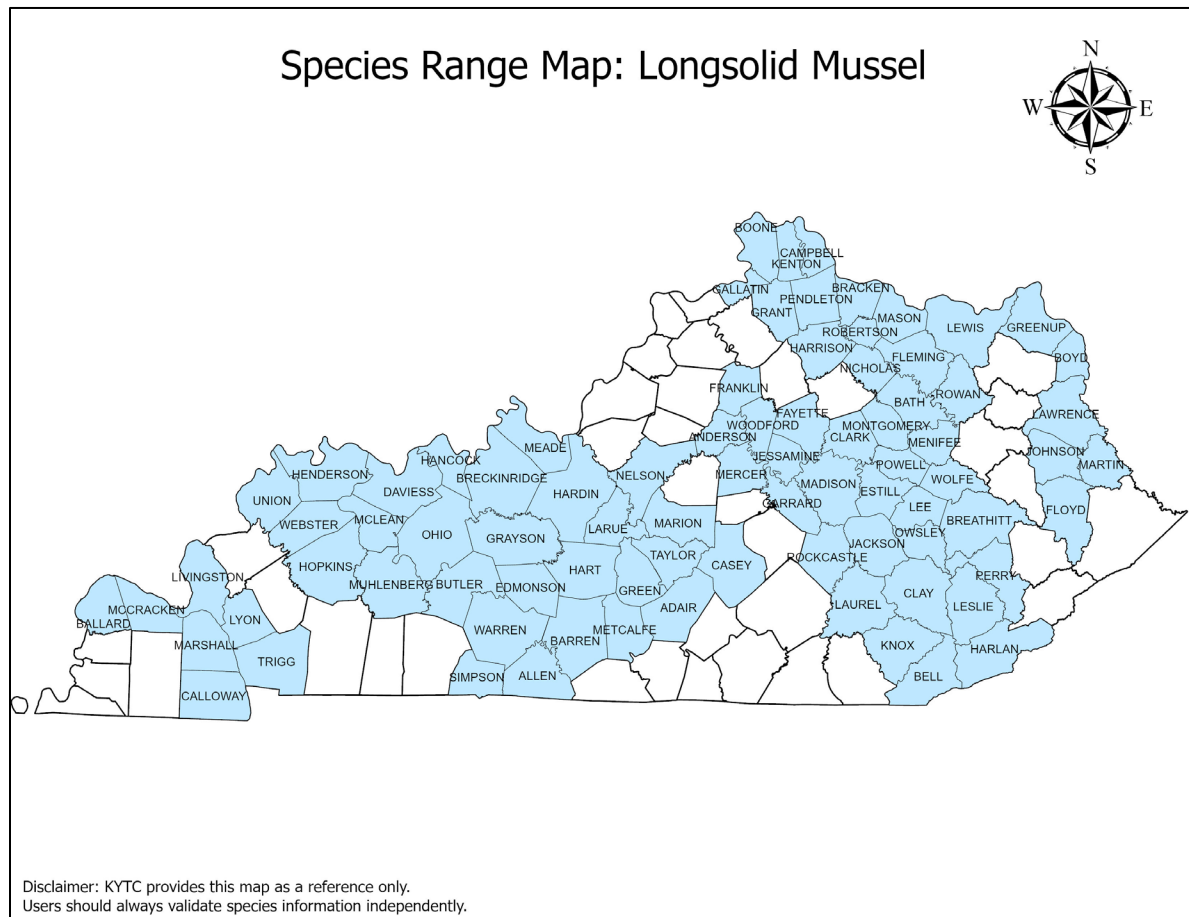
1. Adequate flows, or a hydrologic flow regime (magnitude, timing, frequency, duration, rate of change, and overall seasonality of discharge over time), necessary to maintain benthic habitats where the species are found and to maintain stream connectivity, specifically providing for the exchange of nutrients and sediment for maintenance of the mussels' and fish host's habitat and food availability, maintenance of spawning habitat for native fishes, and the ability for newly transformed juveniles to settle and become established in their habitats.
2. Suitable substrates and connected instream habitats, characterized by geomorphically stable stream channels and banks (i.e., channels that maintain lateral dimensions, longitudinal profiles, and sinuosity patterns over time without an aggrading or degrading bed elevation) with habitats that support a diversity of freshwater mussel and native fish (such as, stable riffle-runpool habitats that provide flow refuges consisting of predominantly silt-free, stable sand, gravel, and cobble substrates).
3. Water and sediment quality necessary to sustain natural physiological processes for normal behavior, growth, and viability of all life stages, including: Dissolved oxygen (generally above 2 to 3 parts per million (ppm)), salinity (generally below 2 to 4 ppm), and temperature (generally below 86 °F (30 °C)). Additionally, water and sediment should be low in ammonia (generally below 0.5 ppm total ammonia-nitrogen) and heavy metal concentrations, and lack excessive total suspended solids and other pollutants.

4. The presence and abundance of fish hosts necessary for recruitment of the longsolid (currently unknown, likely includes minnows of the family Cyprinidae and banded sculpin (*Cottus carolinae*)).

Species, Stream (unit), and State	Currently Occupied River Miles
Longsolid	
Licking River (LS 8), KY	181
Green River (LS 9), KY	156

Range

The longsolid historically occurred in the larger river drainages of the Ohio River and Upper Cumberland River below Cumberland Falls, absent from the Mississippi River and lowland streams in western KY. It is presently considered to occupy larger tributaries or main-stems of the Upper Green, Licking, Kentucky, and Big Sandy, Lower Tennessee, and Lower Ohio Rivers.

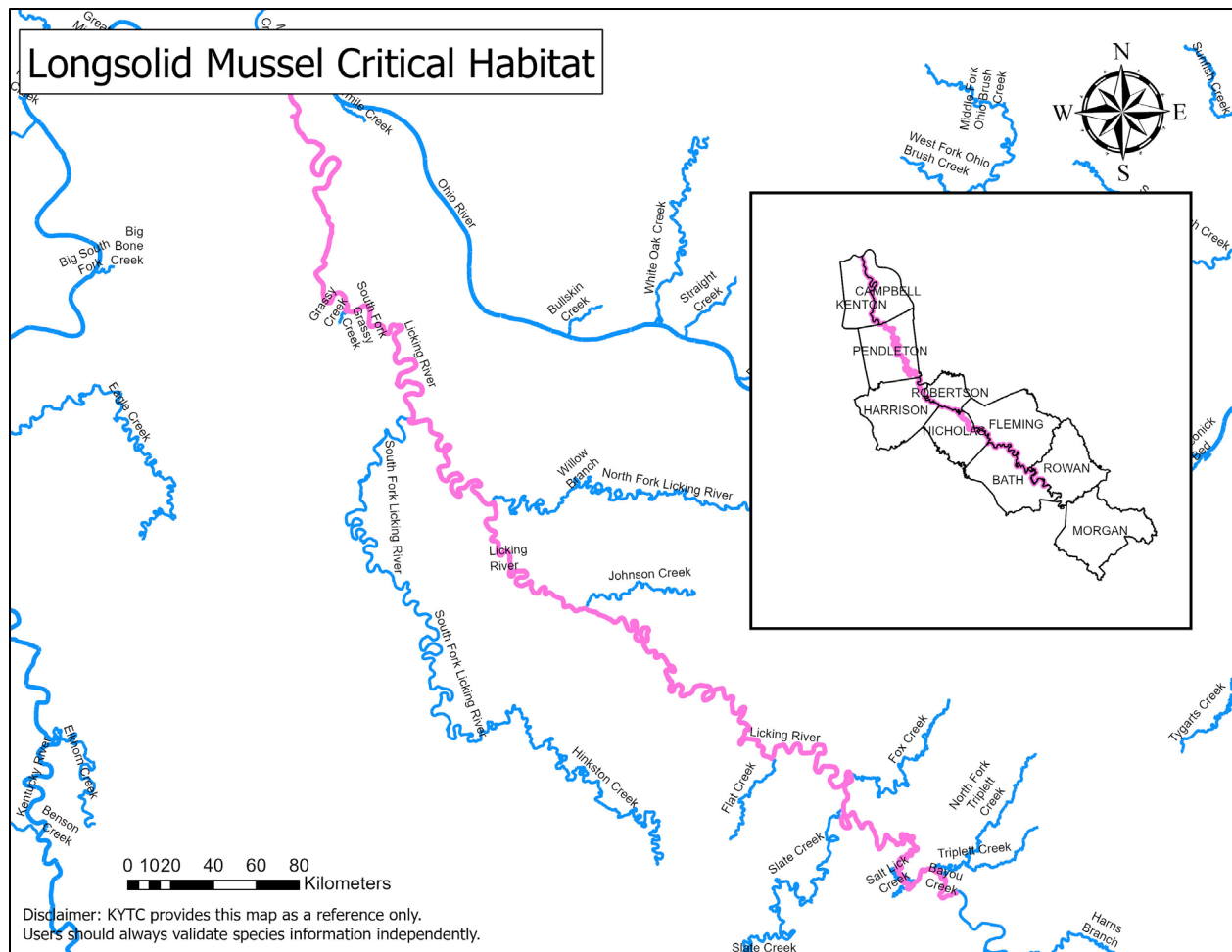


Decision Key

- 1) Does the project include any direct or indirect effects to **perennial streams or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)
 - a. Yes: Contact SME
 - b. No: Prepare NE finding

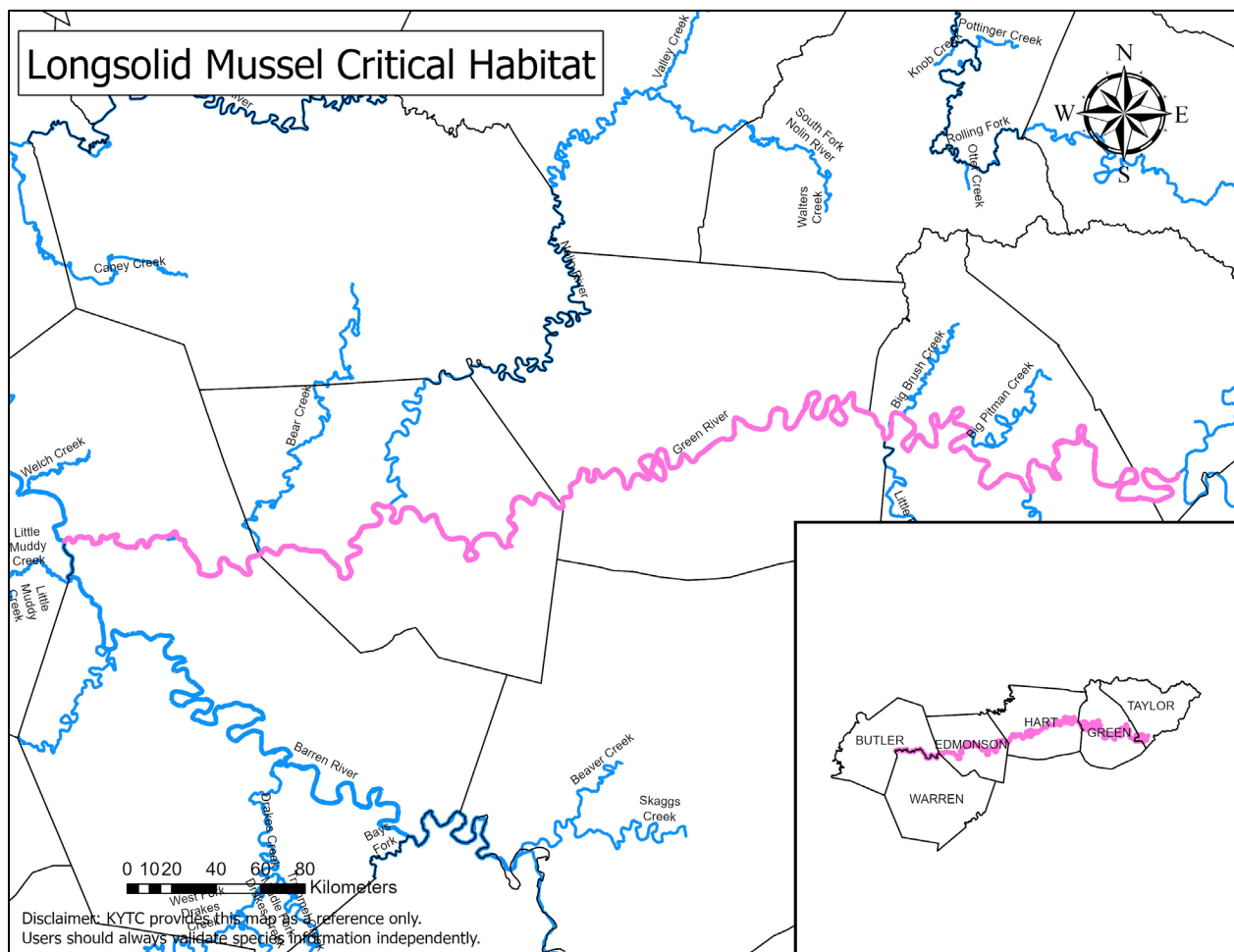
LS 8: Licking River Unit – Bath, Campbell, Fleming, Harrison, Kenton, Morgan, Nicholas, Pendleton, Robertson, and Rowan Counties, KY.

LS 8 partially overlaps with Unit RH 8 for the round hickorynut, described below. Unit LS 8 consists of 181 river mi (291.5 km) of the Licking River in Bath, Campbell, Fleming, Harrison, Kenton, Morgan, Nicholas, Pendleton, Robertson, and Rowan Counties, Kentucky, from Cave Run Dam in Bath/Rowan Counties downstream to its confluence with the Ohio River at Newport, Campbell/ Kenton County, Kentucky. Riparian lands that border the unit include approximately 161 river mi (259.7 km; 90 percent) in private ownership and 19 river mi (31.7 km; 10 percent) in public (Federal, State, and local government) ownership.



LS 9: Green River Unit – Butler, Warren, Edmonson, Green, Hart, and Taylor Counties, KY.

LS 9 partially overlaps with Unit RH 11 for the round hickorynut, described below. Unit LS 9 consists of 156 river mi (251.6 km) of the Green River in Butler/Warren, Edmonson, Green, Hart, and Taylor Counties, Kentucky, from Green River Lake Dam south of Campbellsville in Taylor County downstream to its confluence with the Barren River at Woodbury, Warren/Butler County, Kentucky. Riparian lands that border the unit include approximately 105 river mi (169.2 km; 67 percent) in private ownership and 51 river mi (82.4 km; 33 percent) in public (Federal, State, and local government) ownership; Federal lands include a portion of Mammoth Cave National Park. Unit LS 9 is occupied by the species and contains all of the physical or biological features essential to the conservation of the species. The entire approximately 156-river-mi (252-km) unit overlaps with designated critical habitat for the federally endangered diamond darter (78 FR 52364; August 22, 2013) and the federally threatened rabbitsfoot mussel (80 FR 24692; April 30, 2015).



Northern Riffleshell (*Epioblasma rangiana*)

AKA: *Epioblasma torulosa rangiana*

Species Description

The northern riffleshell mussel was listed as **endangered** on January 22, 1993.

The northern riffleshell are yellowish brown or green in color, and exhibit strong sexual dimorphism. Males tend to be oblong with a wide shallow sulcus



Figure 14 Photo Credit:
<http://www.inhs.illinois.edu/collections/mollusk/publications/guide/index/168/>

running along the posterior ridge from the umbo to the ventral margin. Females have a large expanded and rounded posterior end. Female northern riffleshells appear obovate in outline and swollen/rounded along the post-ventral area of the shell. The periostracum is yellowish brown with numerous fine green rays which may be obscured in older shells. Tubercles on the lateral surface are greatly reduced or absent. The shell is elongate, thick anteriorly, much thinner posteriorly, and compressed. The anterior margin is rounded, while the posterior-ventral margin is broadly rounded in females and indented in males. The umbo is low, and somewhat turned forward with a double-looped beak sculpture and is even with the hinge line. Tubercles or knobs on the lateral surface are greatly reduced or absent. Cardinal teeth are small and serrated; lateral teeth are moderately long and straight. Length 3-4 inches.

Habitat Description

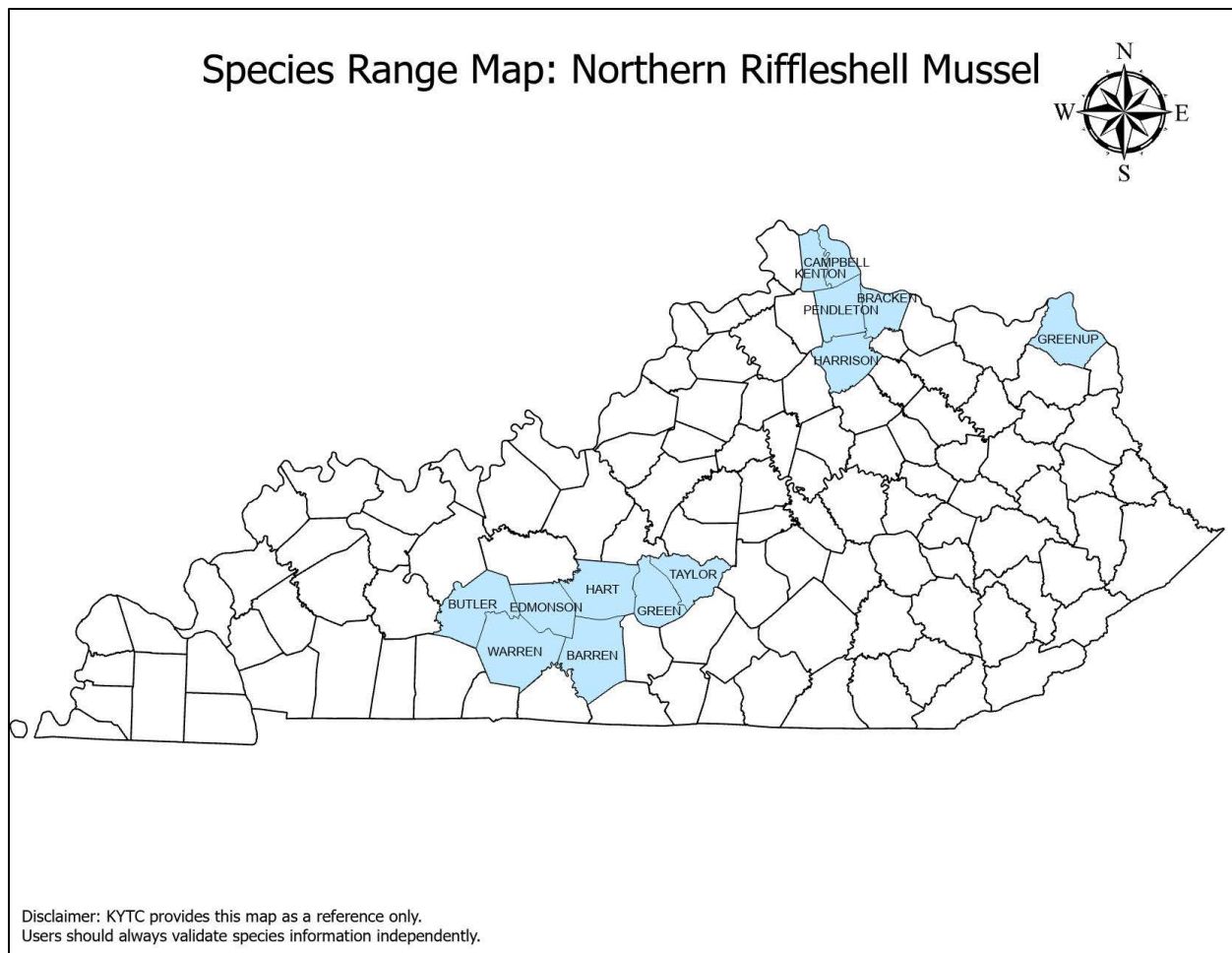
The mussel can be found in **small streams to medium-sized rivers**. The mussel beds are most commonly found in riffles and swift running water with clean substrate bottoms that consist of both firmly packed sand and fine to coarse gravel. Typically the species is found in shallow water, although individuals have been found as deep as two meters (six feet).

Critical Habitat

None

Range

In Kentucky, the northern riffleshell was historically in the Ohio, Green, Kentucky, Licking, Salt, and Cumberland Rivers and their associated tributaries. Today, it is considered to occupy only the Licking River. A nonessential, experimental population has now been placed in the Licking River.



Decision Key

- 1) Does the project include any direct or indirect effects to **perennial streams or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)
 - a. Yes: Contact SME
 - b. No: Prepare NE finding

Orangefoot Pimpleback (*Plethobasus cooperianus*)

Species Description

The orangefoot pimpleback was listed as **endangered** in 1976.

The shell is moderately heavy and thick, oval to triangular, and moderately inflated. Shell is reddish-brown to yellowish-brown with numerous, irregular, raised pustules on the posterior two-thirds of the shell. Green rays typical of juveniles become obliterated as individuals mature. Umbo is

anterior and extends above hinge line. Cardinal teeth are large and serrated; lateral teeth are thick and short. As the name suggest, the foot of this mussel is orange. Length 3-4 inches.



Figure 15 Photo Credit:
<http://www.inhs.illinois.edu/collections/mollusk/publications/guide/index/54>

Habitat Description

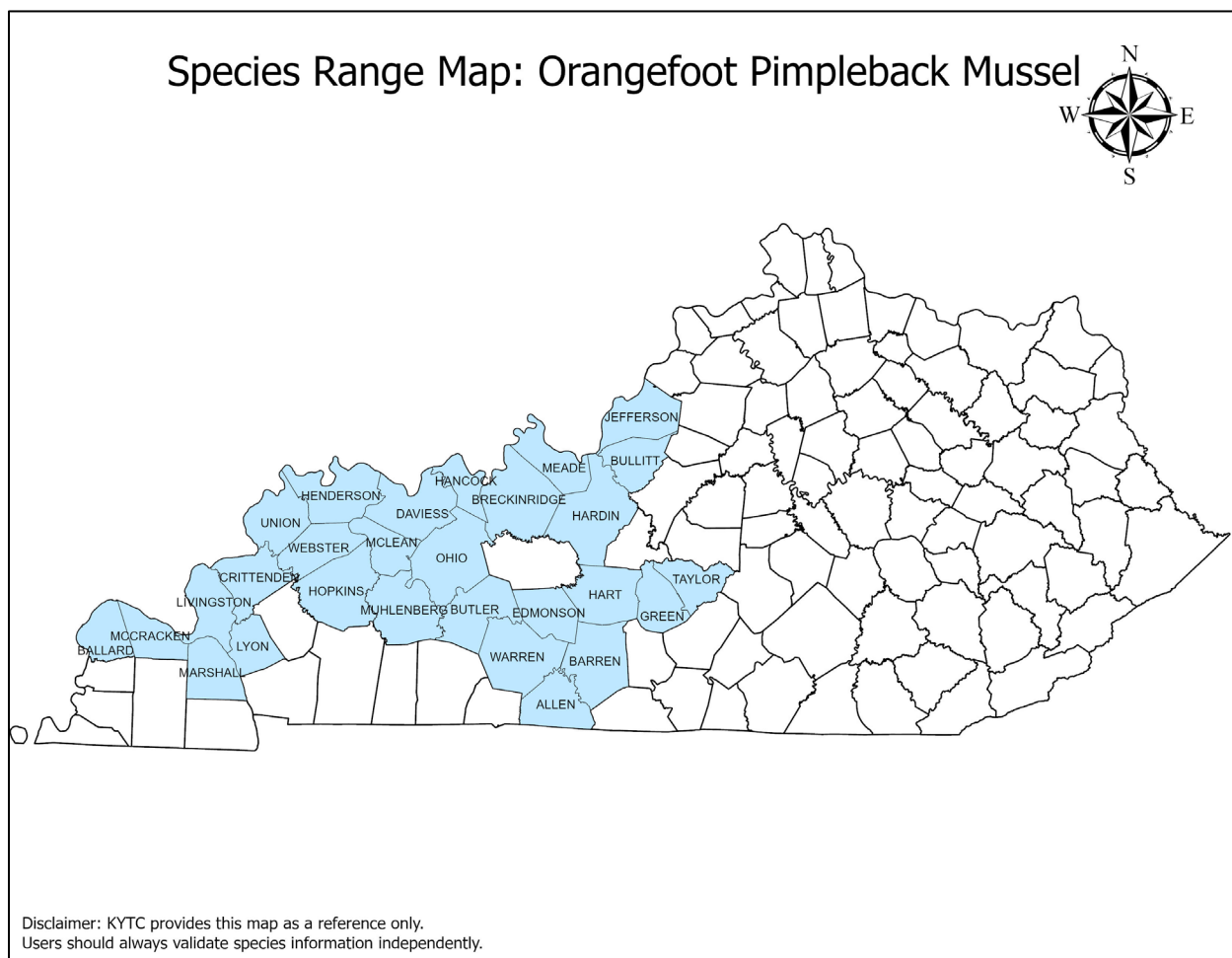
Habitat for this mussel is **medium to large-sized rivers** in sand and gravel with flowing water. Typical water depth for this species ranges from 12 – 18 feet, although it may be found in deeper or shallower water.

Critical Habitat

None

Range

The orangefoot pimpleback ranges throughout the Cumberland, Green, Tennessee, and Ohio River systems in Kentucky. A non-essential, experimental population has been established in portions of the French Broad and Holston Rivers in Tennessee.



Decision Key

- 1) Does the project include any direct or indirect effects to any **medium to large rivers or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)
 - a. Yes: Contact SME
 - b. No: Prepare NE finding

Oyster Mussel (*Epioblasma capsaeformis*)



Figure 16 Photo Credit: <http://www.arkive.org/oyster-mussel/epioblasma-capsaeformis/image-G75628.html>

Species Description

The oyster mussel was listed as **endangered** in 1997.

The oyster mussel has a periostracum that is dull to sub-shiny yellowish to green in color, with numerous narrow dark green rays. The shells of females are expanded along the posterior ventral margin and quite thin and fragile toward the shell's posterior margin. The nacre is whitish to bluish white in color. Shells are somewhat solid. Umbos are moderately full, slightly anterior, and elevated above hinge line. The cardinal teeth are small and serrated; lateral teeth are short and straight. Length 2-2.5 inches.

Habitat Description

This species inhabits **small to medium-sized rivers, and sometimes large rivers**, in areas with coarse sand to boulder substrate (rarely in mud) and moderate to swift currents. It is sometimes found associated with water-willow (*Justicia americana*) beds and in pockets of gravel between bedrock ledges in areas of swift current.

Critical Habitat

Yes - (See additional maps and detailed descriptions provided after the decision key)

Critical habitat for the oyster mussel was designated on August 31, 2004.

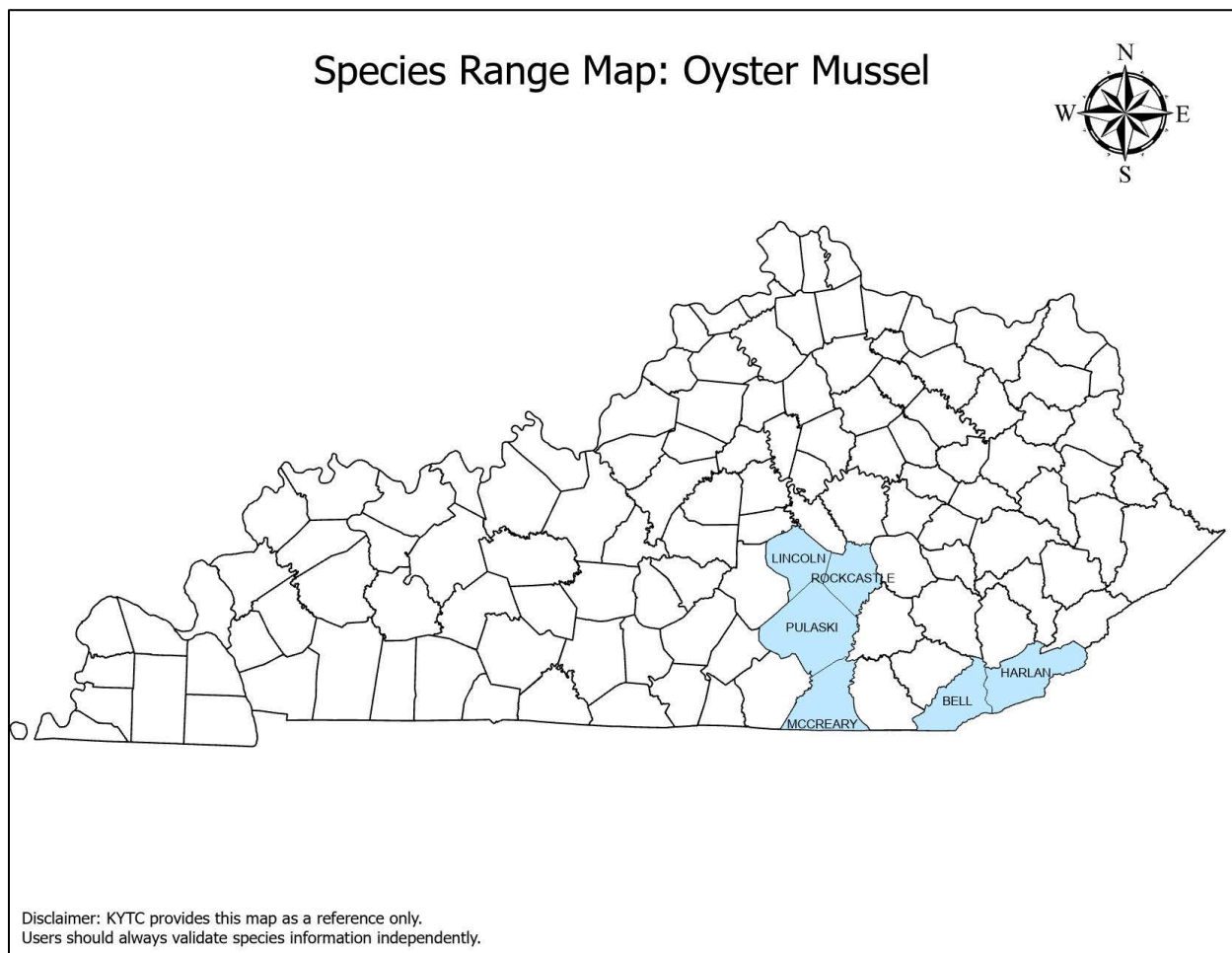
Primary constituent elements of critical habitat for this species include:

1. Permanent, flowing stream reaches with a flow regime (*i.e.*, the magnitude, frequency, duration, and seasonality of discharge over time) necessary for normal behavior, growth, and survival of all life stages of the five mussels and their host fish.
2. Geomorphically stable stream and river channels and banks (structurally stable stream cross section).
3. Stable substrates, consisting of mud, sand, gravel, and/or cobble/ boulder, with low amounts of fine sediments or attached filamentous algae.
4. Water quality (including temperature, turbidity, oxygen content, and other characteristics) necessary for the normal behavior, growth, and survival of all life stages of the mussels and their host fish.
5. Fish hosts with adequate living, foraging, and spawning areas.

Species, Stream (unit), and State		Currently Occupied		Currently Unoccupied	
		River Miles		River Miles	
Oyster Mussel					
	Duck River (Unit 1), TN		46		.....
	Bear Creek (Unit 2), AL, MS		.....		25
	Powell River (Unit 4), TN, VA		.....		94
	Clinch River (Unit 5), TN, VA		150		.....
	Copper Creek (Unit 5), VA		.....		13
	Nolichucky River (Unit 6), TN		5		....
	Big South Fork (Unit 9), Tn, KY		.....		27
	Buck Creek (Unit 10), KY		.....		36

Range

The oyster mussel's range historically included four physiographic provinces (Interior Low Plateau, Cumberland Plateau, Ridge and Valley, Blue Ridge) and six States (Alabama, Georgia, Kentucky, North Carolina, Tennessee, and Virginia). In the Cumberland River it occurred from the base of Cumberland Falls, McCreary and Whitley Counties, Kentucky, downstream to Stewart County, Tennessee. Non-essential, experimental populations have been established in the Tennessee River in Alabama, and in portions of the Holston and French Broad Rivers in Tennessee.

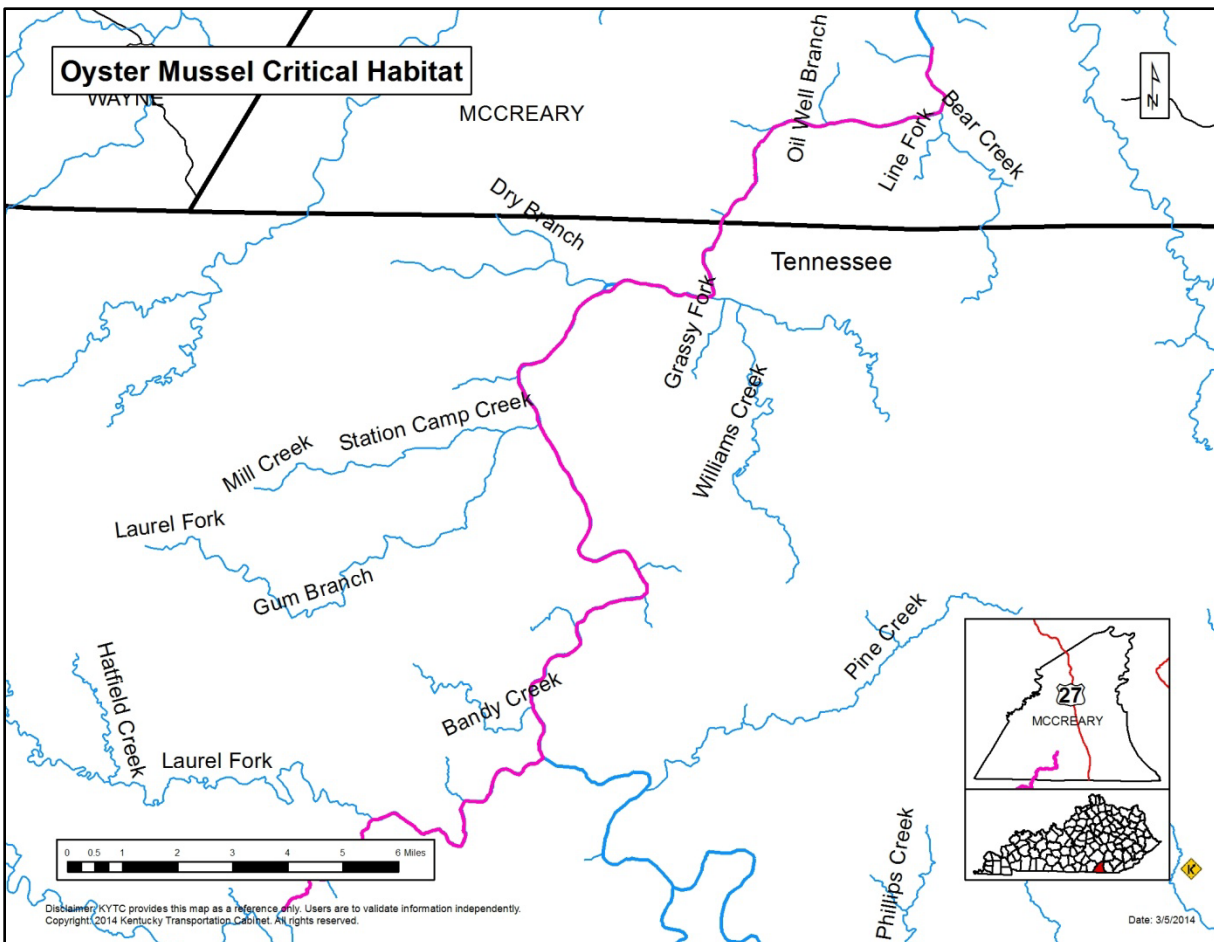


Decision Key

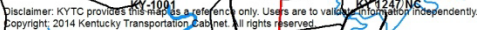
- 1) Does the project include any direct or indirect effects to **perennial streams or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)
 - a. Yes: Contact SME
 - b. No: Prepare NE finding

Unit 9. Big South Fork and Tributaries, Fentress, Morgan, and Scott Counties, Tennessee, and McCreary County, Kentucky.

Unit 9 encompasses 153 rkm (95 rmi) and consists of 43 rkm (27 rmi) of the Big South Fork of the Cumberland River main stem from its confluence with Laurel Crossing Branch downstream of Big Shoals, McCreary County, Kentucky, upstream to its confluence with the New River and Clear Fork, Scott County, Tennessee; 11 rkm (7 rmi) of North White Oak Creek from its confluence with the Big South Fork upstream to Panther Branch, Fentress County, Tennessee; 14.5 rkm (9.0 rmi) of the New River from its confluence with Clear Fork upstream to U.S. Highway 27, Scott County, Tennessee; 40 rkm (25 rmi) of Clear Fork from its confluence with the New River upstream to its confluence with North Prong Clear Fork, Morgan and Fentress Counties, Tennessee; 10 rkm (6 rmi) of White Oak Creek from its confluence with Clear Fork upstream to its confluence with Bone Camp Creek, Morgan County, Tennessee; 6 rkm (4 rmi) of Bone Camp Creek from its confluence with White Oak Creek upstream to Massengale Branch, Morgan County, Tennessee; 14.5 rkm (9.0 rmi) of Crooked Creek from its confluence with Clear Fork upstream to Buttermilk Branch, Fentress County, Tennessee; and 14.5 rkm (9 rmi) of North Prong Clear Fork from its confluence with Clear Fork upstream to Shoal Creek, Fentress County, Tennessee.



Unit 10 encompasses 58 rkm (36 rmi) and includes Buck Creek from the State Route 192 Bridge upstream to the State Route 328 Bridge in Pulaski County, Kentucky.



Pink Mucket (*Lampsilis abrupta*)

Species Description

The pink mucket was listed as **endangered** on June 14, 1976.

The pink mucket has a thick heavy shell with inflated valves that gape on the anterior-ventral edge. Shell shape is elliptical, subovate, and subquadrate. The periostracum typically has no sculpture and color ranges



Figure 17 Photo Credit:

<http://www.inhs.illinois.edu/collections/mollusk/publications/guide/index/154>

from pale yellow to deep brown. The species is sexually dimorphic with females being more broadly rounded to quadrate at the posterior end. Umbo is nearly even with the hinge line, and is on the anterior third of the shell. In young individuals, umbos are marked by faint, scarcely looped ridges. Cardinal teeth are large and serrated; lateral teeth are heavy and short. Length 4-5 inches.

Habitat Description

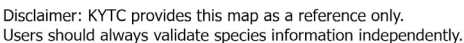
This species prefers sandy mud and gravel substrates of medium to large river systems, in moderate to fast flowing water. The species is most often collected in depths ranging from 1 to 26 ft. However, the species appears to have adapted to deeper water conditions found in the impounded Tennessee and Cumberland rivers where dam releases apparently offer suitable conditions for propagation.

Critical Habitat

None

Historical records for the pink mucket include the Tennessee, Cumberland, and Ohio River drainages with occasional records from the Mississippi River drainage. Watters et al. (2009) describes the range to include the lower Mississippi River system north to the Ohio River, including the Green River of Kentucky, Kanawha River of West Virginia, the upper Tennessee and Cumberland rivers, Meramec and Missouri rivers of Missouri, and the White and Red rivers of Arkansas.

In Kentucky specifically, associated rivers systems of the pink mucket include the Ohio, Green, Cumberland, Licking, Salt, and Tennessee. The pink mucket is a mussel that has always been considered rare, but it seems to be holding its own or increasing, even in some impounded rivers. For this mussel, conservation concern has been assigned not because of current imperilment, but because of the potential for it to become imperiled in the future.



Decision Key

- 1) Does the project include any direct or indirect effects to any **medium to large rivers or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)
 - a. Yes: Contact SME
 - b. No: Prepare NE finding

Purple Catpaw Pearlymussel (*Epioblasma obliquata*)

AKA: *Epioblasma obliquata obliquata*

Species Description

The purple catpaw pearlymussel was listed as **endangered** in 1990.

The mussel's shell is elongate oval to rectangular, inflated, solid and thick. Females are dimorphic from males and are more squared with a protrusion on the posterior margin. Umbo is anterior and above hinge line.



Figure 18 Photo Credit:
<http://www.inhs.illinois.edu/collections/mollusk/publications/guide/index/154>

Shell is smooth, tan or brown, with fine green rays. Cardinal teeth are large and serrated; lateral teeth thick and short. Length 2.5 – 3 inches.

Habitat Description

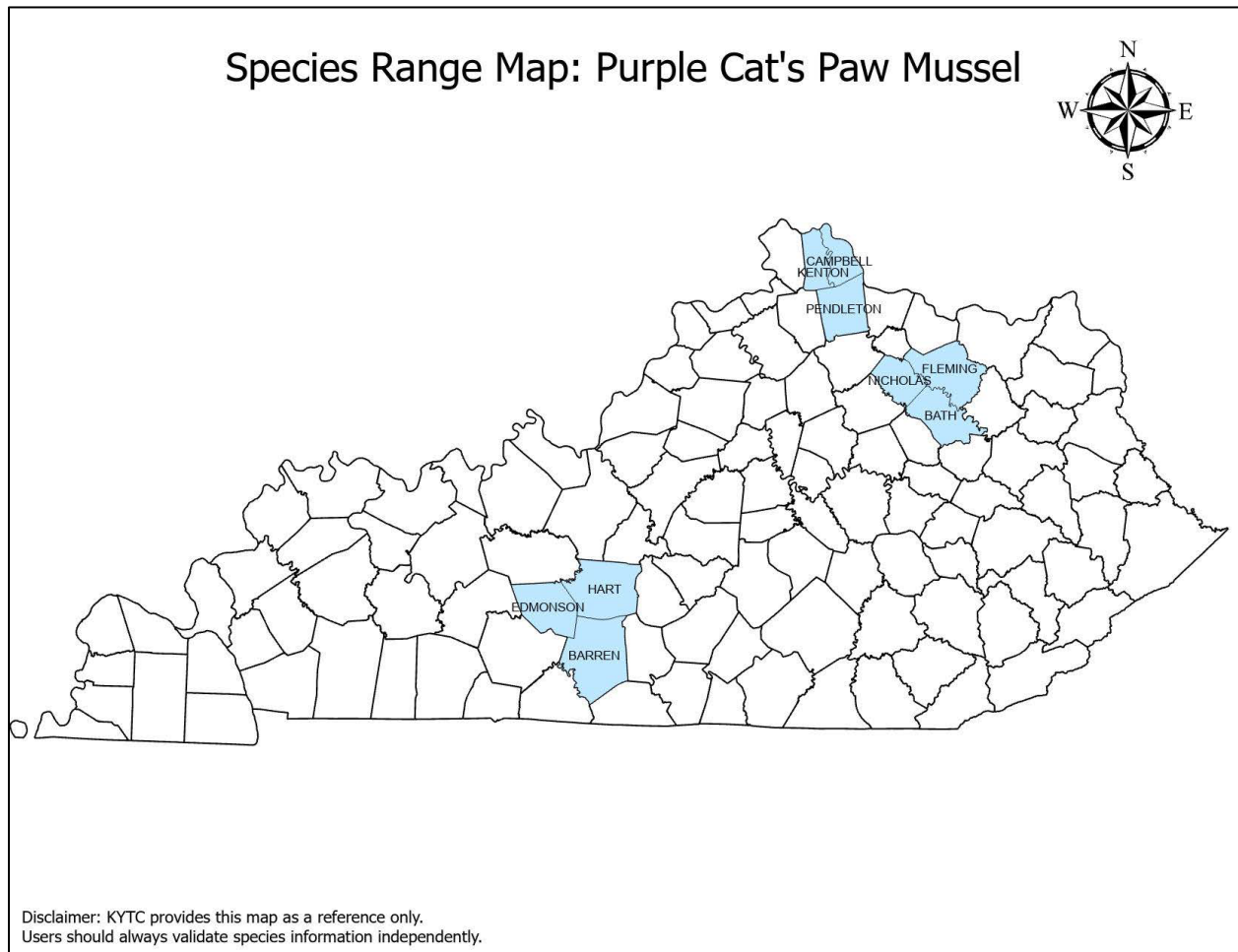
The habitat for this mussel is usually defined as **medium to large rivers** in sand and gravel, and this is the most likely habitat for this species. However, a population exists in a **small stream** (Killbuck Creek) in Ohio. In this small stream habitat, it is found in riffle and run habitats with sand, gravel, and cobble substrates in fairly fast flowing to almost still water. These mussels live completely buried in the substrate, although females will move to the surface when they are ready to release their glochidia. These females are generally found along the margin of the stream in fairly shallow water.

Critical Habitat

None

Range

The purple catspaw pearlymussel ranges from parts of the Cumberland River, Ohio River, and Green River systems. The type specimen is from the Kentucky River, but it is considered extirpated from that river system. A non-essential, experimental population has been established in the Tennessee River in Alabama.



Decision Key

- 1) Does the project include any direct or indirect effects to **perennial streams or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)
 - a. Yes: Contact SME
 - b. No: Prepare NE finding

Rabbitsfoot Mussel (*Theliderma cylindrica*)

AKA: *Quadrula cylindrica cylindrica*

Species Description

The rabbitsfoot mussel was listed as **threatened** on September 17, 2013.

The umbo is moderately elevated and raised only slightly above the hinge line.



Figure 19 Photo Credit:
<http://www.inhs.illinois.edu/collections/mollusk/publications/guide/index/32>

Beak sculpture consists of a few strong ridges or folds continuing onto the newer growth of the umbo as small tubercles. Shell sculpture consists of a few large, rounded, low tubercles on the posterior slope, although some individuals will have numerous small, elongated pustules particularly on the anterior.

The periostracum is generally smooth and yellowish, greenish, or olive in color becoming darker and yellowish-brown with age and usually covered with dark green or nearly black chevrons and triangles pointed ventrally. These patterns are absent in some individuals. Internally, the color of the nacre is white and iridescent, often with a grayish-green tinge in the umbo cavity. Specimens from the southern periphery of its range are occasionally purplish. Soft parts generally have an orange coloration. Cardinal teeth are large and serrated; lateral teeth are long and straight. Length 4-5 inches.

Habitat Description

Rabbitsfoot is primarily an inhabitant of **small to medium-sized streams and some larger rivers**. It usually occurs in shallow water areas along the bank and adjacent runs and shoals with reduced water velocity. Specimens also may occupy deep water runs, having been reported in 9 to 12 feet of water. Bottom substrates generally include gravel and sand. This species seldom burrows but instead lies on its side.

Critical Habitat

Yes - *(See additional maps and detailed descriptions provided after the decision key)*

Critical habitat for the rabbitsfoot was designated on August 27, 2013.

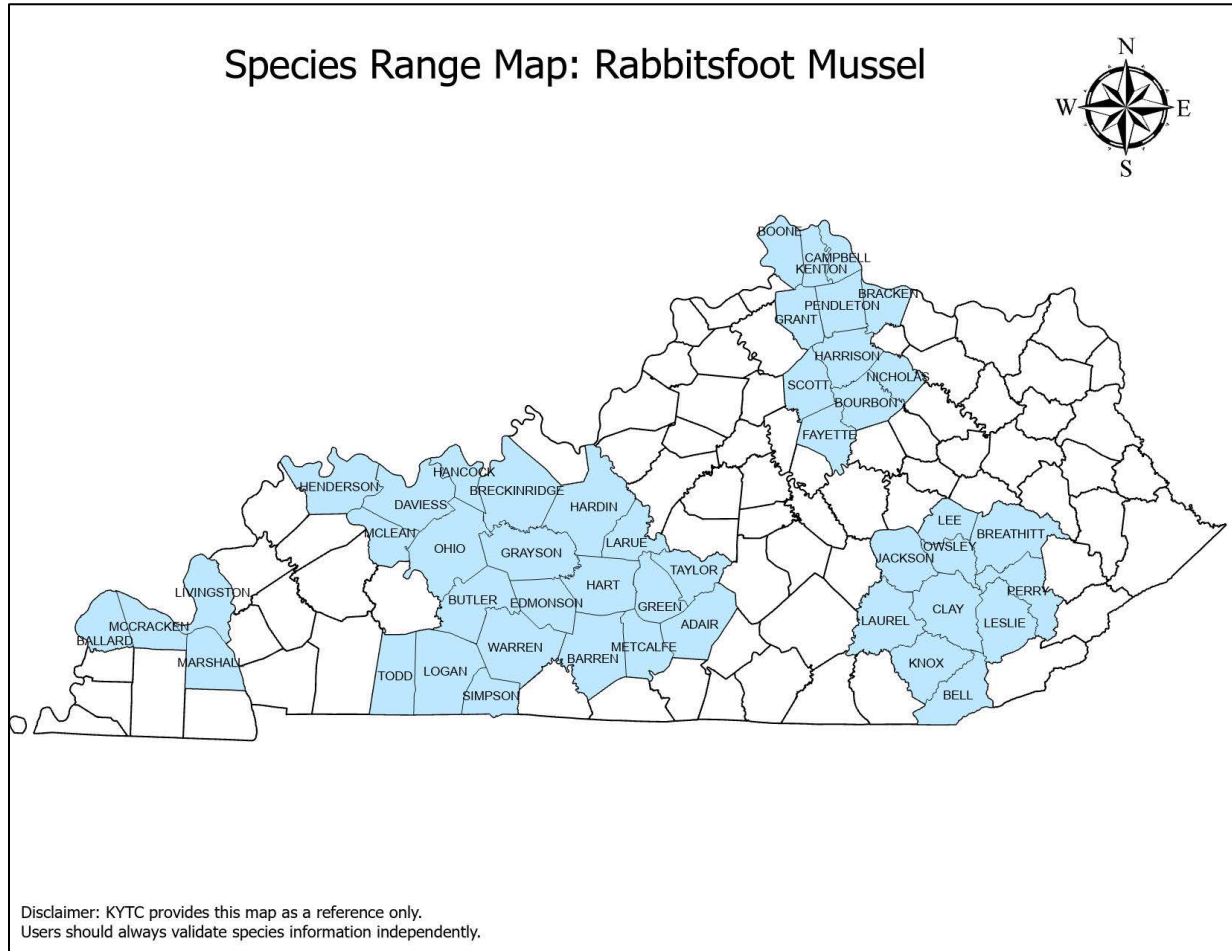
Primary constituent elements of critical habitat for this species are:

1. Geomorphically stable river channels and banks (channels that maintain lateral dimensions, longitudinal profiles, and sinuosity patterns over time without an aggrading or degrading bed elevation) with habitats that support a diversity of freshwater mussel and native fish (such as, stable riffles, sometimes with runs, and mid-channel island habitats that provide flow refuges consisting of gravel and sand substrates with low to moderate amounts of fine sediment and attached filamentous algae).
2. A hydrologic flow regime (the severity, frequency, duration, and seasonality of discharge over time) necessary to maintain benthic habitats where the species are found and to maintain connectivity of rivers with the floodplain, allowing the exchange of nutrients and sediment for maintenance of the mussel's and fish host's habitat, food availability, spawning habitat for native fishes, and the ability for newly transformed juveniles to settle and become established in their habitats.
3. Water and sediment quality (including, but not limited to, conductivity, hardness, turbidity, temperature, pH, ammonia, heavy metals, and chemical constituents) necessary to sustain natural physiological processes for normal behavior, growth, and viability of all life stages.
4. The presence and abundance (currently unknown) of fish hosts necessary for recruitment of the rabbitsfoot. The occurrence of natural fish assemblages, reflected by fish species richness, relative abundance, and community composition, for each inhabited river or creek will serve as an indication of appropriate presence and abundance of fish hosts until appropriate host fish can be identified.
5. Either no competitive or predaceous invasive (nonnative) species, or such species in quantities low enough to have minimal effect on survival of freshwater mussels.

Species, Stream (unit), and State		Currently Occupied		Currently Unoccupied	
		River Miles		River Miles	
	Rabbitsfoot Mussel				
	*Units RF1 - RF20a are not in KY				
	Tennessee River (RF20b), KY		22.1		.....
	Ohio River (RF21), KY, IL		28.5		.....
	Green River (RF22), KY		109.1		.....
	*Units RF23 - RF30 are not in KY				
	Red River (RF31), KY, TN		31.2		.....
	*Remaining units are not in KY				

Range

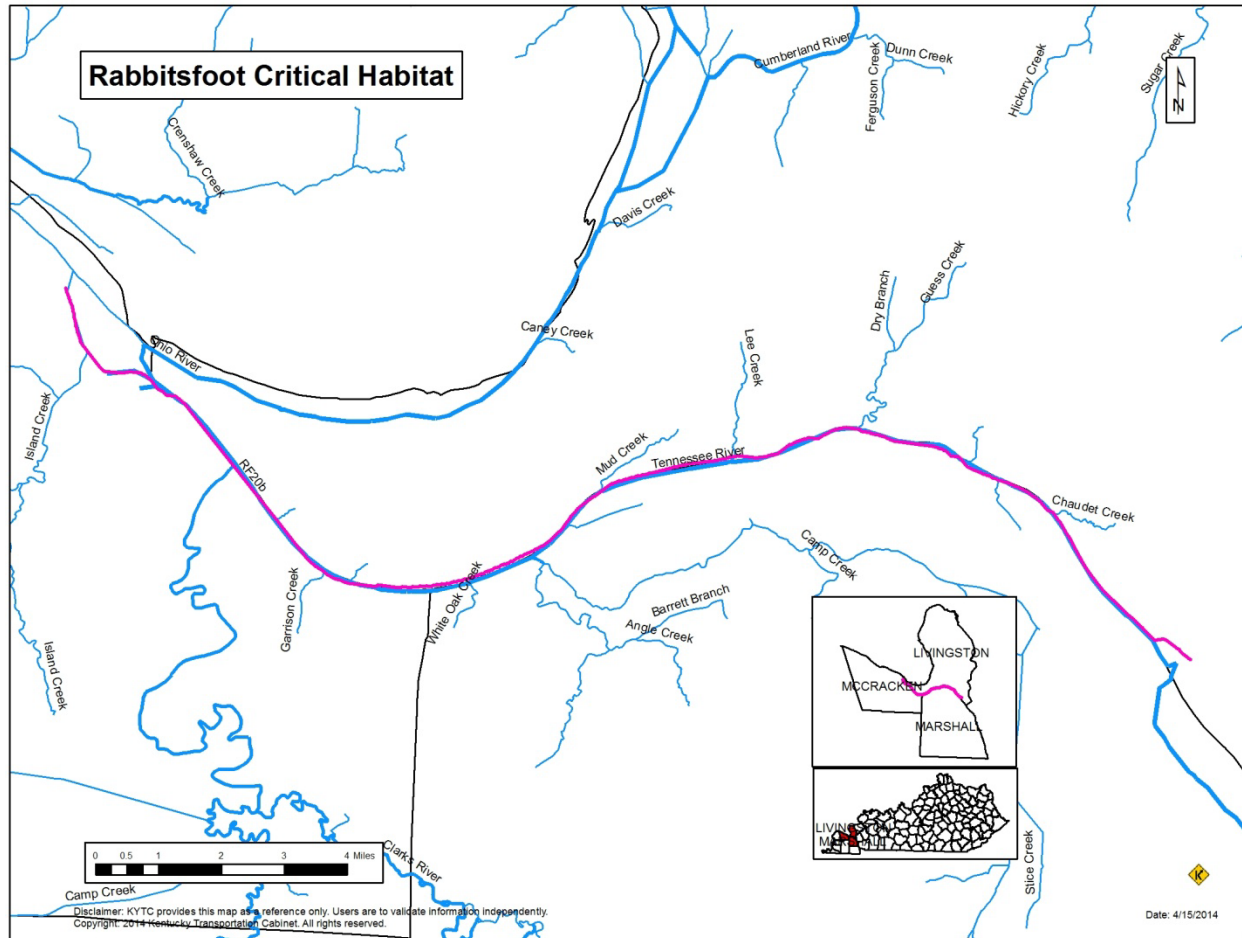
The Rabbitsfoot historically occurred in 140 streams within the lower Great Lakes Sub-basin and Mississippi River Basin. The historical range included Alabama, Arkansas, Georgia, Illinois, Indiana, Kansas, Kentucky, Louisiana, Mississippi, Missouri, Ohio, Oklahoma, Pennsylvania, Tennessee, and West Virginia. Rabbitsfoot populations are considered to be extant in 51 streams in 13 states, representing a 64 percent decline (51 extant streams of 140 historical populations). In streams where it remains extant, populations are highly fragmented and restricted to short reaches. Based upon existing habitat use (need for flowing vs. impounded habitats) and fish host (small minnow species with limited individual ranges) data, it is unlikely that recruitment between populations or establishment of new populations could occur naturally.



Decision Key

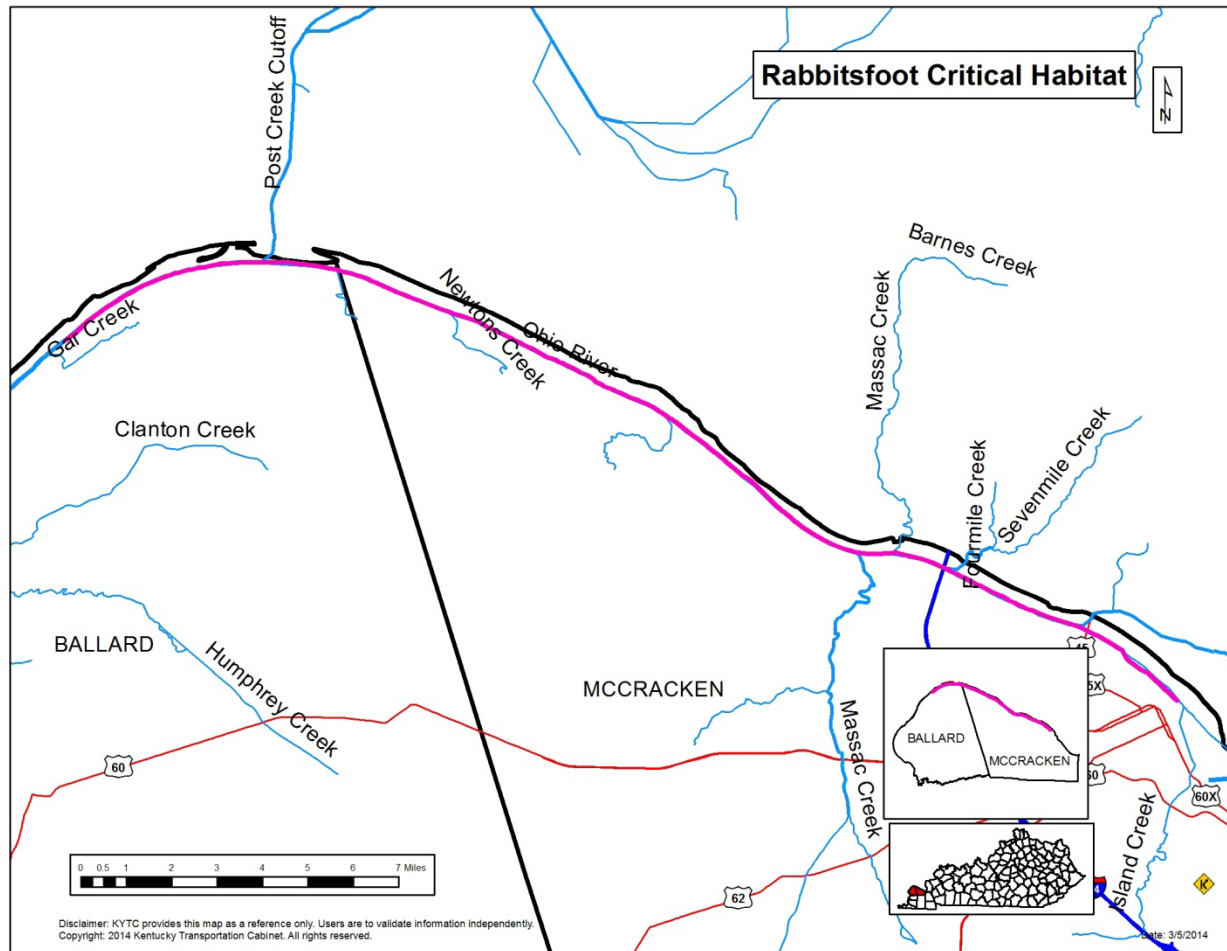
- 1) Does the project include any direct or indirect effects to **perennial streams or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)
 - a. Yes: Contact SME
 - b. No: Prepare NE finding

Unit RF20b: Tennessee River— Livingston, Marshall, and McCracken Counties, Kentucky
 Unit RF20b includes 35.6 rkm (22.1 rmi) of Tennessee River from Kentucky Lake Dam downstream to its confluence with the Ohio River, McCracken and Livingston Counties, Kentucky.



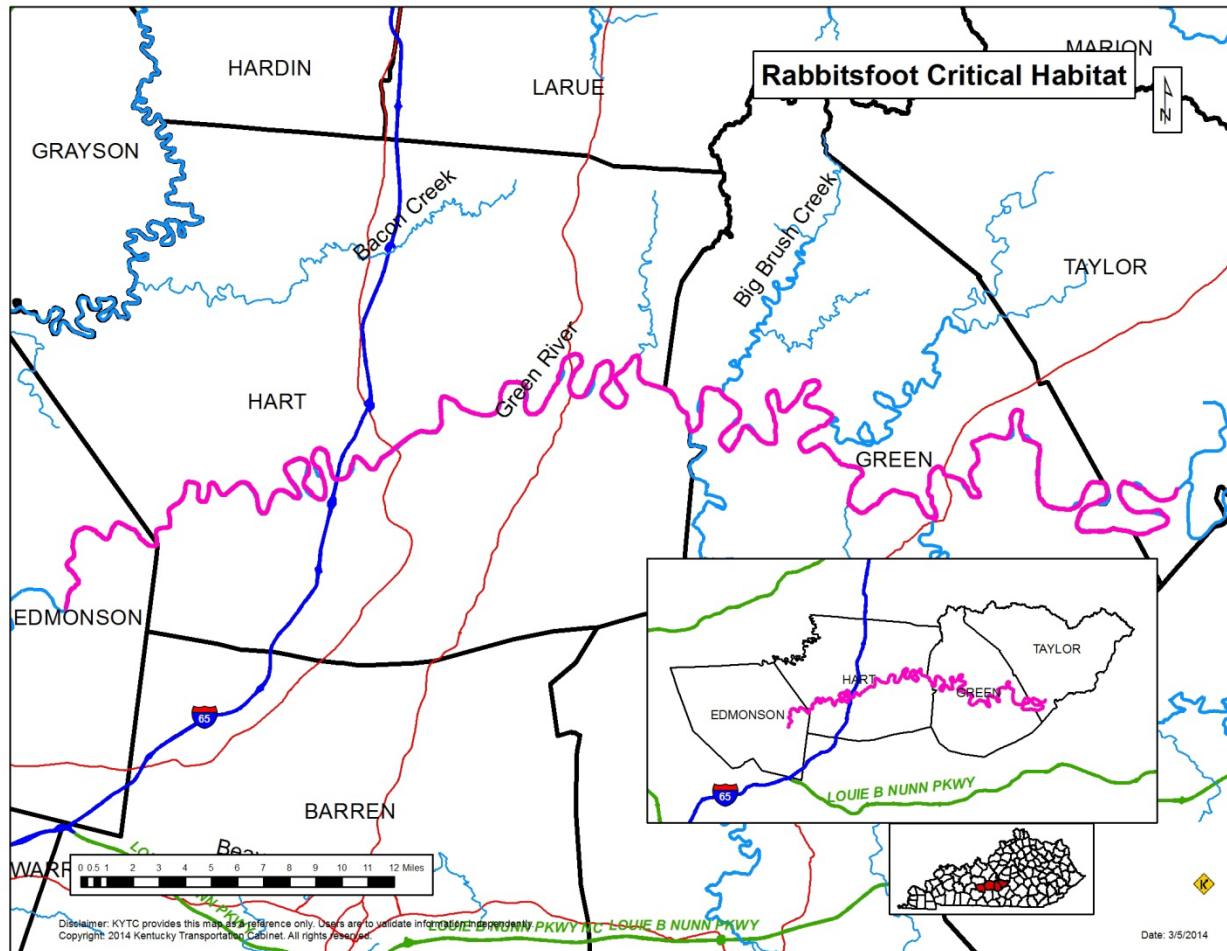
Unit RF21: Ohio River—Ballard, Livingston, and McCracken Counties, Kentucky; Massac and Pulaski Counties, Illinois

Unit RF21 includes 45.9 rkm (28.5 rmi) of the Ohio River from the Tennessee River confluence downstream to Lock and Dam 53 near Olmstead, Illinois.



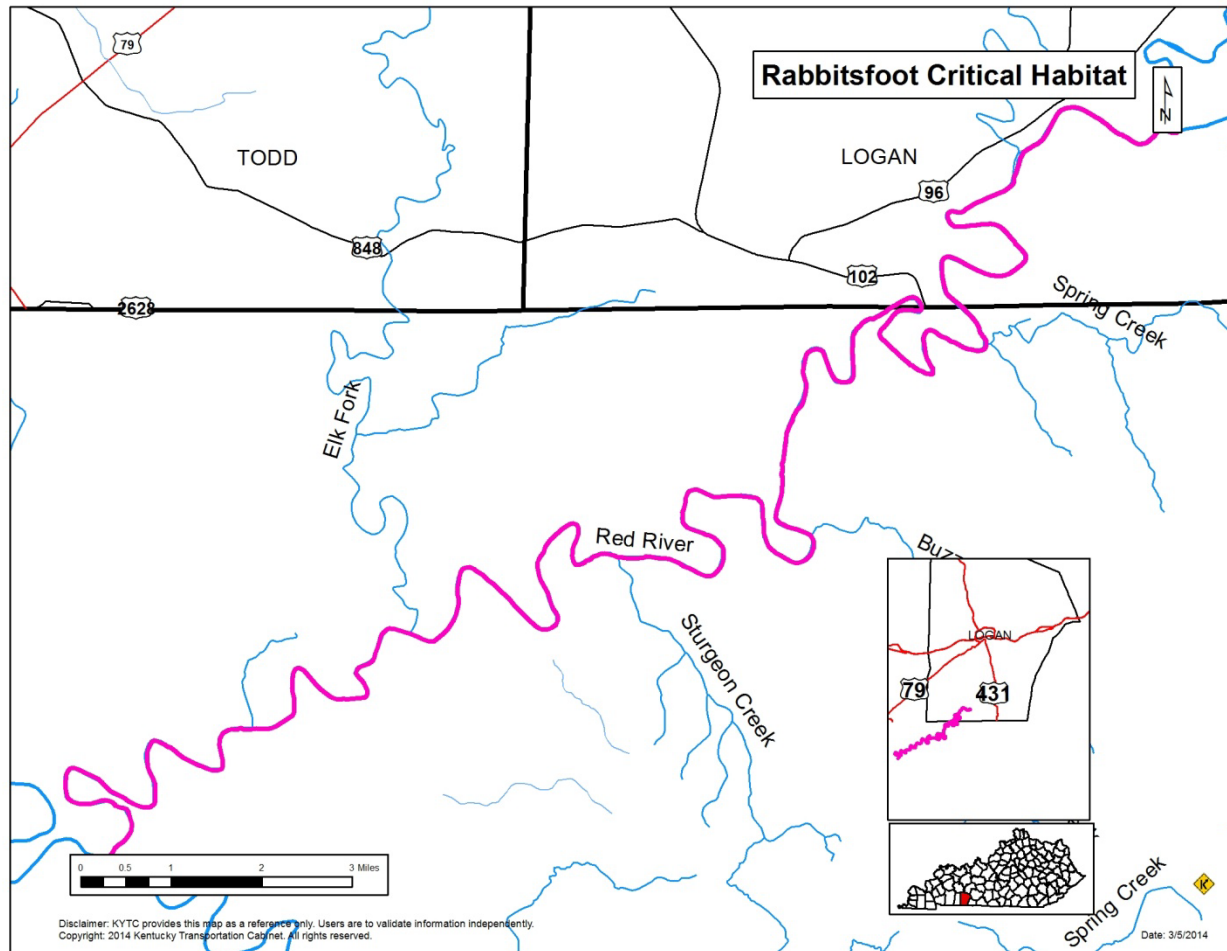
Unit RF22: Green River—Green, Hart, and Taylor Counties, Kentucky

Unit RF22 includes 175.6 rkm (109.1 rmi) of the Green River from Green River Lake Dam south of Campbellsville, Taylor County, Kentucky, downstream to Maple Springs Ranger Station Road in Mammoth Cave National Park, Kentucky.



Unit RF31: Red River—Logan County, Kentucky; and Robertson County, Tennessee

Unit RF31 includes 50.2 rkm (31.2 rmi) of the Red River from the South Fork Red River confluence west of Adairville, Kentucky, downstream to the Sulphur Fork confluence southwest of Adams, Tennessee.



Rayed Bean Mussel (*Paetulunio fabilis*)

IPaC: *Villosa fabalis*

Species Description

The rayed bean was listed as **endangered** on February 14, 2012.

The rayed bean is an elongate oval, moderately inflated, and thick shelled.

Males are posteriorly more pointed than females. Females have

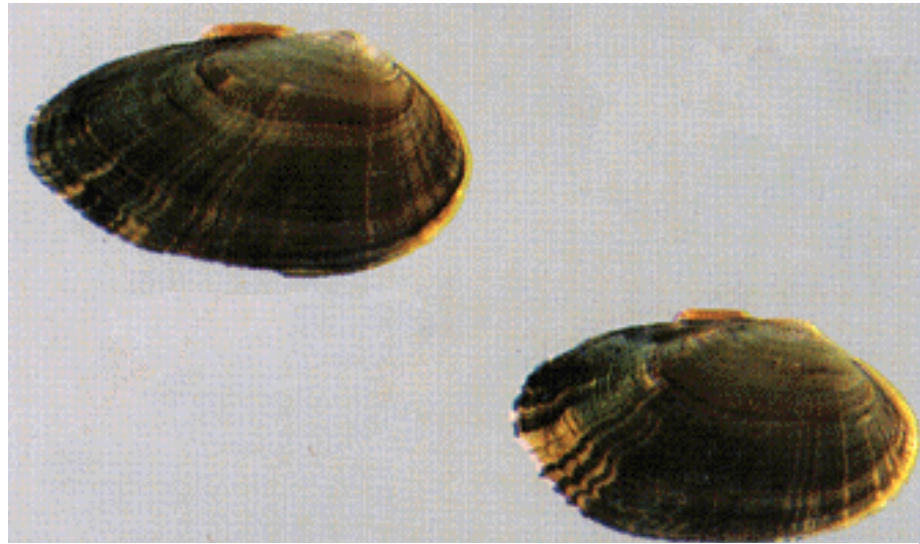


Figure 20 Photo Credit:
<http://www.inhs.illinois.edu/collections/mollusk/publications/guide/index/142>

a slightly more rounded posterior margin. The shell is yellow, tan, or green colored with numerous dark green rays. These rays may nearly cover the entire shell and persist throughout mussel's life time. Umbos are low, but extend above the hinge line. Cardinal teeth are small; lateral teeth are thick and short. Length 1-2 inches.

Habitat Description

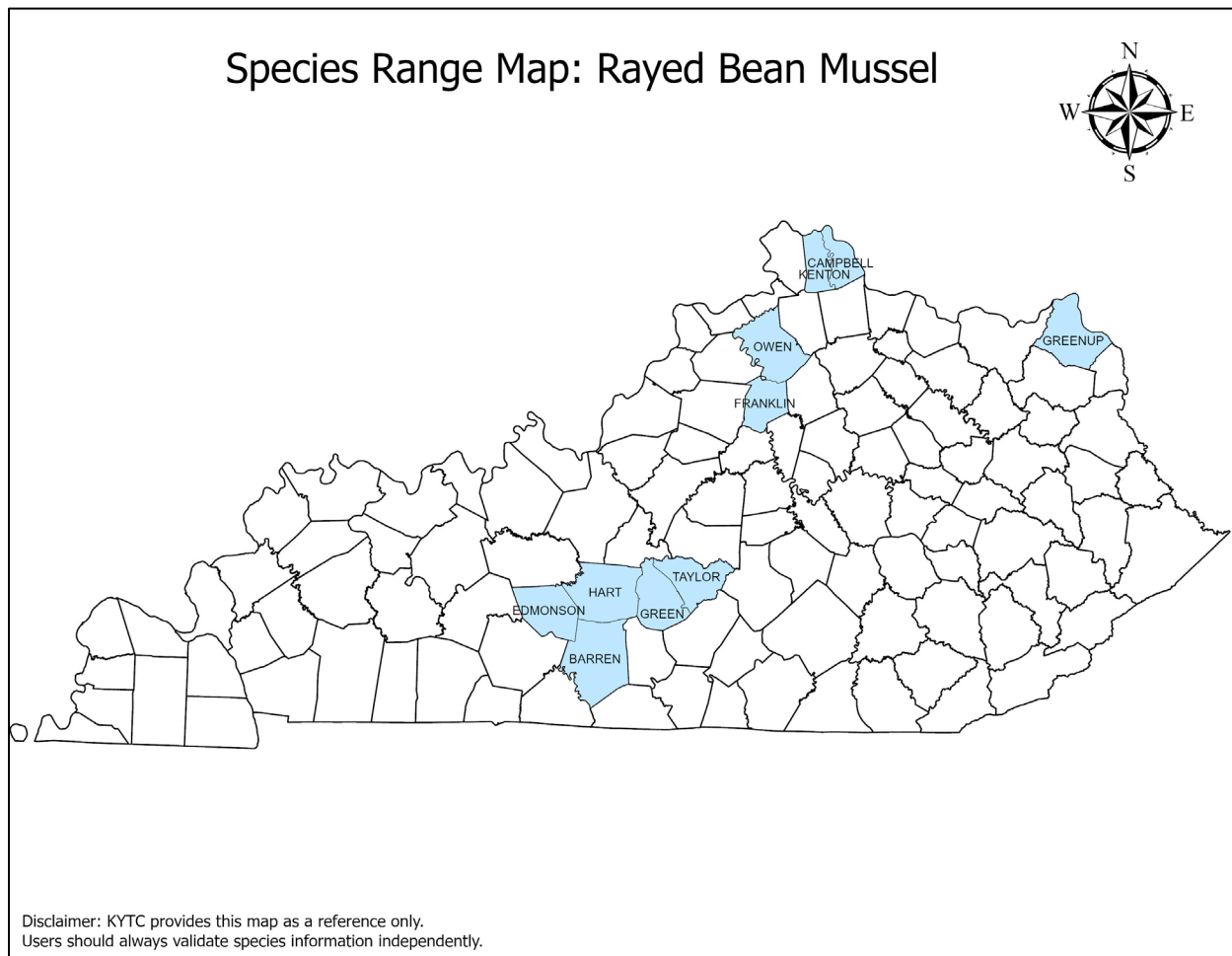
The rayed bean lives in sand and cobble in high quality **medium streams and small rivers**, although sparse records indicate that this mussel is difficult to find during surveys and that it may exist in a wider range of stream sizes. They can often be found near riffles, generally in water weeds, and deeply buried in sand and gravel bound together by roots.

Critical Habitat

Proposed as of December 2024 – none in KY.

Range

This species is perhaps more widely distributed than its current known range would suggest. It is a small, secretive species that is difficult to detect and locate. The rayed bean is widely, but sporadically distributed. In Kentucky, this species is associated with the Green, Ohio, Licking, Salt, Barren, and Kentucky River systems.



Decision Key

- 1) Does the project include any direct or indirect effects to **perennial streams or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)
 - a. Yes: Contact SME
 - b. No: Prepare NE finding

Ring Pink (*Obovaria retusa*)

Species Description

The ring pink was listed as **endangered** on September 29, 1989.

The vertically elongated shell, prominent umbo, and purple nacre are unique to this species. Valves for this shell are thick and heavy. Sexual dimorphism is often present with females having a truncated posterior margin. Periostracum is yellowish-tan to brown, and darkens with age. It can be rayless or have vague green rays. Cardinal teeth are large and serrated; lateral teeth thick and short. Length 2-3 inches.



Figure 21 Photo Credit:
<http://www.inhs.illinois.edu/collections/mollusk/publications/guide/index/112>

Habitat Description

Known as a **medium to large river** species, the ring pink has been found in gravel and sandy substrates in relatively shallow waters (2 feet); typically inhabiting gravel bars of rivers.

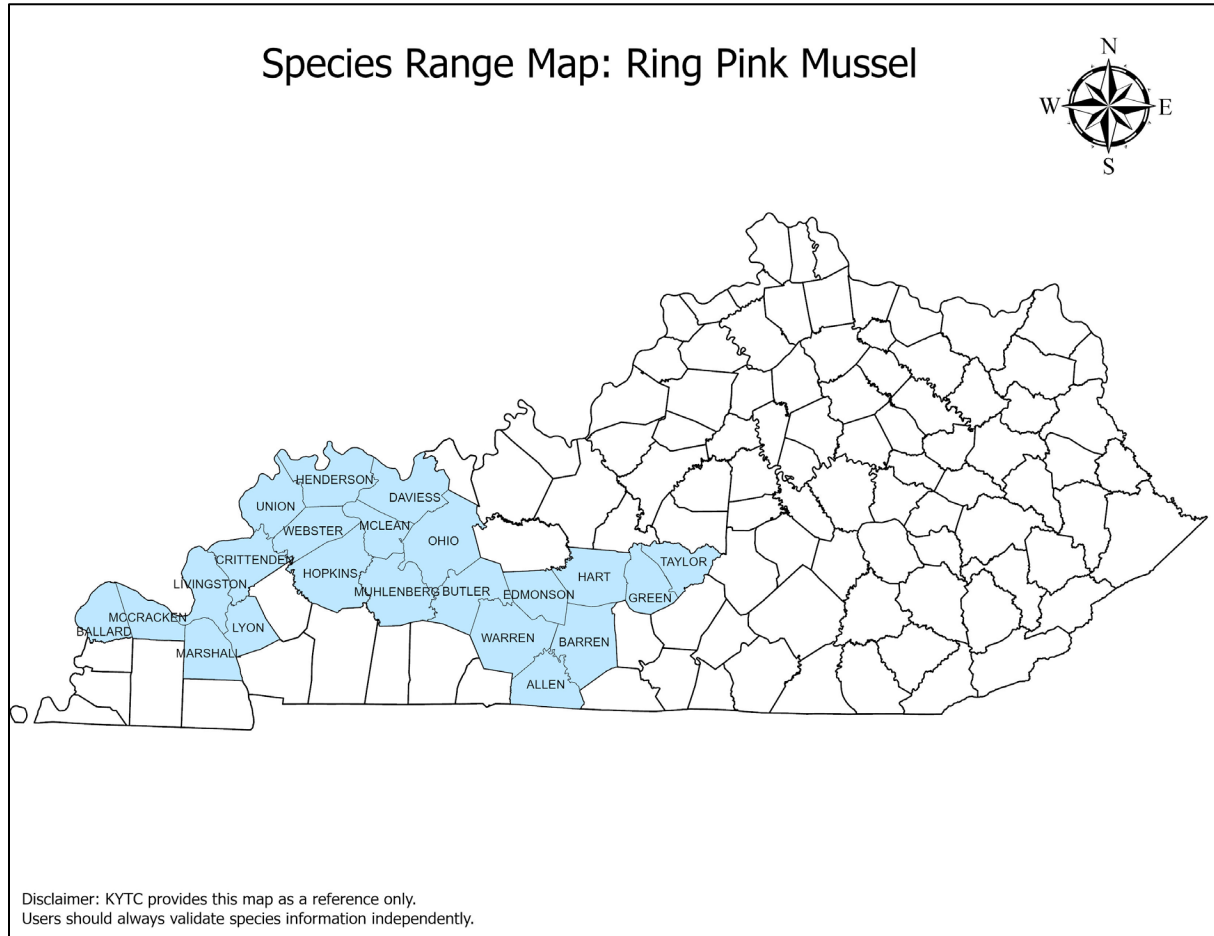
Critical Habitat

None

Range

The historic distribution likely included the Ohio River and its larger tributaries in Alabama, Illinois, Indiana, Kentucky, Ohio, Pennsylvania, Tennessee, and West Virginia. The species is presently known from five relicts, possibly non-reproducing populations in the Tennessee River (one population each in KY and TN), Green (KY), Cumberland (TN), and Kanawha rivers (WV). It is possible that the only viable population remaining is found in the Green River, Kentucky.

In Kentucky specifically, the ring pink is associated with the Ohio, Green, Kentucky, Barren, Cumberland, and Tennessee River systems. The ring pink apparently has the ability to persist at extremely low population densities. As an example of this persistence at low population densities, the ring pink is known to occur in the Green and Tennessee Rivers in Kentucky, but only single individuals have been found about every 10 years since the 1960's. A non-essential, experimental population has been established in portions of the Holston and French Broad Rivers in Tennessee.



Decision Key

- 1) Does the project include any direct or indirect effects to any **medium to large rivers or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)
 - a. Yes: Contact SME
 - b. No: Prepare NE finding

Round Hickorynut (*Obovaria subrotunda*)

Species Description

The round hickorynut was listed as **threatened** in 2023 with a 4(d) rule coupled with the Longsolid mussel. This 4(d) rule will provide for the conservation of the longsolid and round hickorynut by prohibiting the following activities, except as otherwise authorized or permitted: importing or exporting; take; possession and other acts with unlawfully taken specimens; delivering, receiving, carrying, transporting, or shipping in interstate or foreign commerce in the course of commercial activity; or selling or offering for sale in interstate or foreign commerce. This protective regulation includes most of these prohibitions because the longsolid and round hickorynut are at risk of extinction in the foreseeable future and putting these prohibitions in place will help to prevent further declines, preserve the species' remaining populations, slow their rate of decline, and decrease synergistic, negative effects from other ongoing or future threats.



Figure 22 Photo Credit:
<http://www.inhs.illinois.edu/collections/mollusk/publications/guide/index/110>

The round hickorynut's shell is circular to slightly elliptical and moderately thick. Anterior margin is broadly rounded, while the posterior margin is rounded or slightly truncated. Ventral margin is broadly rounded. Umbo is elevated above the hinge line, centrally located along the shell's midline, and broad. The shell is relatively smooth and is tannish-yellow to dark olive brown. Nacre is white. Cardinal teeth are heavy and well-developed; the lateral teeth are short and robust. Length 2.5 inches.

Habitat Description

The round hickorynut occurs in medium to large rivers; typically in main-channel habitat of sand and gravel mixtures.

Critical Habitat

Yes - *(see additional maps and detailed descriptions provided after the decision key)*

Critical habitat was designated for the round hickorynut on April 10, 2023.

Primary constituent elements for the round hickorynut include:

1. Adequate flows, or a hydrologic flow regime (magnitude, timing, frequency, duration, rate of change, and overall seasonality of discharge over time), necessary to maintain benthic habitats where the species are found and to maintain stream connectivity, specifically providing for the exchange of nutrients and sediment for maintenance of the mussels' and fish host's habitat and food availability, maintenance of spawning habitat for native fishes, and the ability for newly transformed juveniles to settle and become established in their habitats.
2. Suitable substrates and connected instream habitats, characterized by geomorphically stable stream channels and banks (i.e., channels that maintain lateral dimensions, longitudinal profiles, and sinuosity patterns over time without an aggrading or degrading bed elevation) with habitats that support a diversity of freshwater mussel and native fish (such as, stable riffle-run/pool habitats that provide flow refuges consisting of predominantly silt-free, stable sand, gravel, and cobble substrates).
3. Water and sediment quality necessary to sustain natural physiological processes for normal behavior, growth, and viability of all life stages, including: Dissolved oxygen (generally above 2 to 3 parts per million (ppm)), salinity (generally below 2 to 4 ppm), and temperature (generally below 86 °F (30 °C)). Additionally, water and sediment should be low in ammonia (generally below 0.5 ppm total ammonia-nitrogen) and heavy metal concentrations, and lack excessive total suspended solids and other pollutants.

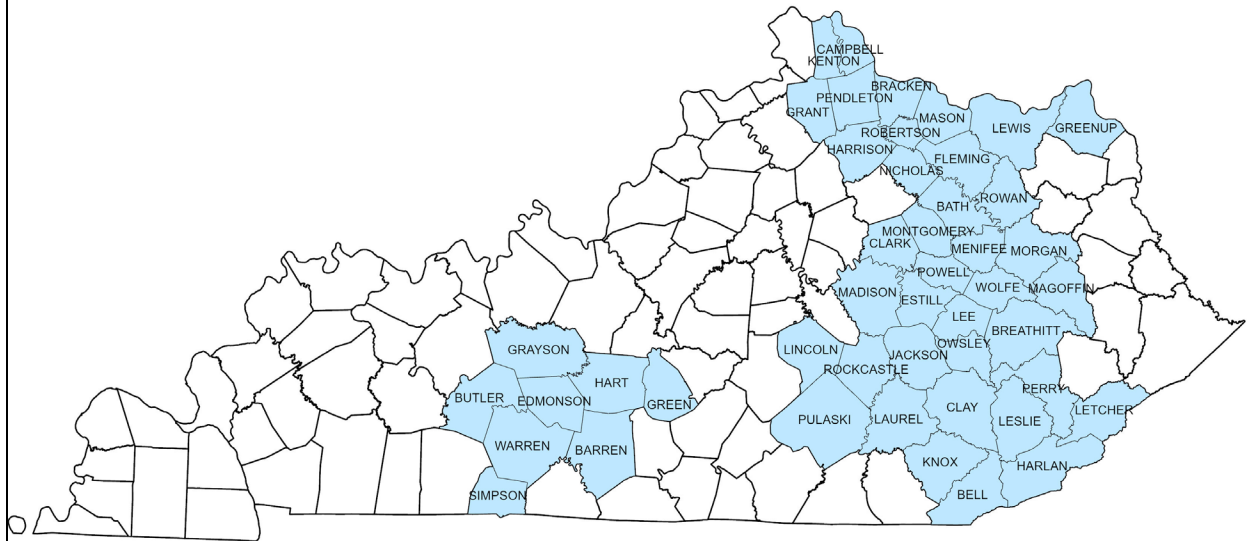
4. The presence and abundance of fish hosts necessary for recruitment of the round hickorynut (i.e., eastern sand darter (*Ammocrypta pellucida*), emerald darter (*Etheostoma baileyi*), greenside darter (*E. blennioides*), Iowa darter (*E. exile*), fantail darter (*E. flabellare*), Cumberland darter (*E. susanae*), spangled darter (*E. obama*), variegate darter (*E. variatum*), blackside darter (*Percina maculata*), frecklebelly darter (*P. stictogaster*), and banded sculpin).

Species, Stream (unit), and State	Currently Occupied River Miles
Round Hickorynut	
Licking River (RH 8), KY	150
Rockcastle River (RH 9), KY	15.3
Buck Creek (RH 10), KY	36
Green River (RH 11), KY	98

Range

The round hickorynut is distributed in the Ohio River basin, although it does not occur in the lowlands of the lower Ohio River watershed. It has also been reported in portions from the Great Lakes. In Kentucky, the mussel is generally distributed in rivers statewide except for lowland systems in the western portion of the state west of the Green River (although it did occur there historically).

Species Range Map: Round Hickorynut Mussel



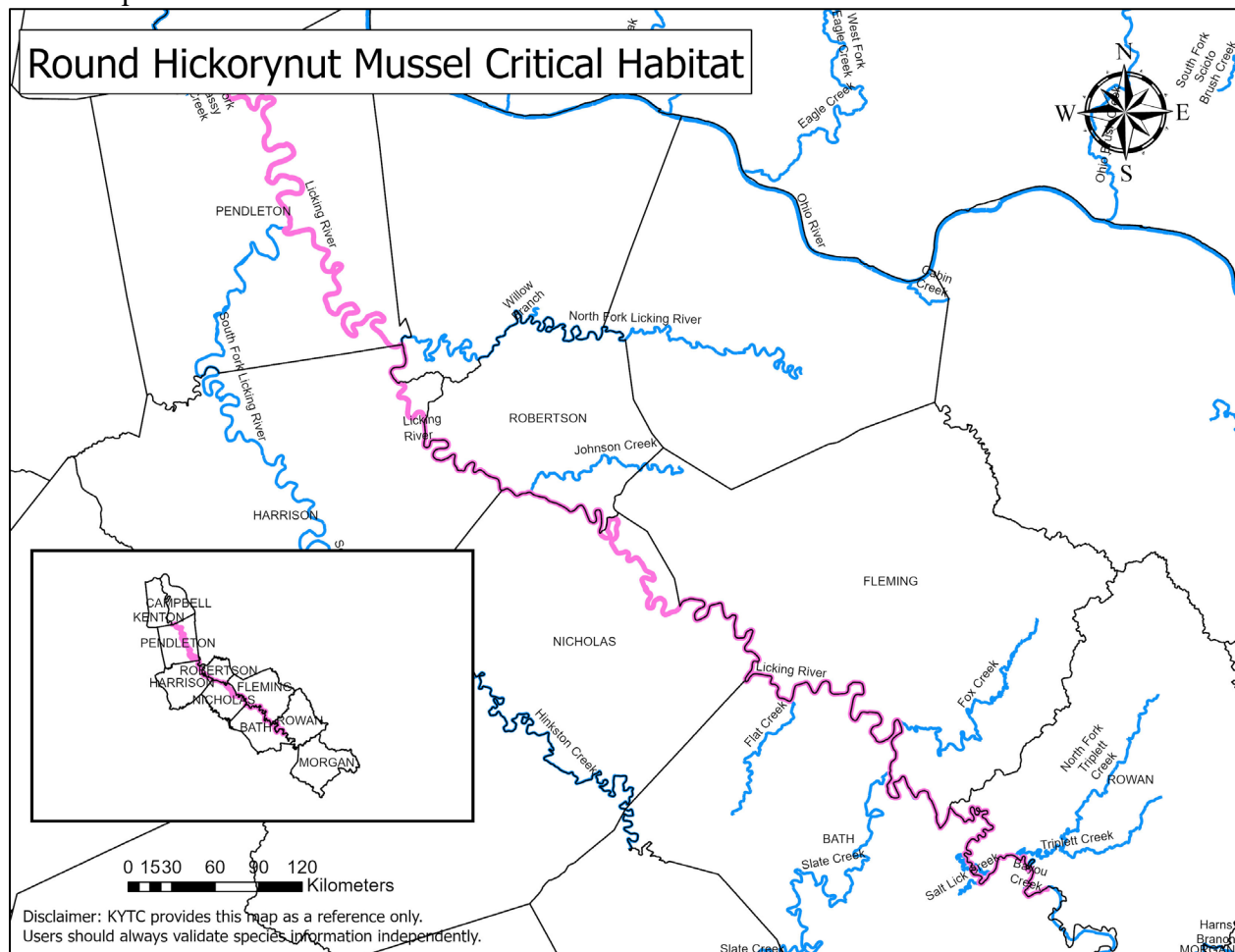
Disclaimer: KYTC provides this map as a reference only.
Users should always validate species information independently.

Decision Key

- 1) Does the project include any direct or indirect effects to **perennial streams or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)
 - a. Yes: Contact SME
 - b. No: Prepare NE finding

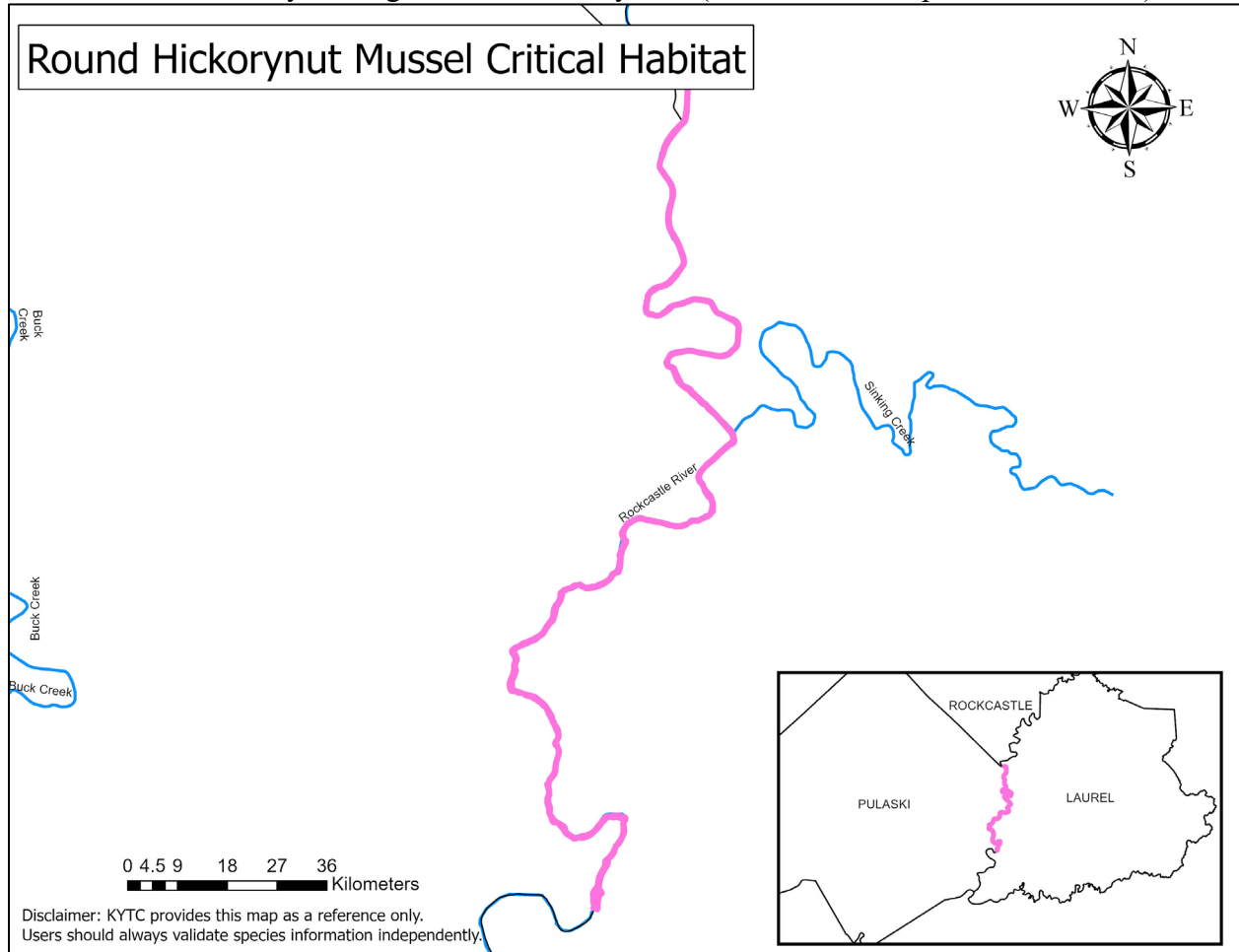
RH 8: Licking River Unit – Bath, Campbell, Fleming, Harrison, Kenton, Morgan, Nicholas, Pendleton, Robertson, and Rowan Counties, KY.

RH 8 partially overlaps with Unit LS 8 for the longsolid, described above. Unit RH 8 consists of 150 mi (241.9 km) of the Licking River in Bath, Campbell, Fleming, Harrison, Kenton, Morgan, Nicholas, Pendleton, Robertson, and Rowan Counties, Kentucky, from Cave Run Dam in Bath/Rowan Counties downstream to the Railroad crossing at the Campbell/Kenton/Pendleton County line at De Mossville, northwest of Butler, Pendleton County, Kentucky. Riparian lands that border the unit include approximately 131 river mi (211.8 km; 87 percent) in private ownership and 18 river mi (30 km; 13 percent) in public (Federal, State, and local government) ownership.



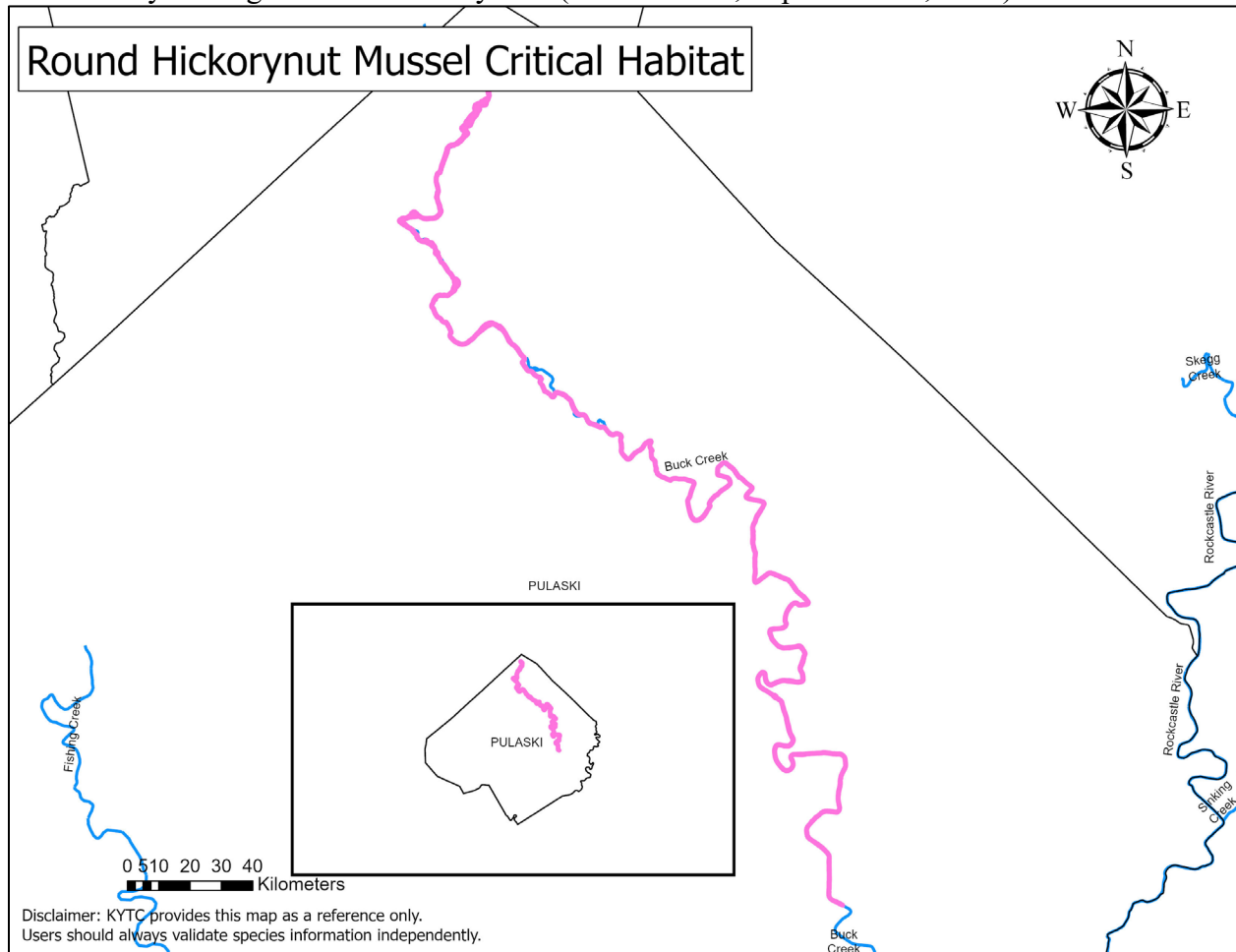
RH 9: Rockcastle River Unit – Laurel, Pulaski, and Rockcastle Counties, KY.

RH 9 consists of 15.3 river mi (24.6 km) of the Rockcastle River in Laurel, Pulaski, and Rockcastle Counties, Kentucky, from Kentucky Route 1956 at Billows downstream to Kentucky Route 192, near its confluence with Cane Creek along the Laurel/ Pulaski County line, northwest of Baldrock, Laurel County, Kentucky. Riparian lands that border the unit include approximately 0.3 river mi (0.4 km; less than 1 percent) in private ownership and 15 river mi (24.2 km; 99 percent) in public (Federal) ownership. Federal ownership is the Daniel Boone National Forest. There is overlap of approximately 15 river mi (23.7 km) of this unit with designated critical habitat for the federally endangered fluted kidneyshell (78 FR 59556; September 26, 2013).



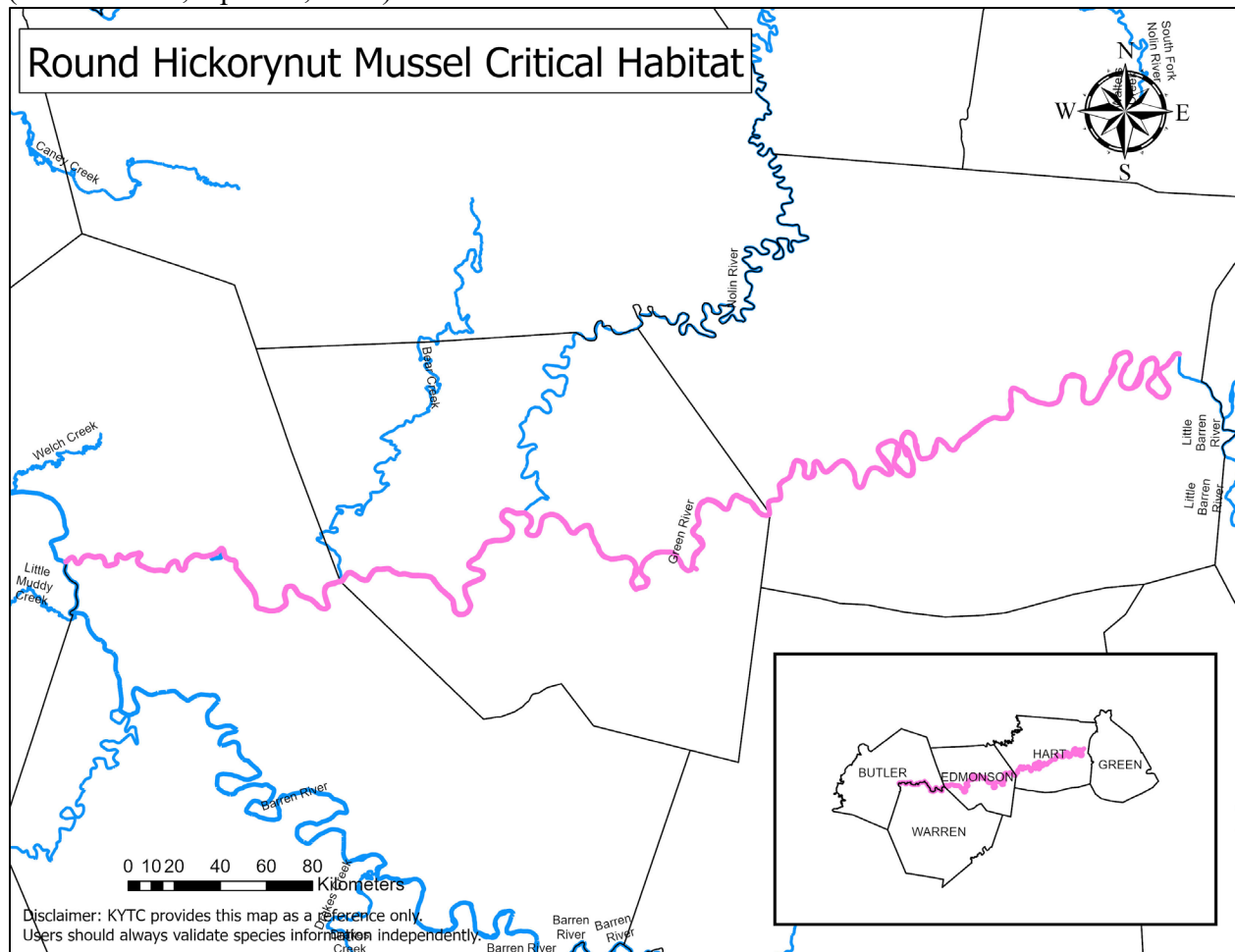
RH 10: Buck Creek Unit – Pulaski County, KY.

RH 10 consists of 36 stream mi (58.1 km) of Buck Creek in Pulaski County, Kentucky, from its confluence with Glade Fork Creek northeast of Goochtown, downstream to its confluence with Whetstone Creek, northeast of Dykes, Pulaski County, Kentucky. Riparian lands that border the unit include approximately 33 stream mi (52.6 km; 92 percent) in private ownership and 3 stream mi (5.5 km; 8 percent) in public (State and local government) ownership. There is overlap of approximately 35 stream mi (56.7 km) with designated critical habitat for the federally endangered Cumberlandian combshell and oyster mussel (69 FR 53136; August 31, 2004), and the federally endangered fluted kidneyshell (78 FR 59556; September 26, 2013).



RH 11: Green River Unit – Butler, Warren, Edmonson, Green, and Hart Counties, KY.

RH 11 partially overlaps with Unit LS 9 for the longsolid, described above. Unit RH 11 consists of 98 river mi (157.7 km) of the Green River in Butler/Warren, Edmonson, Green, and Hart Counties, Kentucky, from the mouth of Lynn Camp Creek east of Linwood in Hart County downstream to its confluence with the Barren River at Woodbury, Warren/Butler Counties, Kentucky. Riparian lands that border the unit include approximately 61 river mi (98.4 km; 62 percent) in private ownership and 37 river mi (59.4 km; 38 percent) in public (Federal and State) ownership; Federal lands include a portion of Mammoth Cave National Park. The entire 98-river-mi (157.7-km) unit overlaps with designated critical habitat for the federally endangered diamond darter (78 FR 52364; August 22, 2013) and the federally threatened rabbitsfoot mussel (80 FR 24692; April 30, 2015).



Rough Pigtoe Mussel (*Pleurobema plenum*)

Species Description

The rough pigtoe was listed as **endangered** in 1976.

The rough pigtoe's shell is triangular, inflated, and thick. Anterior margin is rounded, while the posterior margin is rounded or bluntly pointed. Ventral margin is curved. Umbo is inflated and extends above hinge line. The shell is relatively smooth with a weak sulcus (sometimes). The shell is light to dark brown, sometimes with faint rays. Nacre is white. Cardinal teeth are large and serrated; lateral teeth are thick and short. Length 3-4 inches.



Figure 23 Photo Credit:
<http://www.inhs.illinois.edu/collections/mollusk/publications/guide/index/60>

Habitat Description

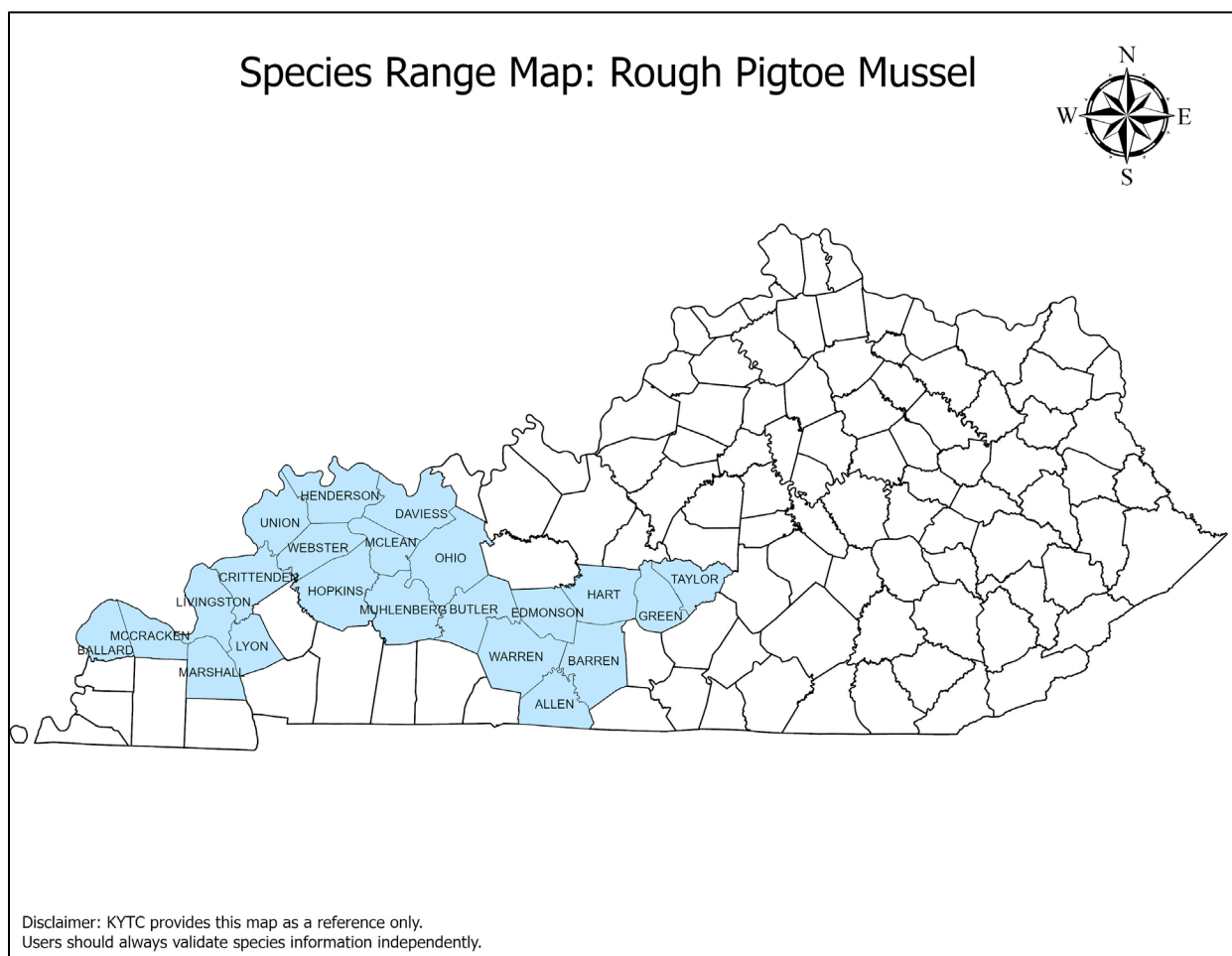
Although the rough pigtoe may become established in small rivers or headwater stretches of rivers, it is a species most typical of large rivers. It occurs in a stable substrate consisting of muddy to coarse sand, cobble, and gravel.

Critical Habitat

None

Range

Historically, the rough pigtoe had a widespread distribution in eastern North America which included the Ohio, Tennessee, and Cumberland Rivers systems (including their tributaries). This range, however, is problematic. The rough pigtoe belongs to what is considered the “*Pleurobema* complex” of mussels, wherein four species (*P. plenum*, *P. rubrum*, *P. cordatum*, and *P. sintoxia*) all look so similar that some historic specimens have undoubtedly been misinterpreted. Despite sometimes unclear morphologic divisions between these mussels, the rough pigtoe is still considered to potentially be in the Ohio, Licking, Kentucky, Cumberland, Green, and Barren River systems. Non-essential, experimental populations have been established in the French Broad and Holston Rivers in Tennessee.



Decision Key

- 1) Does the project include any direct or indirect effects to **perennial streams or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)
 - a. Yes: Contact SME
 - b. No: Prepare NE finding

Salamander Mussel (*Simpsonaias ambigua*)

Species Description

The salamander mussel was listed as **proposed endangered** in 2023.

The salamander mussel's shell is elongate/rectangular, moderately inflated, and thin. Anterior margin is rounded and pinches near the umbo at the dorsal margin. The posterior margin is evenly rounded.

Ventral margin is long and straightish. Umbo is low and barely extends above hinge line. The shell is relatively smooth, and is tan to yellow, darkening to brown with age. It is



Figure 24 Photo Credit:
https://www.inaturalist.org/guide_taxa/2111770

somewhat shiny with a glossy, polished appearance. The nacre is white and is noticeably thicker near the anterior margin. Cardinal teeth are singular, minuscule, and compressed; lateral teeth are vague and are represented by a swelling at the hinge line. The specific epithet of its scientific name, *ambigua*, comes from the mussel's general lack of defining characteristics. Length ~2 inches.

Habitat Description

Found in the habitat of its only known host species – the mudpuppy (*Necturus maculosus*), which consists of fine sediments underneath large, non-embedded rocks; may also be found near water willow beds in gravel bars as well as in crevices along the stream's periphery such as the spaces between shale layers or rock cuts; restricted to small streams and rivers. An important habitat factor is the hydrologic flow regime (the severity, frequency, duration, and seasonality of discharge over time) that maintains the rock structures and aquatic habitat where the salamander mussel and mudpuppy are found. Adequate flows provide for the exchange of nutrients and sediment; ensure delivery of oxygen; reduce contaminants and fine sediments from interstitial spaces; deliver food to filter-feeding mussels; and enable newly transformed salamander mussel

juveniles and young mudpuppies to disperse, settle, and become established. Another habitat need of the mussel is stream velocity that is not static over time with variations attributed to seasonal changes (with higher flows in winter/spring and lower flows in summer/fall) or extreme weather events (e.g., drought or floods), or anthropogenic influence (e.g., flow regulation via impoundments).

Critical Habitat

Yes, proposed - (*see additional maps and detailed descriptions provided after the decision key*)

Critical habitat was proposed for the salamander mussel on August 22, 2023.

Primary constituent elements for the salamander mussel include:

1. Shelter habitat with flat rocks and bedrock crevices free of excessive silt and fine sediments.
2. A hydrologic flow regime (the severity, frequency, duration, and seasonality of discharge over time) that maintains the rock structures and aquatic habitat where the salamander mussel and mudpuppy are found. Adequate flows provide for the exchange of nutrients and sediment; ensure delivery of oxygen; reduce contaminants and fine sediments from interstitial spaces; deliver food to filterfeeding mussels; and enable newly transformed salamander mussel juveniles and young mudpuppies to disperse, settle, and become established. Stream velocity is not static over time, and variations may be attributed to seasonal changes (with higher flows in winter/spring and lower flows in summer/fall), extreme weather events (e.g., drought or floods), or anthropogenic influence (e.g., flow regulation via impoundments).
3. Water and sediment quality, such as (but not limited to) dissolved oxygen above 5 milligrams per liter (mg/L); water temperatures generally below 86 degrees Fahrenheit (°F) (30 degrees Celsius (°C)); concentrations of ammonia, metals, and other pollutants below acute toxicity levels; and an absence of excessive total suspended solids.
4. Habitat connectivity (that is, a lack of barriers for passage of mudpuppy hosts and dispersal of mussels).

5. The presence and abundance of the mudpuppy host, necessary for recruitment of the salamander mussel.
6. Appropriate food sources (phytoplankton, zooplankton, rotifers, protozoans, detritus, and dissolved organic matter) in adequate supply

Species, Stream (unit), and State	Currently Occupied River Miles
Salamander Mussel	
Kinniconick Creek (25), KY	51.01
North Fork Licking River (26), KY	20.67
Licking River (27), KY	179.56
South Fork Licking River (28), KY	18.26
Drennon Creek (29), KY	22.36
Beech Fork River (34), KY	50.39
Rolling Fork River (35), KY	87.9

Range

The salamander mussel occurs in the Green, Salt, Kentucky, Licking, Kinniconick, Tygarts, and Little Sandy River watersheds; absent from the mainstem Ohio River and the western portion of Kentucky. This species could potentially occur in almost any stream in the eastern 2/3 of the state.

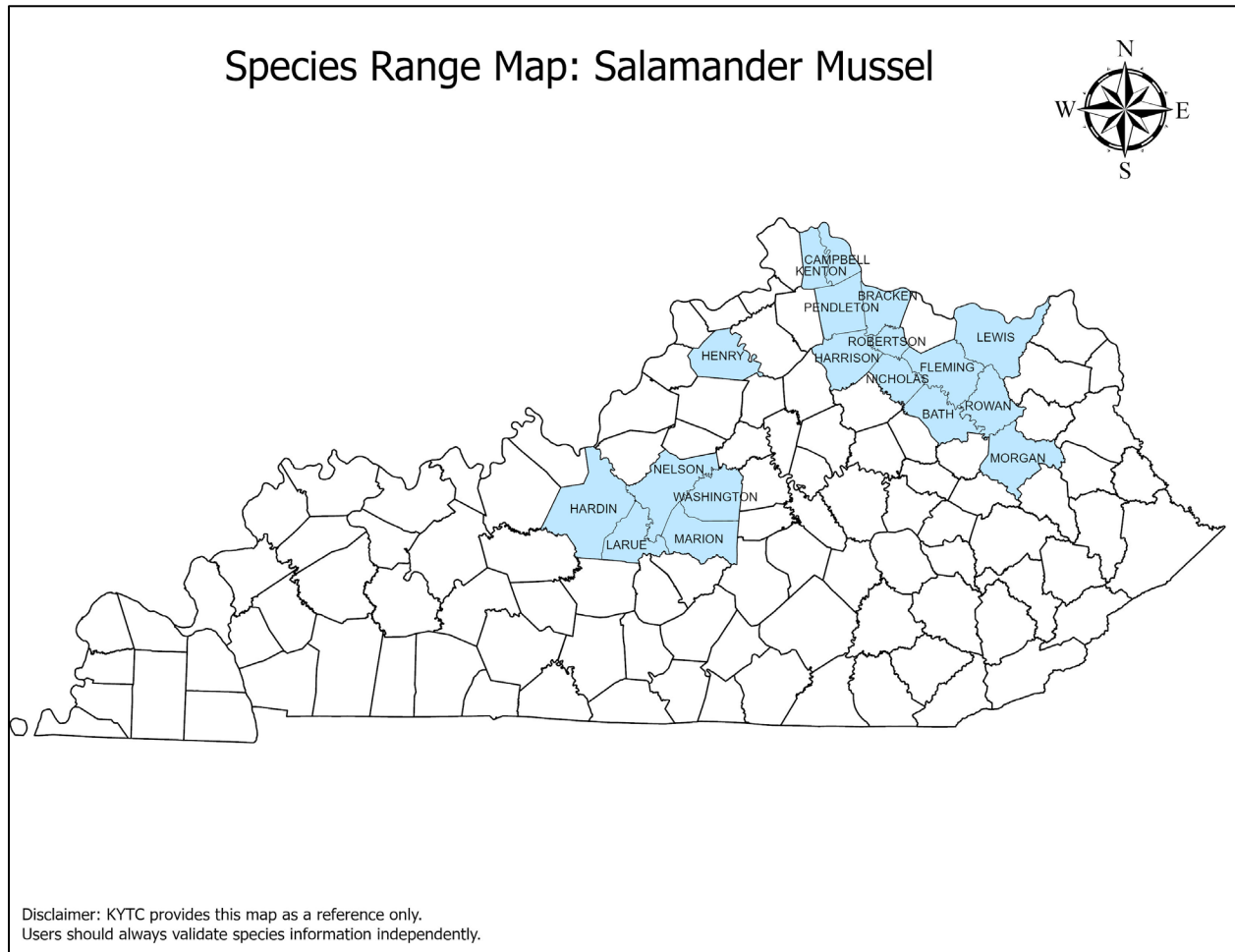


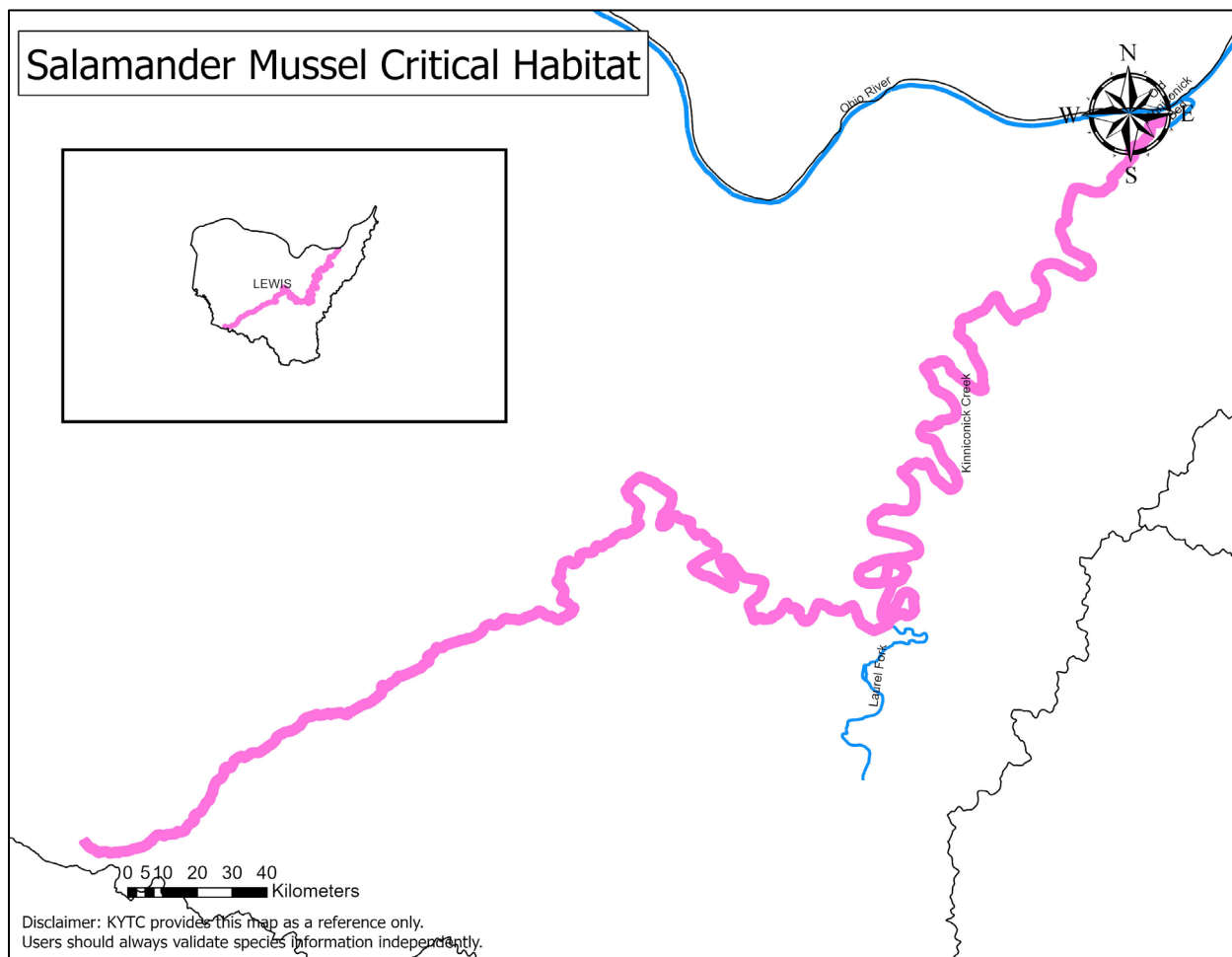
Figure 25 County list from ECOS is currently unavailable, so the range map is subject to change as any point is not all inclusive of expected counties to be listed.

Decision Key

- 1) Does the project include any direct or indirect effects to **perennial streams or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)
 - a. Yes: Contact SME
 - b. No: Prepare NE finding

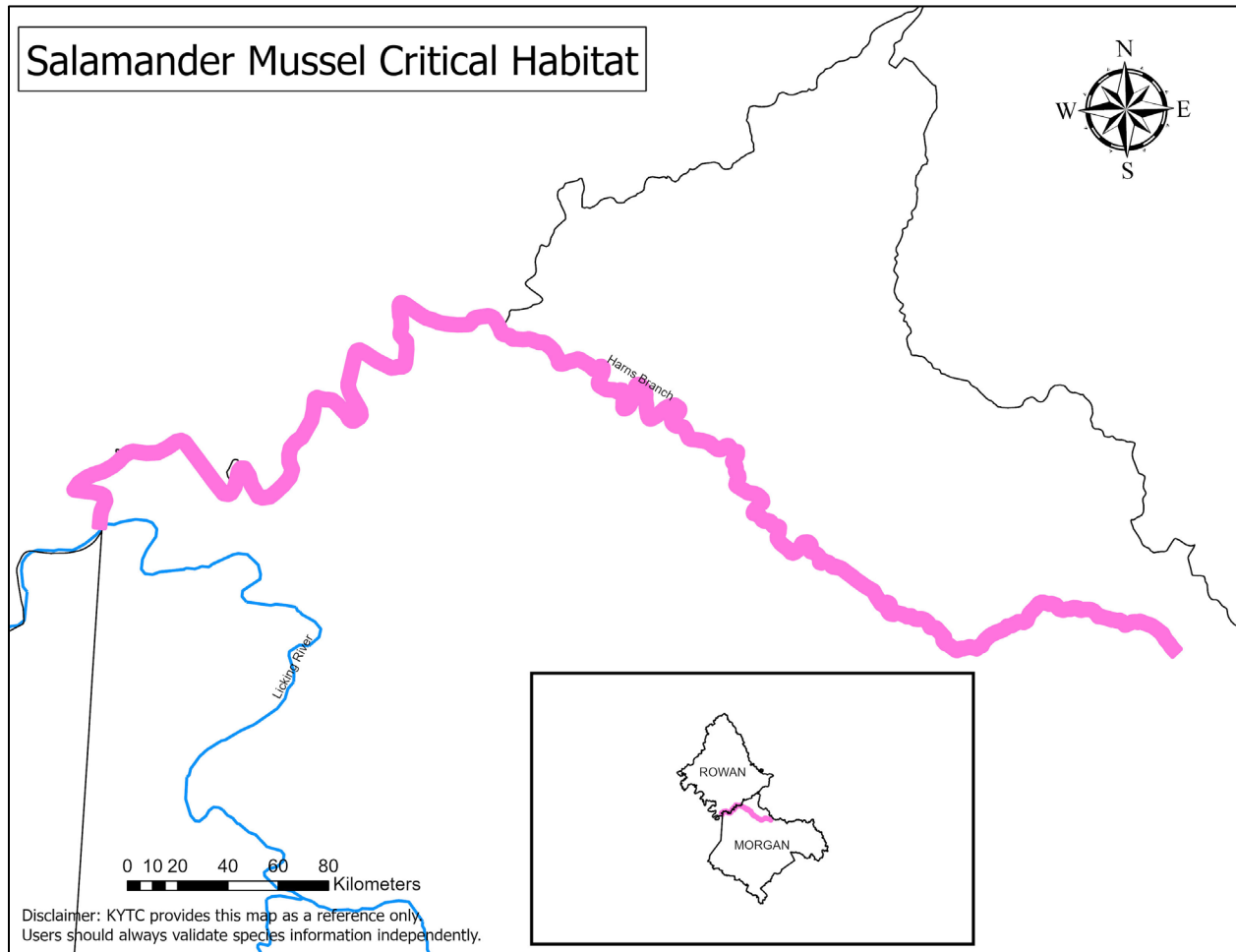
Unit 25: Kinniconick Creek Unit – Lewis County, KY.

25 consists of 51.01 miles (82.10 km) of Kinniconick Creek in Lewis County, Kentucky. This unit extends from the headwaters of Kinniconick Creek southwest of Petersville (Lewis County, Kentucky) downstream to the confluence with the Ohio River at Rexton (Lewis County, Kentucky). The unit includes the river channel up to the ordinary high water mark. Unit 25 is occupied by the species and contains one or more of the physical or biological features essential to the species' conservation. The riparian lands adjacent to, but not included in, this unit are in private ownership.



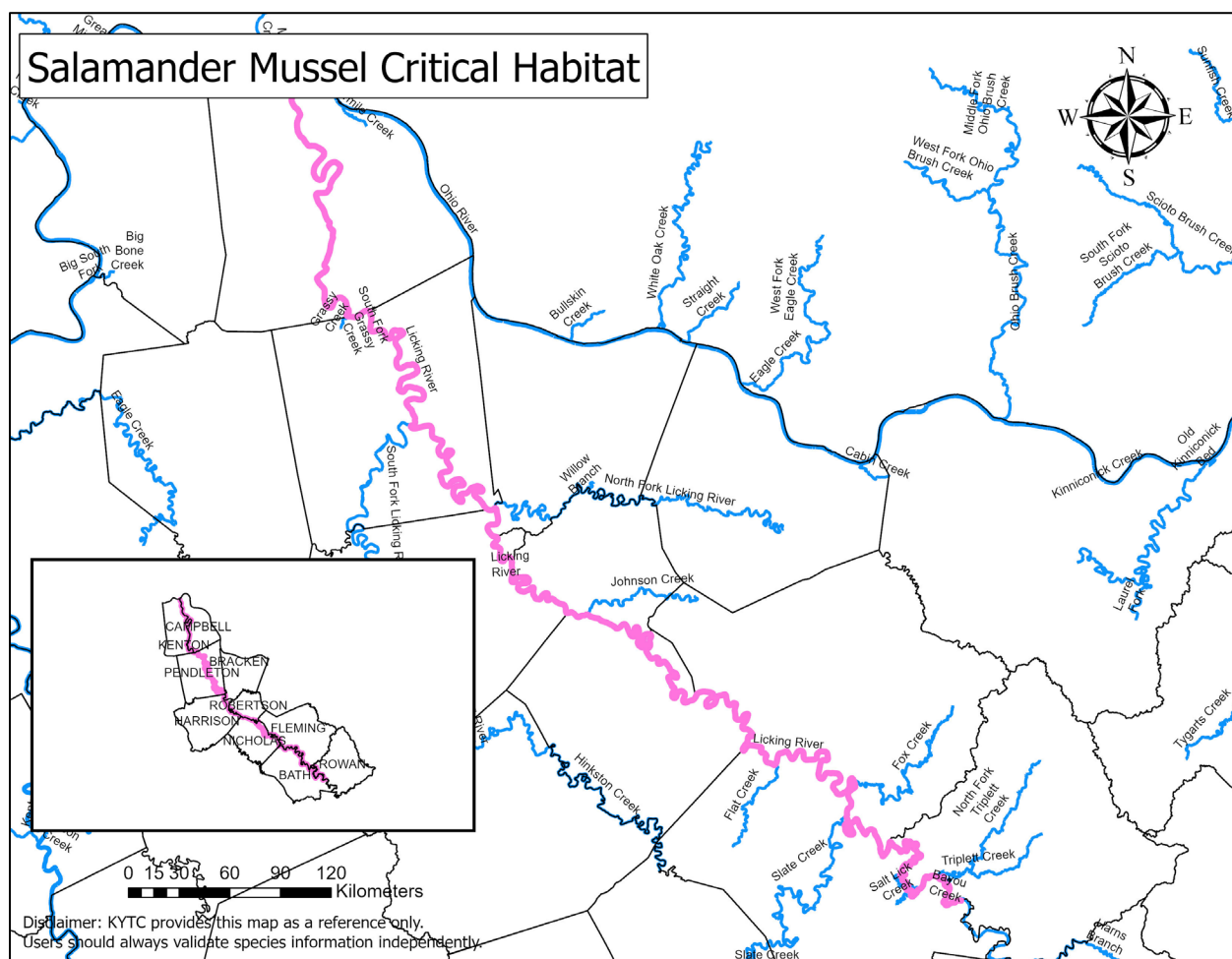
Unit 26: North Fork Licking River – Morgan and Rowan Counties, KY.

Unit 26 consists of 20.67 miles (33.27 miles) of North Fork Licking River in Morgan and Rowan Counties, Kentucky. This unit extends from the headwaters of North Fork Licking River at Redwine (Morgan County, Kentucky) downstream to the confluence of the Licking River at Bangor (Rowan County, Kentucky). Approximately 63.5% of the riparian lands adjacent to, but not included in, this unit are in public ownership, and 36.5% are in private ownership. The lands in public ownership are Federal lands associated with the USACE’s Cave Run Recreation Area and U.S. Forest Service’s (USFS) Daniel Boone National Forest.



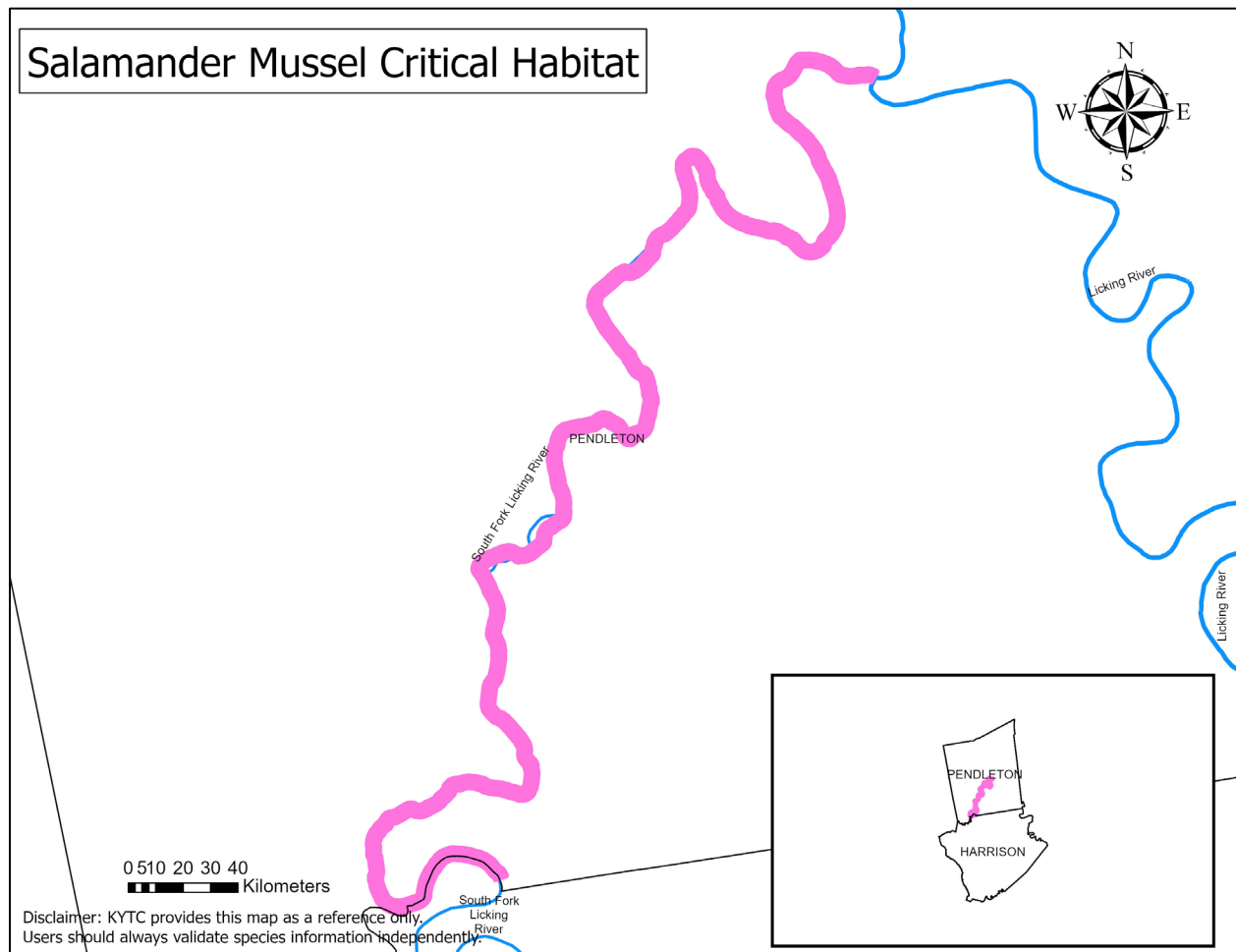
Unit 27: Licking River – Harrison, Robertson, Kenton, Bracken, Campbell, Rowan, Pendleton, Fleming, Bath, and Nicholas Counties, KY.

Unit 27 consists of 179.56 miles (288.98 km) of Licking River in Harrison, Robertson, Kenton, Bracken, Campbell, Rowan, Pendleton, Fleming, Bath, and Nicholas Counties, Kentucky. This unit extends from below the dam at Cave Rune Lake south of Farmers (Rowan County, Kentucky) downstream to the confluence with the Ohio River at Newport (Campbell County, Kentucky). Approximately 11.6% of the riparian lands adjacent to, but not included in, this unit are in public ownership, 88.4% are in private ownership. Unit 27 entirely overlaps with designated critical habitat for the longsolid.



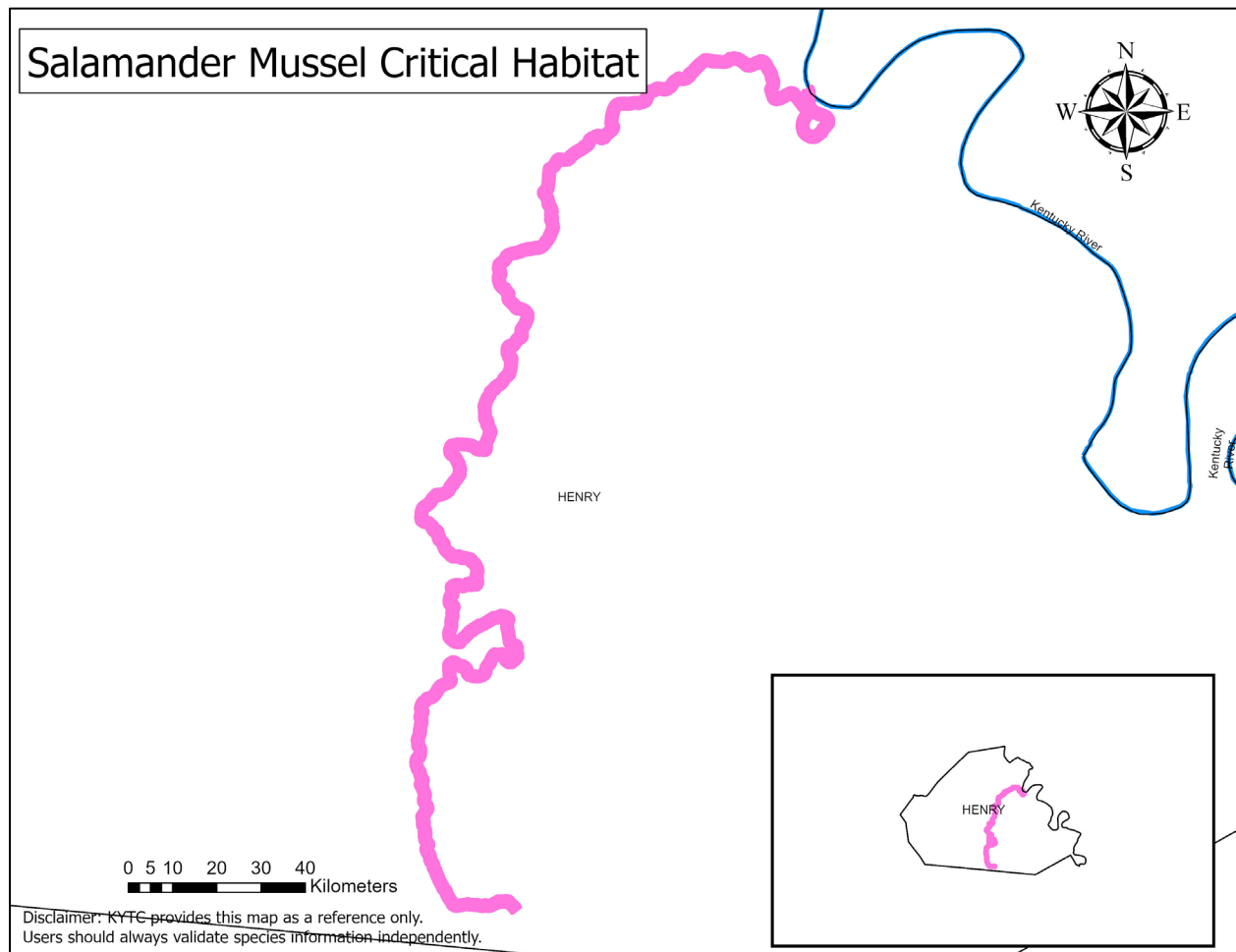
Unit 28: South Fork Licking River – in Pendleton and Harrison Counties, KY.

Unit 28 consists of 18.26 miles (29.39 km) of South Fork Licking River in Pendleton and Harrison Counties, Kentucky. This unit extends from 1 mile upstream from the confluence with Crooked Creek north of Boyd (Harrison County, Kentucky) downstream to the confluence with the Licking River at Falmouth (Pendleton County, Kentucky). The riparian lands adjacent to, but not included in, this unit are in private ownership.



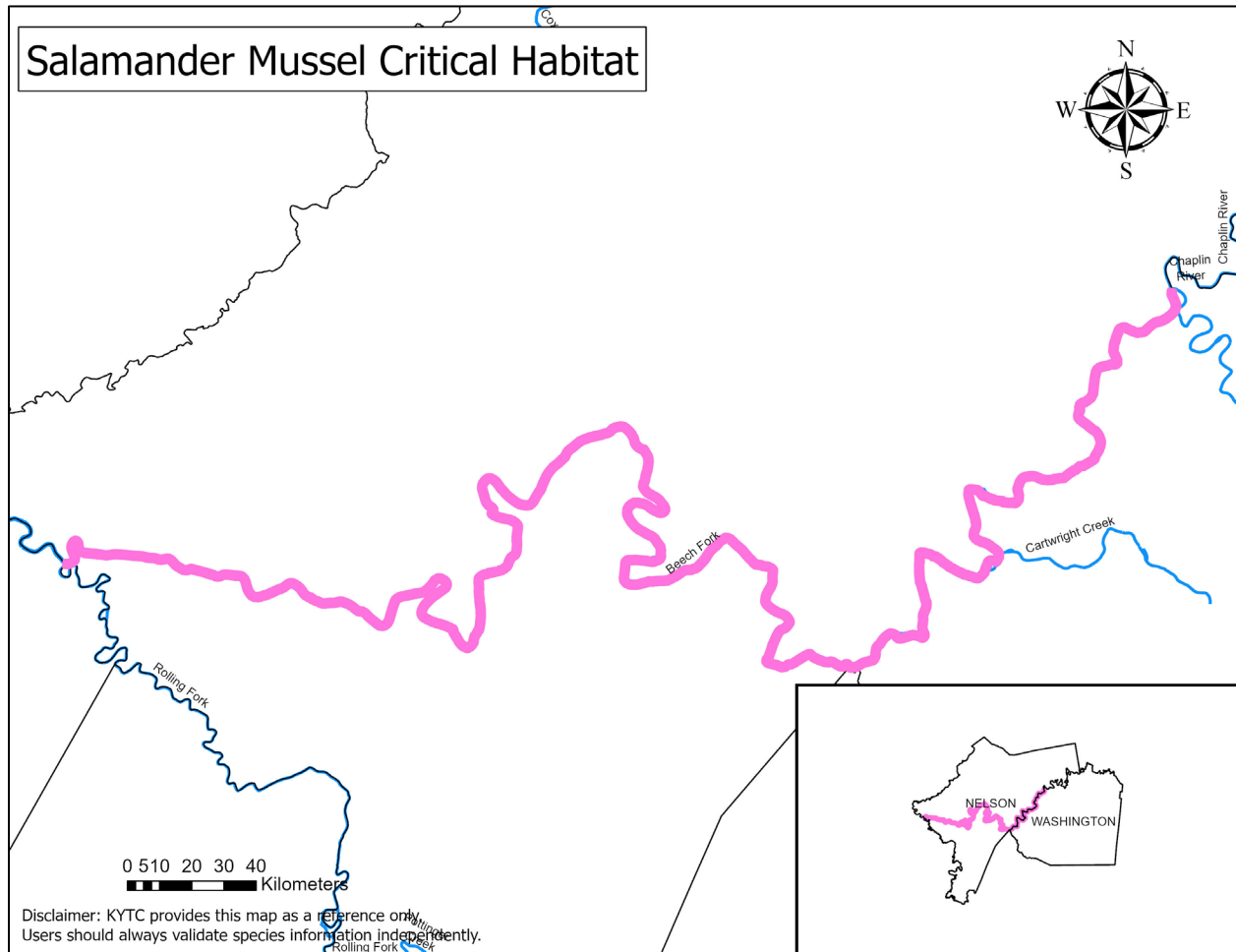
Unit 29: Drennon Creek – Henry County, KY.

Unit 29 consists of 22.36 miles (35.99 km) of Drennon Creek in Henry County, Kentucky. This unit extends from the headwaters of Drennon Creek south of Bethlehem (Henry County, Kentucky) downstream to the confluence with the Kentucky River southeast of Drennon Springs (Henry County, Kentucky). The riparian lands adjacent to, but not included in, this unit are in private ownership.



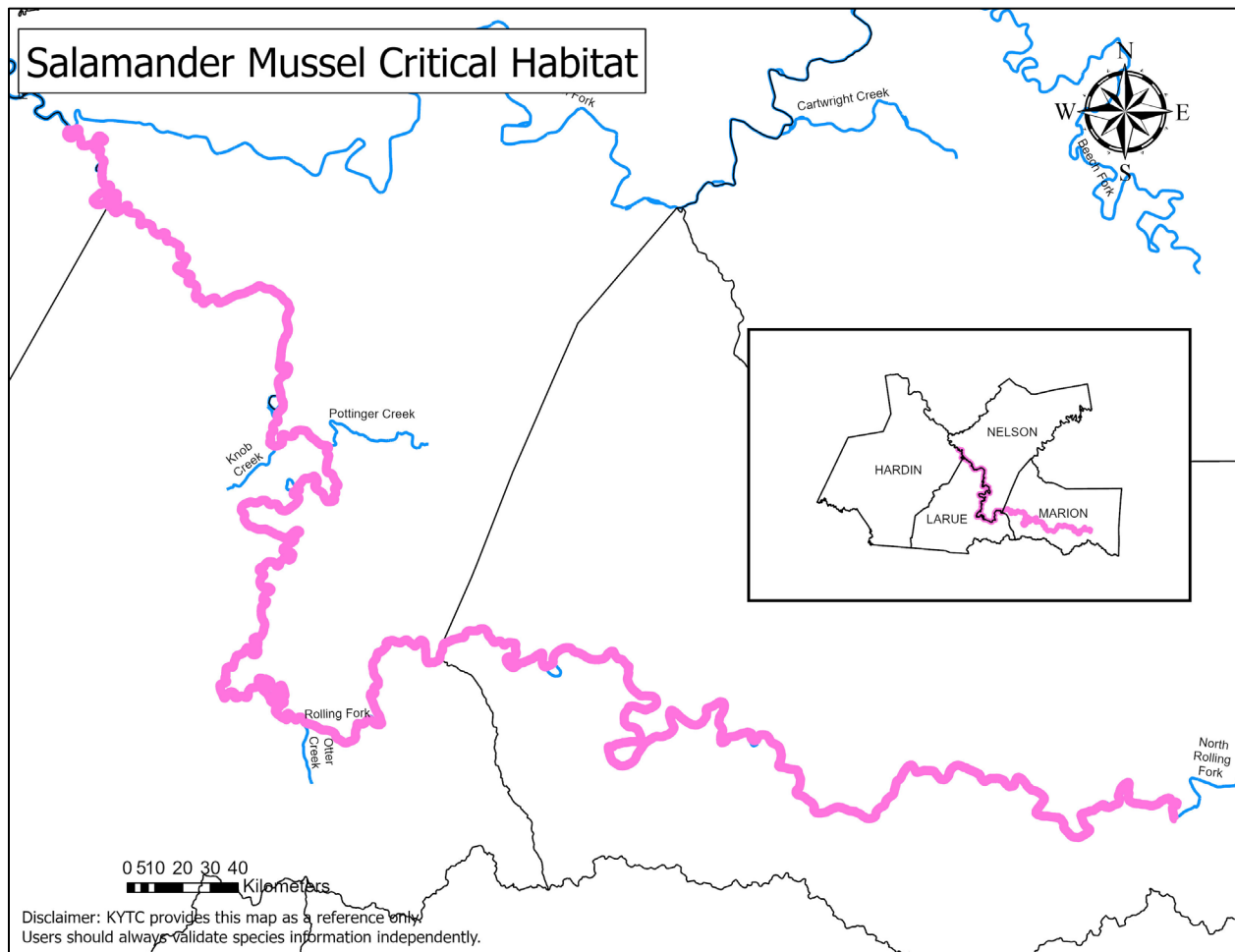
Unit 34: Beech Fork River – Washington and Nelson Counties, KY.

Unit 34 consists of 50.39 miles (81.10 km) of Beech Fork River in Washington and Nelson Counties, Kentucky. This unit extends from the confluence of Beech Fork and Chaplin River north of Mooresville (Washington County, Kentucky) extending downstream to the confluence of Beech Fork River and the Rolling Fork River northeast of Elizabethtown (Hardin County, Kentucky). Approximately 3.9% of the riparian lands adjacent to, but not included in, this unit are in public ownership, and 96.1% are in private ownership.



Unit 35: Rolling Fork River – LaRue, Hardin, Marion, and Nelson Counties, KY.

Unit 35 consists of 87.9 miles (141.47 km) of Rolling Fork River in LaRue, Hardin, Marion, and Nelson Counties, Kentucky. This unit extends from the confluence of the North Rolling Fork River and Big South Fork River west of Bradfordsville (Marion County, Kentucky) downstream to the confluence with Beech Fork River east of Younger Creek (Hardin County, Kentucky). The riparian lands adjacent to, but not included in, this unit are in private ownership.



Sheepnose Mussel (*Plethobasus cyphus*)

Species Description

The sheepnose mussel was listed as **endangered** in 2012.

The shell of the sheepnose is thick, moderately inflated, and forms an elongate oval in profile. The posterior margin forms a blunt point or is squared while the anterior margin is rounded. The posterior ridge is rounded,



Figure 26 Photo Credit:
<http://www.museum.state.il.us/ismdepts/zoology/mussels/gallery.html>

anterior of which is a faint sulcus. Faint sculpture, in the form of low knobs, runs from the umbo to the ventral margin. The periostracum is yellow to brown. Umbos are wide and prominent. Cardinal teeth are moderately large and serrated; lateral teeth are thick and long. Length 4-5 inches.

Habitat Description

The sheepnose is known from **medium to large rivers** in sand, mud, and gravel. More specifically, the habitat can be described as rivers in gravel substrates with swift to moderate current.

Critical Habitat

Yes, proposed - (*see additional maps and detailed descriptions provided after the decision key*)

Critical habitat was proposed for the sheepnose mussel on December 13, 2024.

Primary constituent elements for the sheepsnose mussel include:

1. *General Mussel Biology*: Freshwater mussels, including sheepsnose mussels, have a complex life history that involves parasitic larvae, called glochidia, which are wholly reliant on host fish(es). As adult freshwater mussels are generally sessile, suspension-feeders that spend their entire lives partially or completely buried within the substrate, dispersal occurs solely through the behavior of their host fish(es).
2. *Habitat Conditions, Suitable Substrates, and Flow Conditions*: All life stages of the sheepsnose mussels require flowing water for survival. Appropriate flow is critical for delivering oxygen and nutrients for respiration and filtration (i.e., survival and growth), essential for reproduction to allow glochidia to move to their host and encyst, as well as removing silt and other fine sediments from within rock structures and crevices, which prevents mussel suffocation and degradation of mussel and/or host-fish shelter habitats. Normal fluctuations in flow velocity are expected; however, extreme changes can be detrimental. Alternatively, extreme low flows, typically associated with drought or water withdrawals, can impact reproduction, feeding, respiration, and in some cases, result in exposure and/ or desiccation of the species. Appropriate water quality is critical to the survival, reproduction, and persistence of all life stages of freshwater mussels. In general, mussels need water temperatures below 86 degrees F, dissolved oxygen concentrations greater than 5 milligrams per liter, and water quality concentrations below acute toxicity levels to mussels for contaminants such as total ammonia, nitrogen, copper, chloride, and sulfate.
3. *Habitat Connectivity*: A mussel population includes more than one mussel bed; it is the collection of mussel beds within a stream reach between which infested host fish may travel, allowing for ebbs and flows in mussel bed density and abundance through time throughout the population's occupied reach. Connectivity is characterized by suitable water quality, lack of barriers to dispersal (e.g., perched culverts, hydropower dams that lack passage for host fishes, water control structures), and presence of suitable shelter habitat and forage base for host fish(es).
4. *Presence of Host Fish Species*: Sheepsnose are obligate parasites that rely on specific host-fish for developing into juvenile mussels and dispersal. Sheepsnose depend on mimic shiner

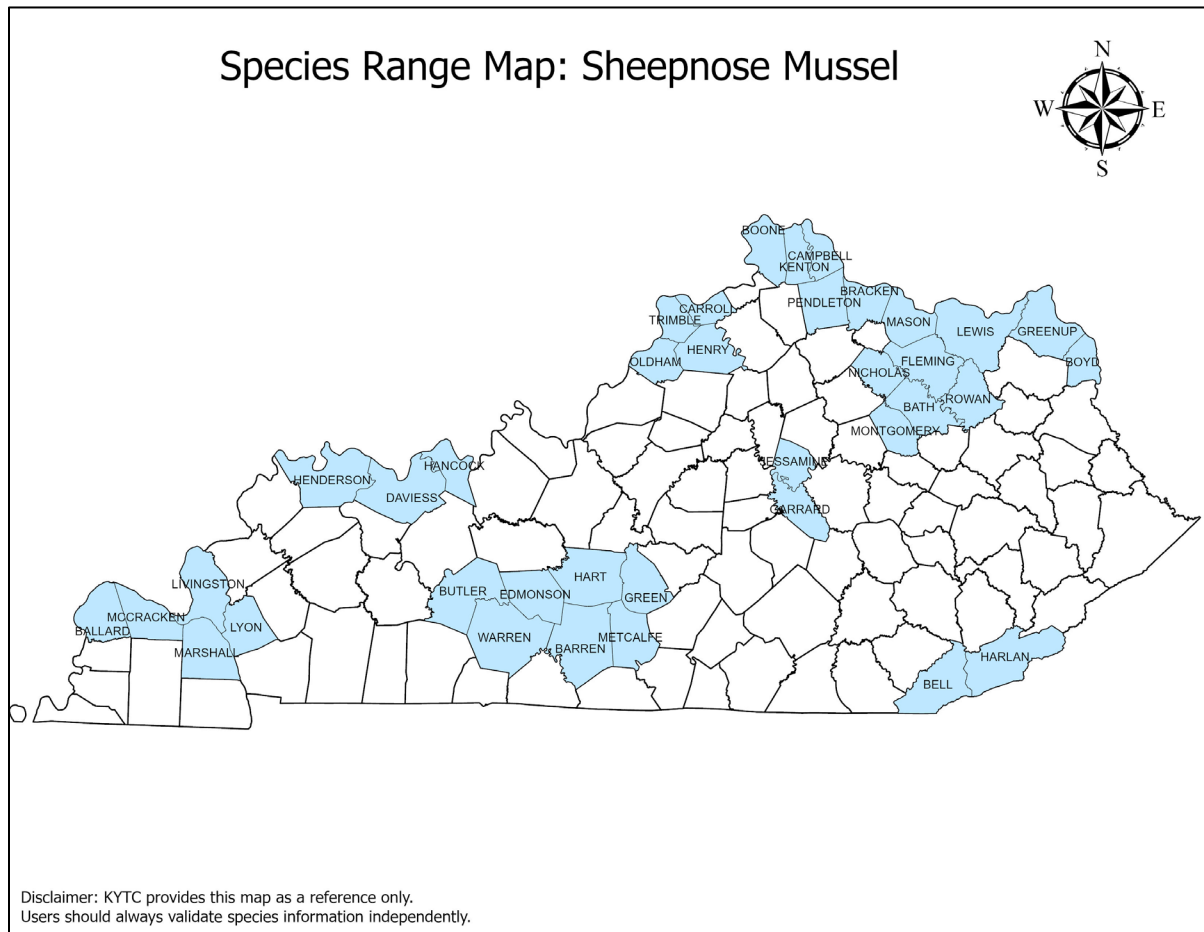
(*Notropis volucellus*) and sauger (*Sander canadensis*) as host fish; of these, only mimic shiner has been observed to be naturally infested and successfully facilitate transformation of juveniles in the lab and is most likely the primary host species. However, lab studies suggest that sheepnose may be able to use a wider variety of fish species including fathead minnow (*Pimephales promelas*), creek chub (*Semotilus atromaculatus*), central stoneroller (*Campostoma anomalum*), brook stickleback (*Culaea inconstans*), and golden shiner (*Notemigonus cryoleucas*).

Species, Stream (unit), and State	Currently Occupied River Miles
Sheepnose Mussel Upper Green River (SHNO 5), KY	157

Range

The sheepnose occurs nearly statewide, but sporadically. It ranges in the United States from northern Alabama into Minnesota and Wisconsin. In Kentucky, it is more specifically associated with the larger rivers around the state: Kentucky, Cumberland, Licking, Ohio, Tennessee, Green,

and Barren Rivers.



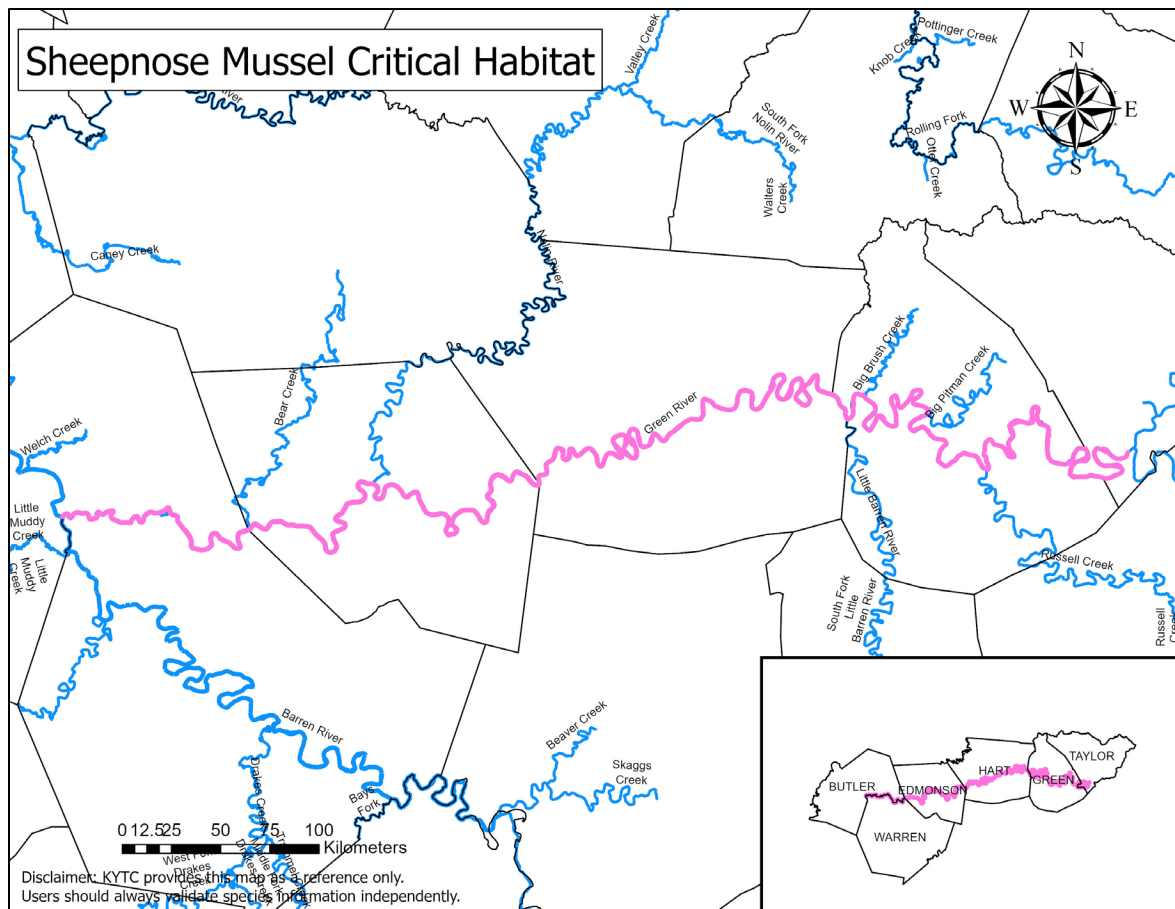
Decision Key

- 1) Does the project include any direct or indirect effects to **medium to large rivers or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)
 - a. Yes: Contact SME
 - b. No: Prepare NE finding

SHNO 5: Upper Green – Butler, Edmonson, Green, Hart, Taylor, and Warren Counties, KY.

SHNO 5 consists of 157 rmi of the Green River in Butler, Edmonson, Green, Hart, Taylor, and Warren Counties, Kentucky. This unit extends from the confluence of the Green River with the Barren River (Taylor County, Kentucky) downstream to the Green River Dam (Butler County, Kentucky). The unit includes the river channel up to the ordinary high-water mark.

Approximately 22.5% of the riparian lands adjacent to, but not included in, this unit are in public (Federal, State, and local) ownership, and 77.5% are in private ownership. The unit overlaps in full or in part with designated critical habitat for the federally endangered diamond darter (*Crystallaria cincotta*) (see 50 CFR 17.95(e) and 78 FR 52364, August 22, 2013), the federally threatened longsolid and the federally threatened round hickorynut (see 50 CFR 17.95(f) and 88 FR 14794, March 9, 2023), and the federally threatened rabbitsfoot (see 50 CFR 17.95(f) and 80 FR 24692, April 30, 2015), and proposed critical habitat for the federally endangered snuffbox, and the federally endangered spectaclecase.



Snuffbox Mussel (*Epioblasma triquetra*)

Species Description

The snuffbox mussel was listed as **endangered** by the USFWS on February 14, 2012.

The shape of the shell is somewhat triangular (females), oblong, or ovate (males), with the valves solid, thick, and very inflated. The umbos are located somewhat anterior of the middle, and are



Figure 27 Photo Credit:
<http://www.inhs.illinois.edu/collections/mollusk/publications/guide/index/162>

swollen, turned forward and inward, and extended above the hinge line. The anterior end of the shell is rounded, and the posterior end is truncated, highly so in females. The posterior ridge is prominent, being high and rounded, while the posterior slope is widely flattened. The posterior ridge and slope in females is covered with fine ridges and grooves, and the posteroventral shell edge is finely toothed. The shell is yellow or yellowish-green and covered with dark green rays or chevrons. The nacre is white or with a slightly iridescent bluish-white. Cardinal teeth are relatively large and serrated; lateral teeth are thick and short.

Habitat Description

The snuffbox is usually found in **small streams to medium-sized rivers**, inhabiting areas with a swift current, although it is also found in Lake Erie and some larger rivers. Adults often burrow deep in sand, gravel or cobble substrates, except when they are spawning or the females are attempting to attract host fish. They can be found in water as shallow as 2 inches to 2 feet, usually in shallower areas of moderate to swiftly flowing streams.

Critical Habitat

Yes, proposed - (*see additional maps and detailed descriptions provided after the decision key*)

Critical habitat was proposed for the snuffox mussel on December 13, 2024.

Primary constituent elements for the snuffbox mussel include:

1. *General Mussel Biology*: Freshwater mussels, including snuffbox mussels, have a complex life history that involves parasitic larvae, called glochidia, which are wholly reliant on host fish(es). As adult freshwater mussels are generally sessile, suspension-feeders that spend their entire lives partially or completely buried within the substrate, dispersal occurs solely through the behavior of their host fish(es).
2. *Habitat Conditions, Suitable Substrates, and Flow Conditions*: All life stages of the sheepsnose mussels require flowing water for survival. Appropriate flow is critical for delivering oxygen and nutrients for respiration and filtration (i.e., survival and growth), essential for reproduction to allow glochidia to move to their host and encyst, as well as removing silt and other fine sediments from within rock structures and crevices, which prevents mussel suffocation and degradation of mussel and/or host-fish shelter habitats. Normal fluctuations in flow velocity are expected; however, extreme changes can be detrimental. Alternatively, extreme low flows, typically associated with drought or water withdrawals, can impact reproduction, feeding, respiration, and in some cases, result in exposure and/ or desiccation of the species. Appropriate water quality is critical to the survival, reproduction, and persistence of all life stages of freshwater mussels. In general, mussels need water temperatures below 86 degrees F, dissolved oxygen concentrations greater than 5 milligrams per liter, and water quality concentrations below acute toxicity levels to mussels for contaminants such as total ammonia, nitrogen, copper, chloride, and sulfate.
3. *Habitat Connectivity*: A mussel population includes more than one mussel bed; it is the collection of mussel beds within a stream reach between which infested host fish may travel, allowing for ebbs and flows in mussel bed density and abundance through time throughout

the population's occupied reach. Connectivity is characterized by suitable water quality, lack of barriers to dispersal (e.g., perched culverts, hydropower dams that lack passage for host fishes, water control structures), and presence of suitable shelter habitat and forage base for host fish(es).

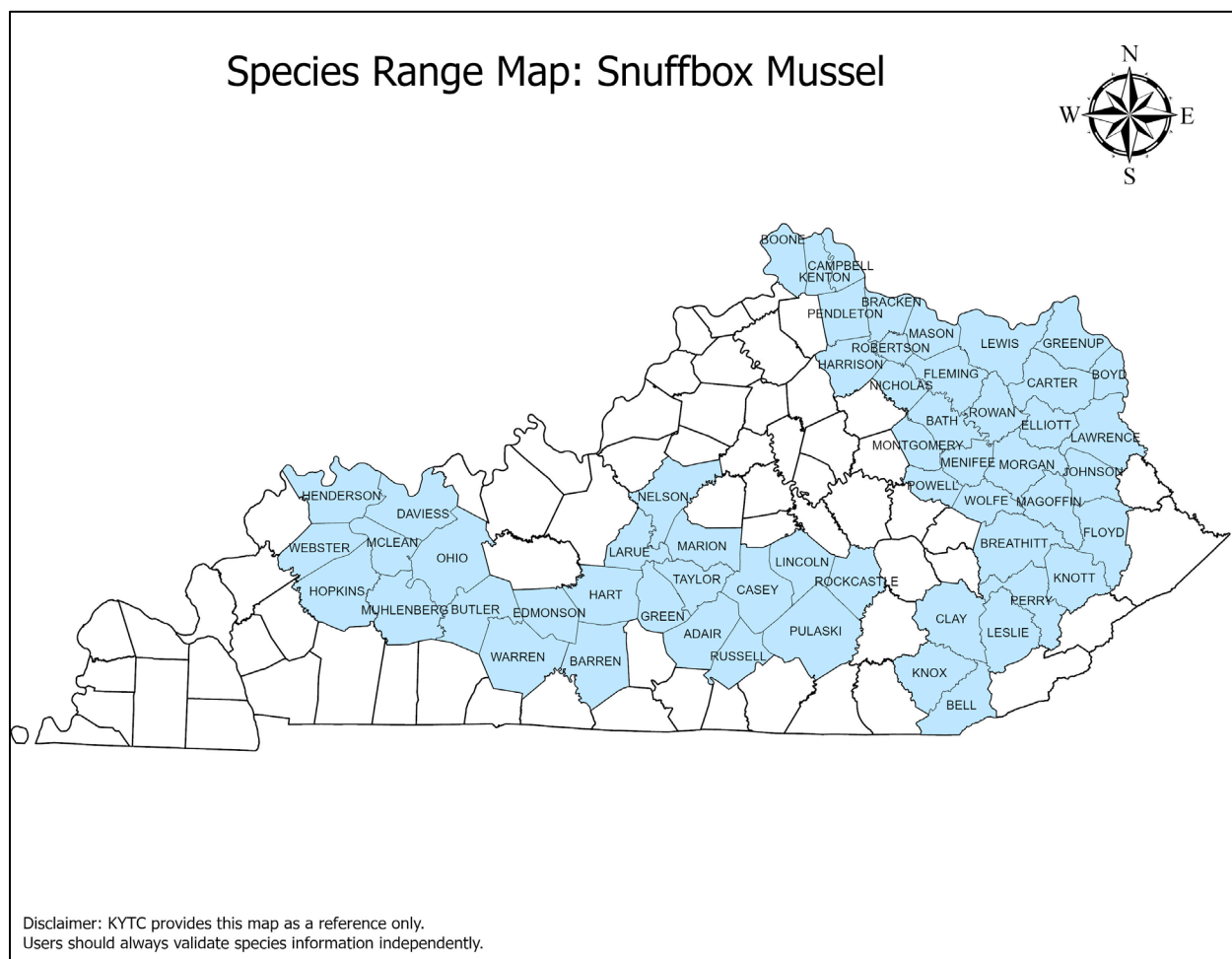
4. *Presence of Host Fish Species:* Snuffbox are obligate parasites that rely on specific host-fish for developing into juvenile mussels and dispersal. Snuffbox mussels rely on darter and sculpin species as fish hosts, using log perch (*Percina caprodes*) as their primary host species. Female snuffbox lure host fish with an inflated mantle (i.e., lure) and close their shell around the head of the fish long enough to expel their glochidia and allow for their attachment to the gills of the fish, before releasing the fish. Given this life history strategy, they rely on clear water that allows their lures to be visible by potential fish hosts. Other potential host species from lab studies include the blackside darter (*P. maculata*), rainbow darter, Iowa darter (*E. exile*), blackspotted topminnow (*Fundulus olivaceus*), mottled sculpin, banded sculpin (*C. carolinae*), Ozark sculpin (*C. hypselurus*), largemouth bass, and brook stickleback (*Culaea inconstans*).

Species, Stream (unit), and State	Currently Occupied River Miles
Snuffbox Mussel	
Tygarts Creek (SNBO 19), KY	89
Kinniconick Creek (SNBO 20), KY	52
Licking River (SNBO 21), KY	239
Middle Fork Kentucky River (SNBO 22), KY	13
Red Bird River (SNBO 23), KY	60
Red River (SNBO 24), KY	31
Green River (SNBO 25), KY	157
Rolling Fork Salt River (SNBO 29), KY	95

Range

The snuffbox historically occurred in 210 streams and lakes in 18 States and 1 Canadian province: Alabama, Arkansas, Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Mississippi, Missouri, New York, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and Wisconsin; and Ontario, Canada. The major watersheds of historical streams and lakes of

occurrence include: the upper Great Lakes sub-basin (Lake Michigan drainage), lower Great Lakes sub-basin (Lakes Huron, Erie, and Ontario drainages), upper Mississippi River sub-basin, lower Missouri River system, Ohio River system, Cumberland River system, Tennessee River system, lower Mississippi River sub-basin, and White River system. Extant populations of the snuffbox are known from 79 streams in 14 States and 1 Canadian province, representing a 62% decline in occupied streams. In Kentucky, snuffbox is associated with the river systems of the Licking, Green, Tygarts, Kinniconick, Little Sandy, Red(s), Barren, Cumberland, Salt, Rolling Fork, and parts of the Rockcastle River. Distribution is sporadic and nearly statewide.



Decision Key

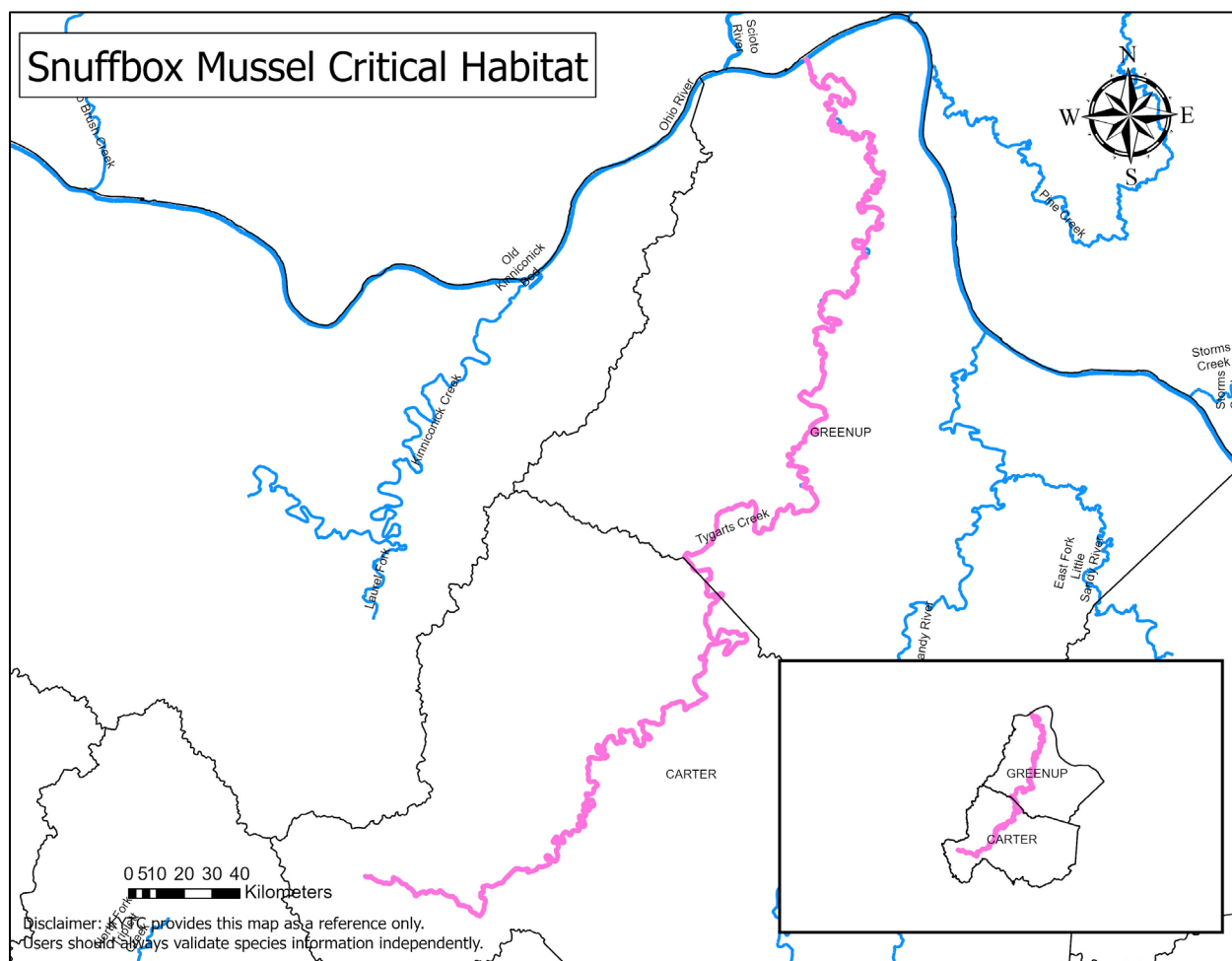
- 1) Does the project include any direct or indirect effects to **perennial streams or their nearby tributaries?** (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)
 - a. Yes: Contact SME

- b. No: Prepare NE finding

SNBO 19: Tygarts Creek – Carter and Greenup Counties, KY.

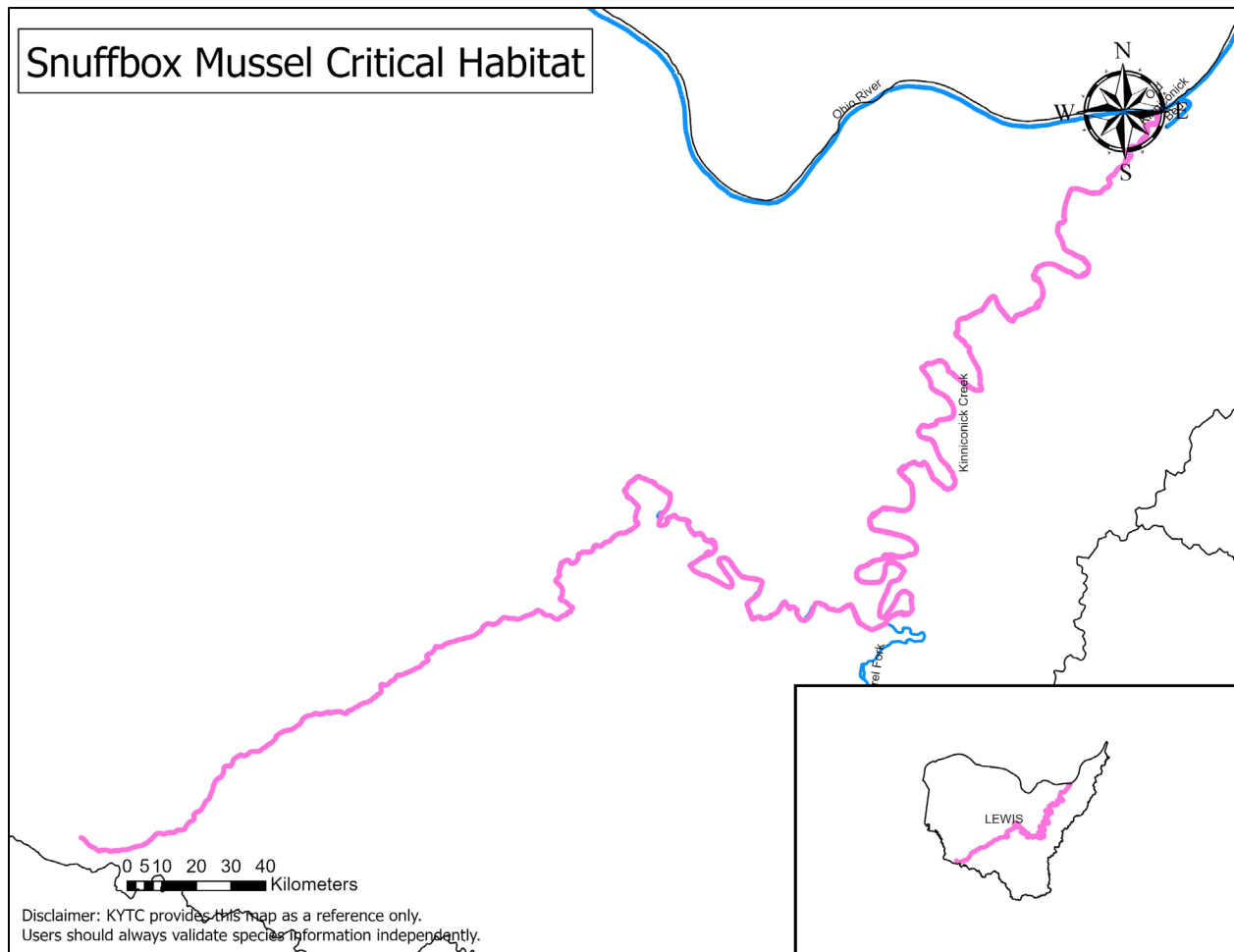
SNBO 19 consists of 89 rmi of Tygarts Creek in Carter and Greenup Counties, Kentucky. This unit extends from the confluence of Flat Fork just north of U.S Highway 60 in Carter County, Kentucky, downstream to the confluence with the Ohio River in South Shore (Greenup County, Kentucky). The unit includes the river channel up to the ordinary high-water mark.

Approximately 1.4% of the riparian lands adjacent to, but not included in, this unit are in public (State) ownership, and 98.6% are in private ownership. Adjacent State lands are owned or managed by the Kentucky Department of Parks. SNBO 19 is occupied by the species and contains all the physical or biological features essential to the species' conservation.



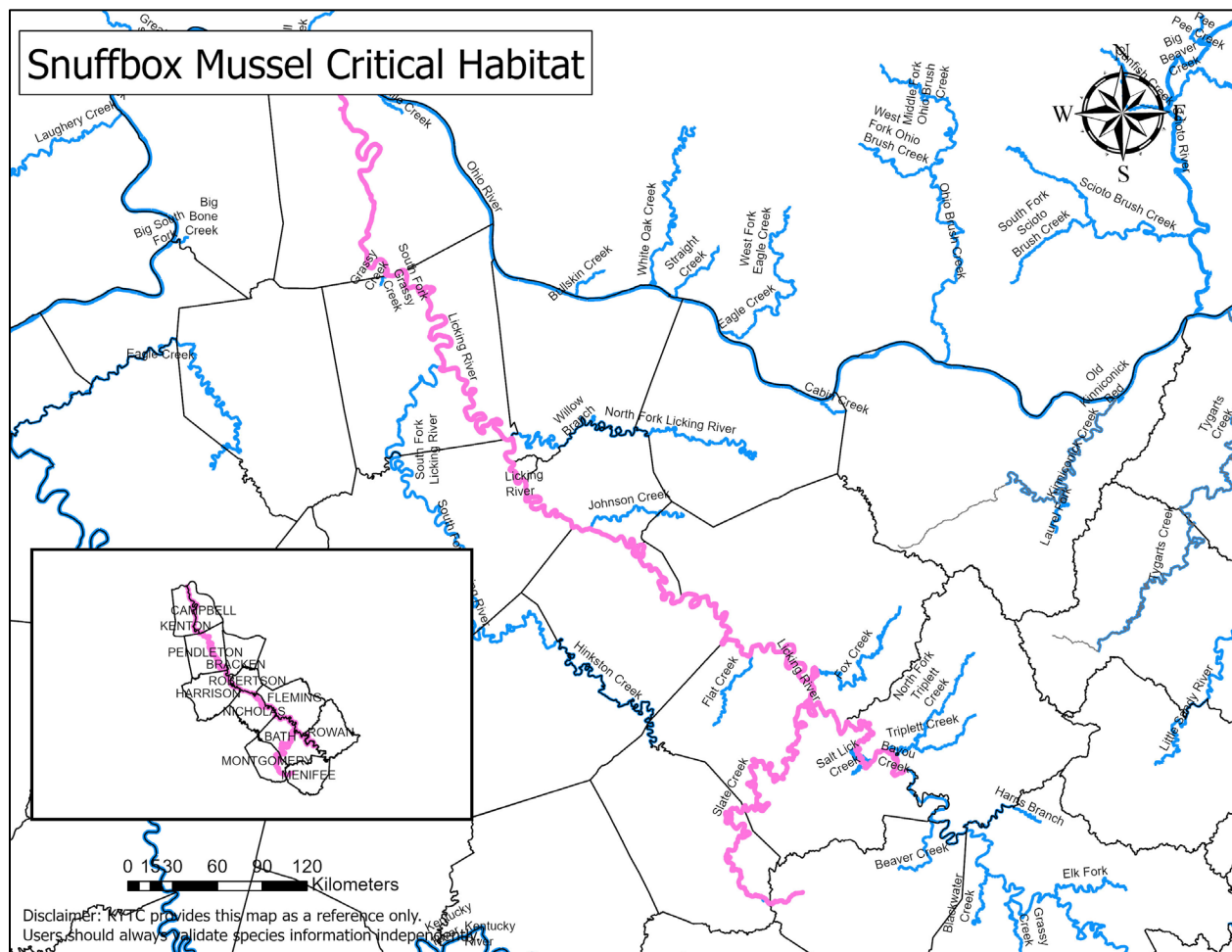
SNBO 20: Kinniconick Creek – Lewis County, KY.

SNBO 20 consists of 52 rmi of Kinniconick Creek in Lewis County, Kentucky. This unit extends from the headwaters of Kinniconick Creek southwest of Petersville downstream to its confluence with the Ohio River at Rexton, in Lewis County, Kentucky. The unit includes the river channel up to the ordinary high-water mark. All the riparian lands adjacent to, but not included in, this unit are in private ownership. The unit overlaps in part or in full with proposed critical habitat for the proposed endangered salamander mussel (88 FR 57224; August 22, 2023). The unit overlaps in part or in full with proposed critical habitat for the proposed endangered salamander mussel (88 FR 57224; August 22, 2023).



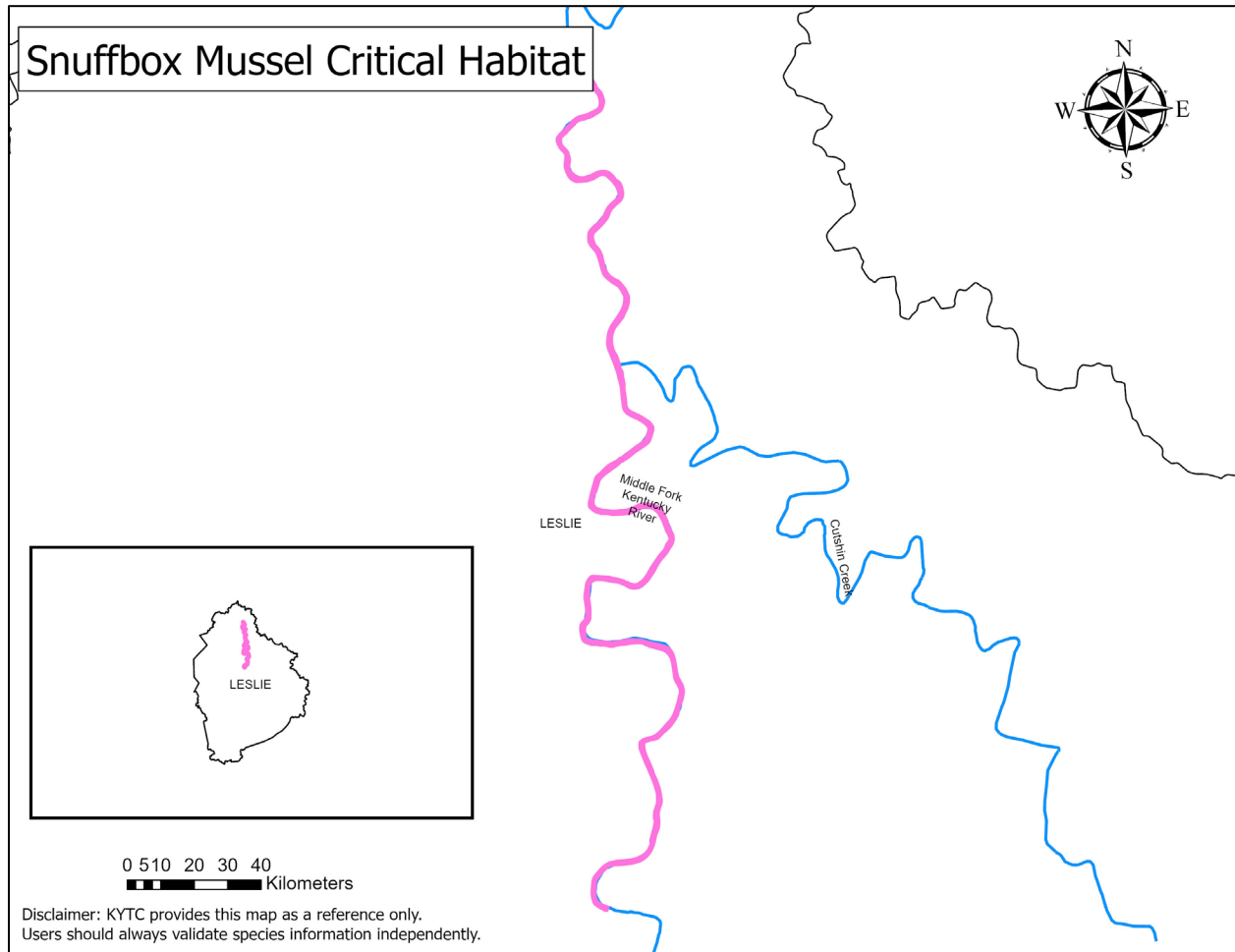
SNBO 21: Licking River – Bath, Bracken, Campbell, Fleming, Harrison, Kenton, Menifee, Montgomery, Nicholas, Pendleton, Robertson, and Rowan Counties, KY.

SNBO 21 consists of 239 rmi of the Licking River and Slate Creek in Bath, Bracken, Campbell, Fleming, Harrison, Kenton, Menifee, Montgomery, Nicholas, Pendleton, Robertson, and Rowan Counties, Kentucky. The Licking River portion of this unit includes 179 rmi from the Cave Run Dam in Bath/Rowan Counties, Kentucky, downstream to the confluence with the Ohio River in Covington (Kenton County, Kentucky). The Slate Creek portion of this unit includes 60 rmi from the U.S. Route 460 Bridge in Menifee County, Kentucky, downstream to the confluence with Licking River in Bath County, Kentucky. The unit includes the river channel up to the ordinary high-water mark. Approximately 8.6 % of the riparian lands adjacent to, but not included in, this unit are in public (Federal, State, and local) ownership, and 91.4 % are in private ownership. The unit entirely overlaps in part or in full with designated critical habitat for the federally threatened longsolid and the federally threatened round hickorynut (see 50 CFR 17.95(f) and 88 FR 14794, March 9, 2023); and proposed critical habitat for the proposed endangered salamander mussel (88 FR 57224; August 22, 2023).



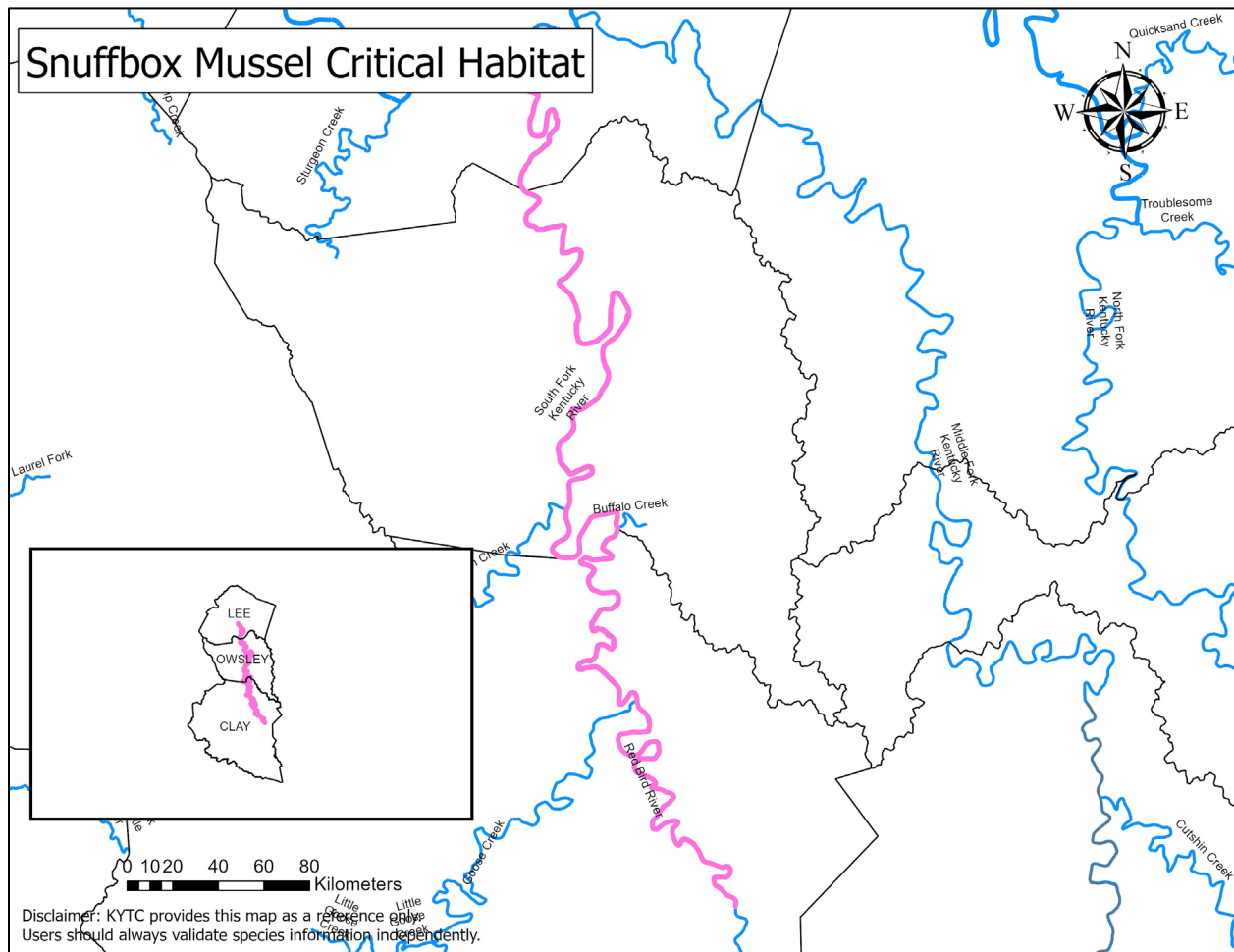
SNBO 22: Middle Fork Kentucky River – Leslie County, KY.

SNBO 22 consists of 13 rmi of the Middle Fork Kentucky River in Leslie County, Kentucky. This unit extends from the dam south of Hyden downstream to County Road 1475, in Leslie County, Kentucky. The unit includes the river channel up to the ordinary high-water mark. All of the riparian lands adjacent to, but not included in, this unit are in private ownership.



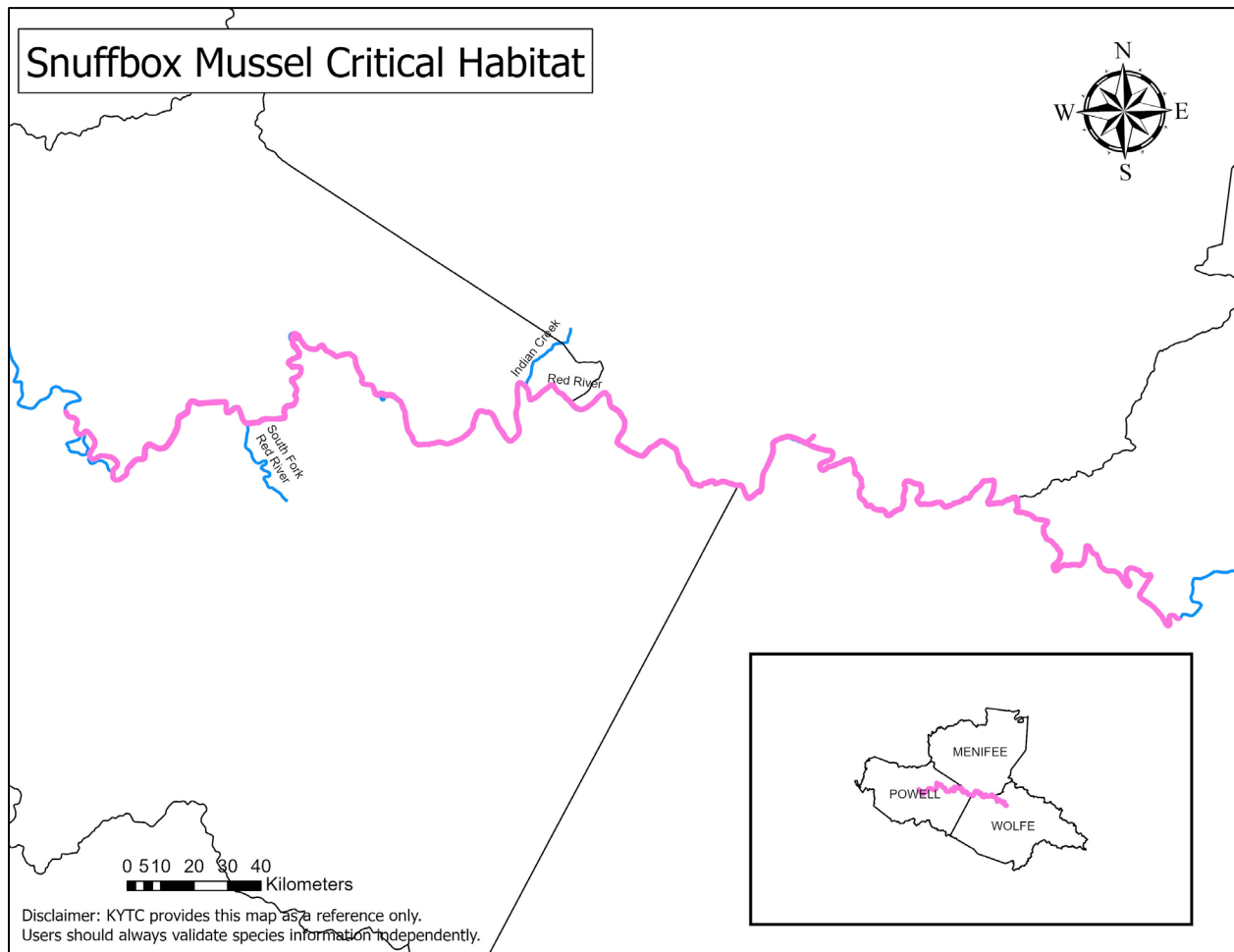
SNBO 23: Red Bird River – Clay, Lee, and Owsley Counties, KY.

SNBO 23 consists of 60 rmi of the Red Bird River and South Fork Kentucky River in Clay, Lee, and Owsley Counties, Kentucky. The Red Bird River portion of this unit extends from the East Hal Rogers Parkway downstream to its confluence with the South Fork Kentucky River near Oneida, in Clay County, Kentucky. The South Fork Kentucky River portion of this unit extends from its confluence with the Red Bird River (Clay County, Kentucky) downstream to its confluence with the North Fork Kentucky River in Beattyville (Lee County, Kentucky). The unit includes the river channel up to the ordinary high-water mark. Approximately 8.0% of the riparian lands adjacent to, but not included in, this unit are in public (Federal) ownership, and 92.0% are in private ownership. Adjacent Federal lands are owned or managed by the U.S. Forest Service. SNBO 23 is occupied by the species and contains all the physical or biological features essential to the species' conservation.



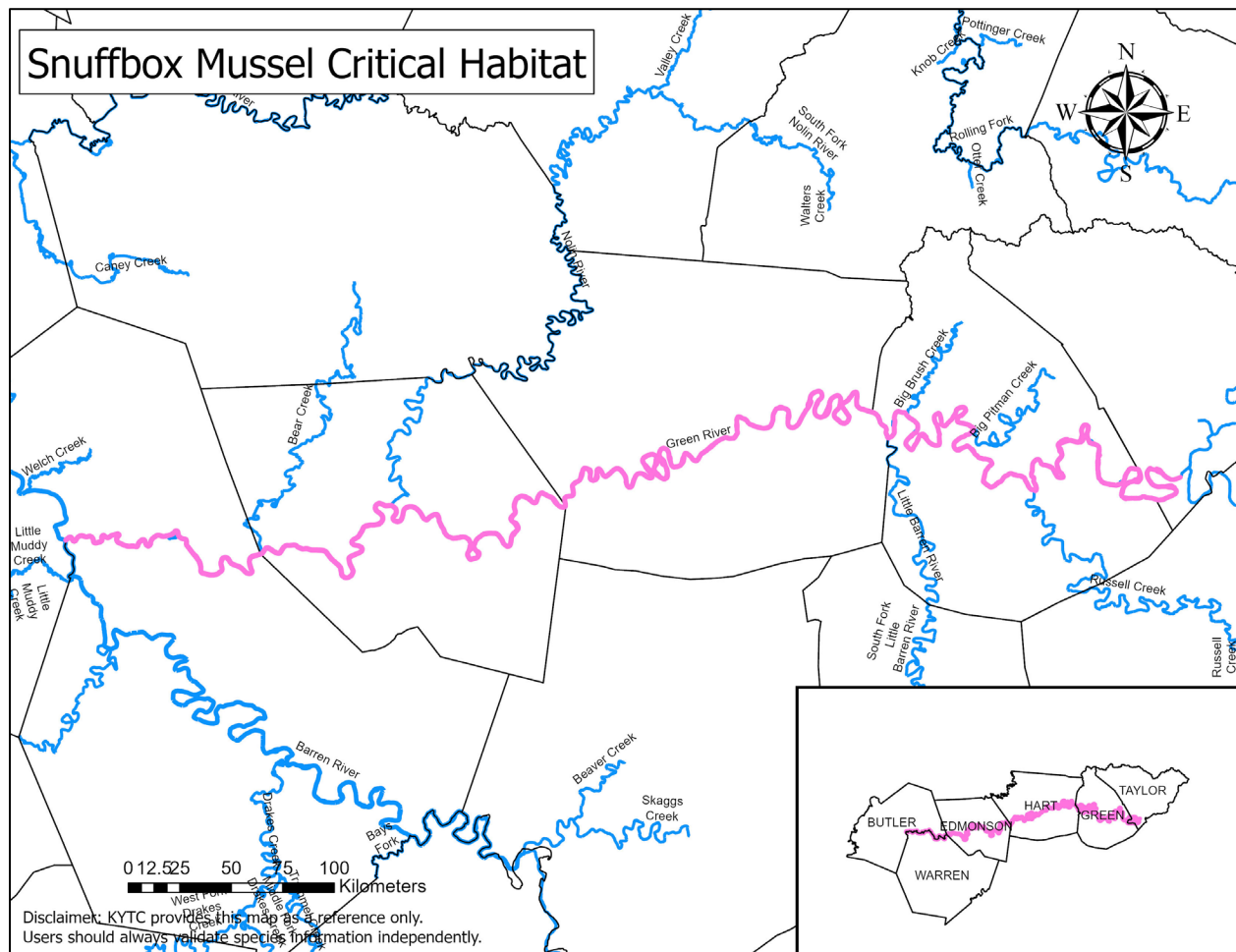
SNBO 24: Red River – Wolfe, Menifee, and Powell Counties, KY.

SNBO 24 consists of 31 rmi of the Red River in Wolfe, Menifee, and Powell Counties, Kentucky. This unit extends from the Red River’s confluence with Stillwater Creek (Wolfe County, Kentucky) downstream to the Bert T. Combs Mountain Parkway Bridge (Powell County, Kentucky). The unit includes the river channel up to the ordinary high-water mark. Approximately 60.5% of the riparian lands adjacent to, but not included in, this unit are in public (Federal and State) ownership, and 39.5% are in private ownership. SNBO 24 is occupied by the species and contains all the physical or biological features essential to the species’ conservation.



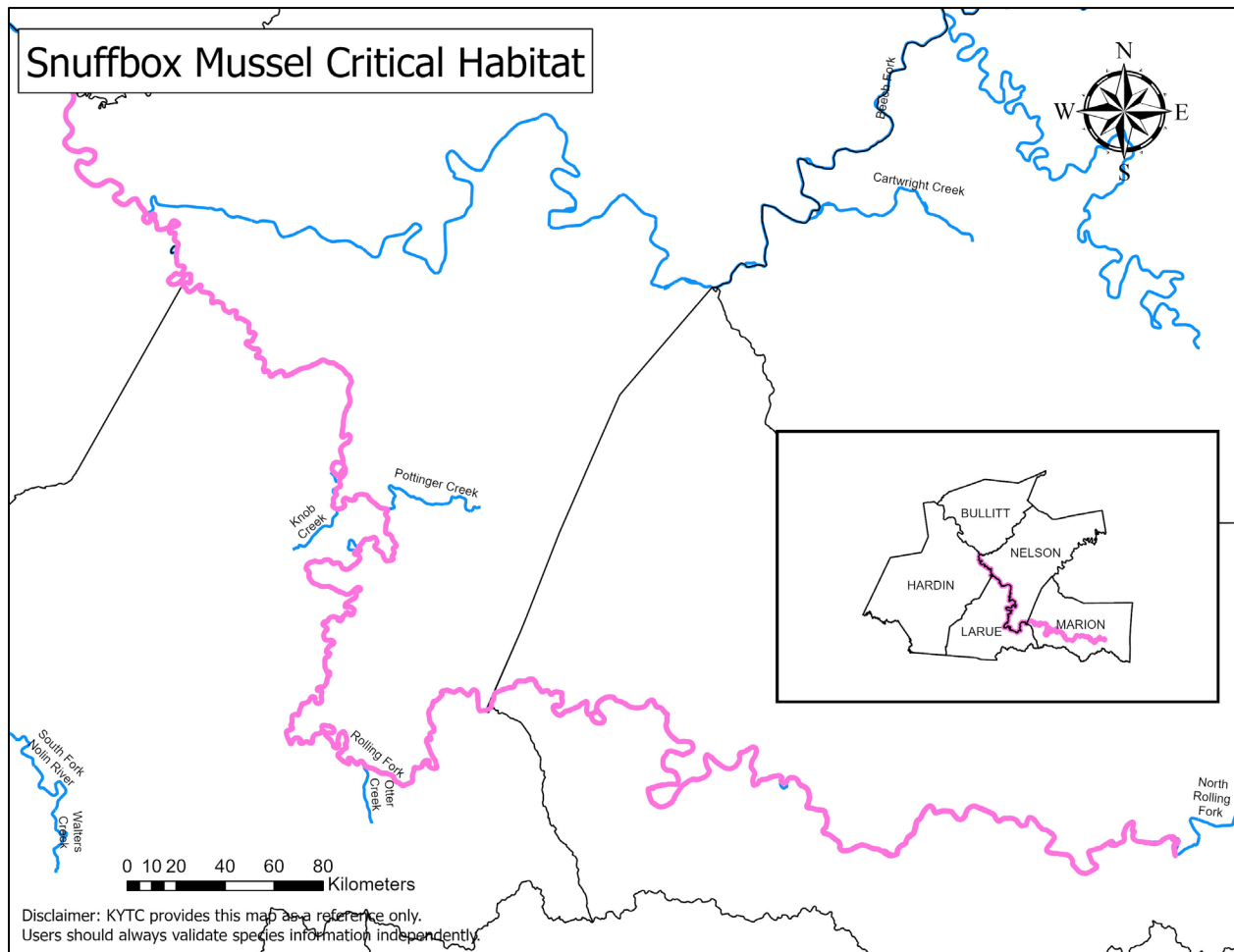
SNBO 25: Green River – Butler, Warren, Edmonson, Green, Hart, and Taylor Counties, KY.

SNBO 25 consists of 157 rmi (253 rkm) of the Green River in Butler, Warren, Edmonson, Green, Hart, and Taylor Counties, Kentucky. This unit extends from the Green River Lake Dam south of Campbellsville (Taylor County, Kentucky) downstream to the confluence with the Barren River at Woodbury (Warren/Butler Counties, Kentucky). The unit includes the river channel up to the ordinary high-water mark. Approximately 22.7% of the riparian lands adjacent to, but not included in, this unit are in public (Federal, State, and local) ownership, and 77.3% are in private ownership. This unit overlaps in part or in full with designated critical habitat for the federally endangered diamond darter (see 50 CFR 17.95(e) and 78 FR 52364, August 22, 2013); the federally threatened longsolid and the federally threatened round hickorynut (see 50 CFR 17.95(f) and 88 FR 14794, March 9, 2023); and the federally threatened rabbitsfoot (see 50 CFR 17.95(f) and 80 FR 24692, April 30, 2015); and proposed critical habitat for the federally endangered sheepsnout and the federally endangered spectaclecase.



SNBO 29: Rolling Fork Salt River – Marion, LaRue, Hardin, Nelson, and Bullitt Counties, KY.

SNBO 29 consists of 95 rmi of the Rolling Fork Salt River in Marion, LaRue, Hardin, Nelson, and Bullitt Counties, Kentucky. This unit extends from the confluence with North Rolling Fork near State Highway 337 (Marion County, Kentucky) downstream to the Interstate 65 Bridge southwest of Lebanon Junction (Bullitt County, Kentucky). The unit includes the river channel up to the ordinary high-water mark. All of the riparian lands adjacent to, but not included in, this unit are in private ownership. SNBO 29 is occupied by the species and contains all the physical or biological features essential to the species' conservation. The unit overlaps in part or in full with proposed critical habitat for the proposed endangered salamander mussel (88 FR 57224, August 22, 2023).



Spectaclecase Mussel (*Cumberlandia monodonta*)

Formerly: *Margaritifera monodonta*

Species Description

The spectaclecase was listed as **endangered** on March 13, 2012.

The spectaclecase is a member of the mussel family Margaritiferidae. It is the only mussel in this family in Kentucky.



Figure 28 Photo Credit:
<http://www.inhs.illinois.edu/collections/mollusk/publications/guide/index/22>

The shape of the shell is greatly elongated, sometimes arcuate (curved), and moderately inflated, with the valves being solid and moderately thick, especially in older individuals. Both anterior and posterior ends of the shell are rounded with a shallow depression near the center of the shell. The anterior end is higher than the posterior end. The posterior ridge is low and broadly rounded. Year-one specimens have heavy ridges running parallel with the growth arrests, which are shell lines that indicate slower periods of growth, thought to be laid down annually. The periostracum is somewhat smooth, rayless, and light yellow, greenish-tan, or brown in young specimens, becoming rough and dark brown to black in old shells. The shell commonly will crack posteriorly when dried. Cardinal teeth are greatly reduced, with a single peg-like tooth in the right valve fitting into a depression in the left. Lateral teeth are evident in younger specimens, but merge into a thickening of the hinge line in older specimens. Length 6-7 inches.

Habitat Description

The spectaclecase generally inhabits **medium streams to large rivers**, and is found in microhabitats sheltered from the main force of current. It occurs in substrates from mud and sand to gravel, cobble, and boulders in relatively shallow riffles and shoals with a slow to swift current. This species is usually found in firm mud between large rocks in quiet water very near the interface with swift currents. Specimens have also been reported in tree stumps, in root masses, and in beds of rooted vegetation. Similar to other Margaritiferids, spectaclecase occurrences throughout much of its range tend to be aggregated, particularly under slab boulders or bedrock shelves, where they are protected from the current. Up to 200 specimens have been reported from under a single large slab in the Tennessee River at Muscle Shoals, Alabama.

Critical Habitat

Yes, proposed - (*see additional maps and detailed descriptions provided after the decision key*)

Critical habitat was proposed for the spectaclecase mussel on December 13, 2024.

Primary constituent elements for the spectaclecase mussel include:

1. *General Mussel Biology*: Freshwater mussels, including spectaclecase mussels, have a complex life history that involves parasitic larvae, called glochidia, which are wholly reliant on host fish(es). As adult freshwater mussels are generally sessile, suspension-feeders that spend their entire lives partially or completely buried within the substrate, dispersal occurs solely through the behavior of their host fish(es).
2. *Habitat Conditions, Suitable Substrates, and Flow Conditions*: All life stages of the sheepnose mussels require flowing water for survival. Appropriate flow is critical for delivering oxygen and nutrients for respiration and filtration (i.e., survival and growth), essential for reproduction to allow glochidia to move to their host and encyst, as well as removing silt and other fine sediments from within rock structures and crevices, which prevents mussel suffocation and degradation of mussel and/or host-fish shelter habitats. Normal fluctuations in flow velocity are expected; however, extreme changes can be detrimental. Alternatively, extreme low flows, typically associated with drought or water

withdrawals, can impact reproduction, feeding, respiration, and in some cases, result in exposure and/ or desiccation of the species. Appropriate water quality is critical to the survival, reproduction, and persistence of all life stages of freshwater mussels. In general, mussels need water temperatures below 86 degrees F, dissolved oxygen concentrations greater than 5 milligrams per liter, and water quality concentrations below acute toxicity levels to mussels for contaminants such as total ammonia, nitrogen, copper, chloride, and sulfate.

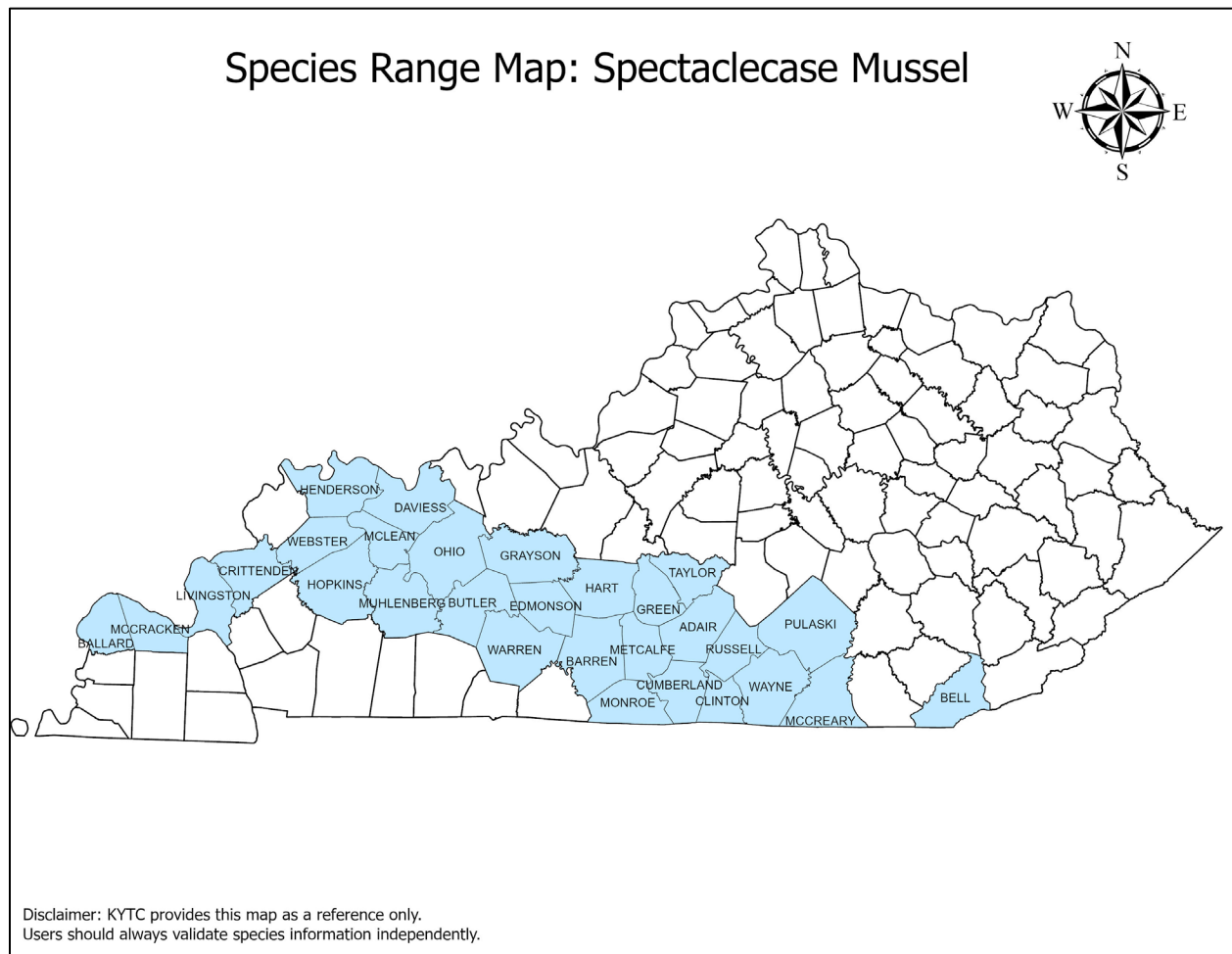
3. *Habitat Connectivity*: A mussel population includes more than one mussel bed; it is the collection of mussel beds within a stream reach between which infested host fish may travel, allowing for ebbs and flows in mussel bed density and abundance through time throughout the population's occupied reach. Connectivity is characterized by suitable water quality, lack of barriers to dispersal (e.g., perched culverts, hydropower dams that lack passage for host fishes, water control structures), and presence of suitable shelter habitat and forage base for host fish(es).
4. *Presence of Host Fish Species*: Spectaclecase are obligate parasites that rely on specific host-fish for developing into juvenile mussels and dispersal. Spectaclecase depend on mooneye (*Hiodon tergisus*) and goldeye (*Hiodon alosoides*) as host fishes. Natural infestations of spectaclecase have been observed on bigeye chub (*Hybopsis amblops*) and pealip redhorse (*Moxostoma pisolabrum*); however, they are not confirmed host fish species because juvenile mussels have not been observed transforming from these species in lab studies.

Species, Stream (unit), and State	Currently Occupied River Miles
Spectaclecase Mussel Green River (SPCA 11), KY	77

Range

The spectaclecase has declined rangewide, with the exception of a few significant populations. Its occurrence in the St. Croix, Meramec, Gasconade, and Clinch Rivers represent the only sizable, sustainable, and reproducing populations remaining, although the Clinch River population appears to be in decline. It has been eliminated from three-fifths of the total number

of streams from which it was historically known. This species has also been eliminated from long reaches of former habitat in thousands of miles of the Illinois, Ohio, Cumberland, and other rivers, and from long reaches of the Mississippi and Tennessee Rivers. In addition, the species is no longer known from the States of Ohio, Indiana, and Kansas. The extirpation of this species from numerous streams and stream reaches within its historical range signifies that substantial population losses have occurred. In Kentucky, it is considered to have the potential to occur in the Cumberland, Green, Tennessee, and parts of the Ohio and Licking Rivers.



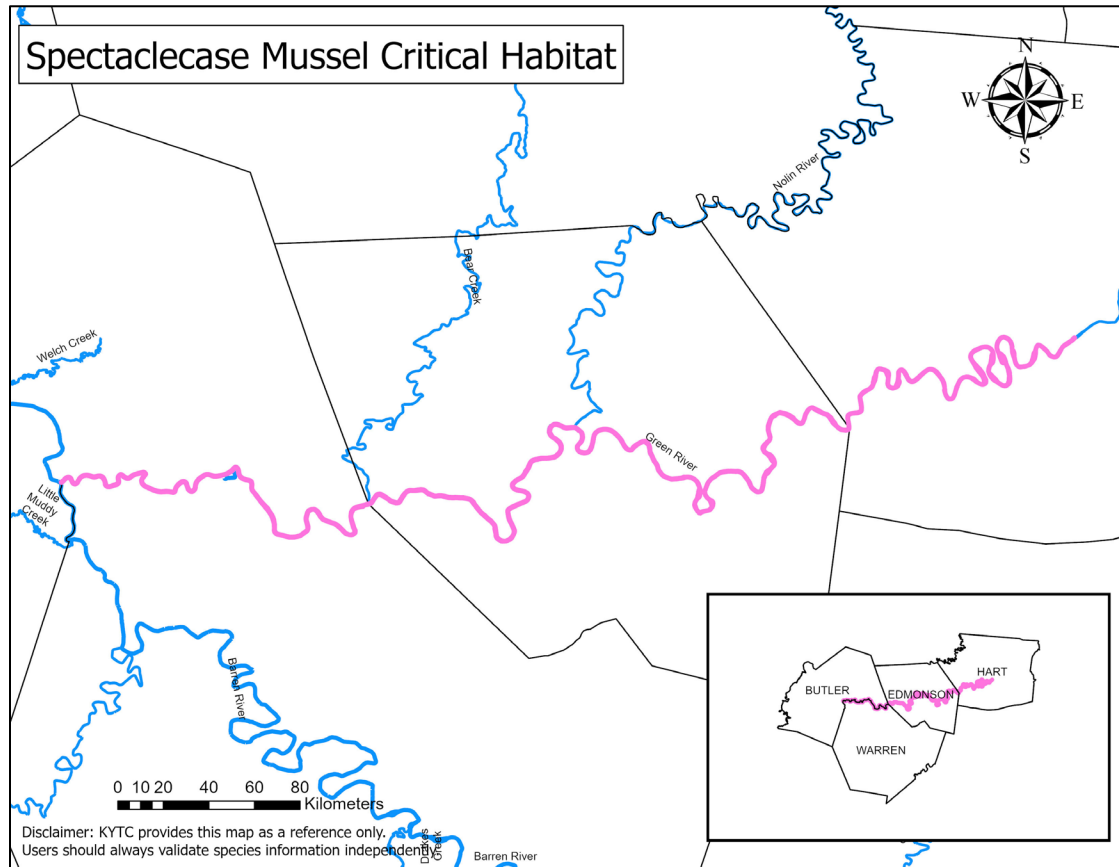
Decision Key

- 1) Does the project include any direct or indirect effects to **perennial streams or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)
 - a. Yes: Contact SME

- b. No: Prepare NE finding

SPCA 11: Green River – Hart, Edmonson, Warren, and Butler Counties, KY.

SPCA 11 consists of 77 rmi of the Green River in Hart, Edmonson, Warren, and Butler Counties, Kentucky. The unit extends from the downstream side of the bridge at Highway 31W at Munfordville (Hart County, Kentucky) downstream to the confluence with the Barren River near Woodbury (Warren County, Kentucky). The unit includes the river channel up to the ordinary high-water mark. Approximately 40.2% of the riparian lands adjacent to, but not included in, SPCA 11 are in public (Federal and State) ownership, and 59.8% are in private ownership. SPCA 11 is occupied by the species and contains all the physical or biological features essential to the species' conservation. This unit overlaps in part or in full with designated critical habitat for the federally endangered diamond darter (see 50 CFR 17.95(e) and 78 FR 52364, August 22, 2013); the federally threatened longsolid and the federally threatened round hickorynut (see 50 CFR 17.95(f) and 88 FR 14794, March 9, 2023); and the federally threatened rabbitsfoot (see 50 CFR 17.95(f) and 80 FR 24692, April 30, 2015); and proposed critical habitat for the federally endangered sheepnose and the federally endangered snuffbox.



Tan Riffleshell Mussel (*Epioblasma walkeri*)

AKA: *Epioblasma florentina walkeri*



Figure 29 Photo Credit: <http://www.dinkinsbiological.com/kentucky.html>

Species Description

The tan riffleshell mussel was listed as **endangered** in 1977.

The tan riffleshell has an elongated oval shape, and is moderately inflated. The shell is thicker anteriorly. The anterior margin is rounded, while the posterior margin is blunted pointed (males) or broadly rounded (females). Umbos are full, anterior, and slightly above the hinge line. The shell is smooth, shiny, and tanish-green with numerous fine, green rays. Cardinal teeth are small and serrated; lateral teeth are short and slightly curved. Length 1.5-2 inches.

Habitat Description

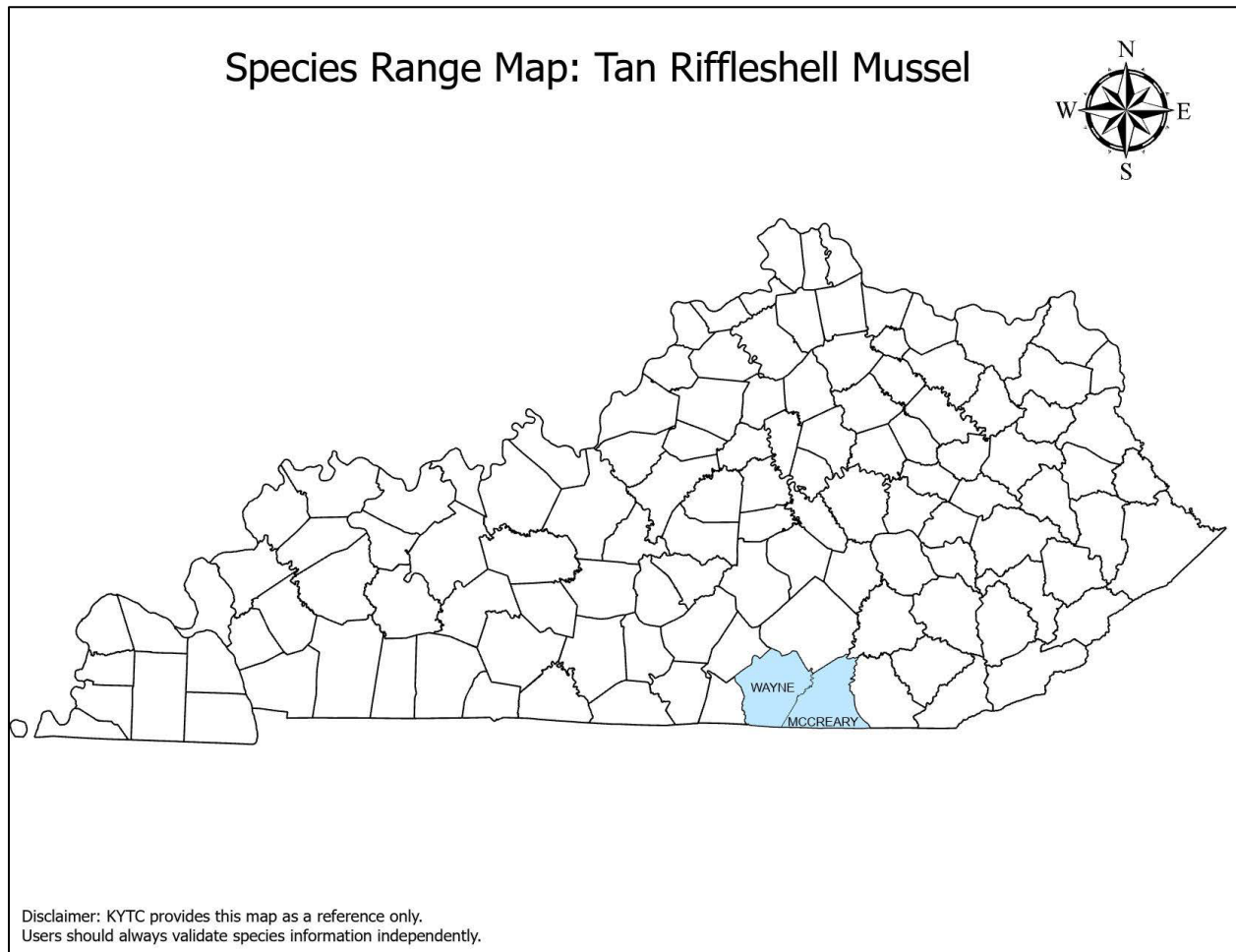
This is an ecologically variable species that ranges from the headwaters of small rivers to the main channel of bigger rivers. It is likely a riffle and shoal species living in sand and gravel substrates.

Critical Habitat

None

Range

The tan riffleshell is a Tennessee and Cumberland River endemic. In Kentucky, it is associated with the Upper Cumberland River system below the falls.



Decision Key

- 1) Does the project include any direct or indirect effects to **perennial streams or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)
 - a. Yes: Contact SME
 - b. No: Prepare NE finding

Tennessee Clubshell (*Pleurobema oviforme*)

Species Description

The Tennessee clubshell was listed as **proposed endangered** in August 2023.

The Tennessee clubshell is elongate and triangular in shape and can be up to ~3.5 inches in length. It is moderately compressed to inflated, with a bluntly pointed anterior margin. The dorsal and ventral margins are relatively straight to slightly curved, while the anterior margin is weakly rounded and nearly vertical. The shell is relatively smooth and yellow to brown in color. Broken green rays are typically present. The pseudocardinal teeth are thick and somewhat compressed. The lateral teeth are well-developed and robust. The nacre is white



Figure 30 Photo Credit:
<http://www.femorable.com.br/shellphotos/detail.asp?species=>

and the beak cavity is open and shallow. *P. oviforme* is most easily confused with *P. clava*, but *P. clava* has a nearly overlapping umbo to the anterior margin, where *P. oviforme* is positioned less anteriorly; *P. oviforme* also has a less developed sulcus.

Habitat Description

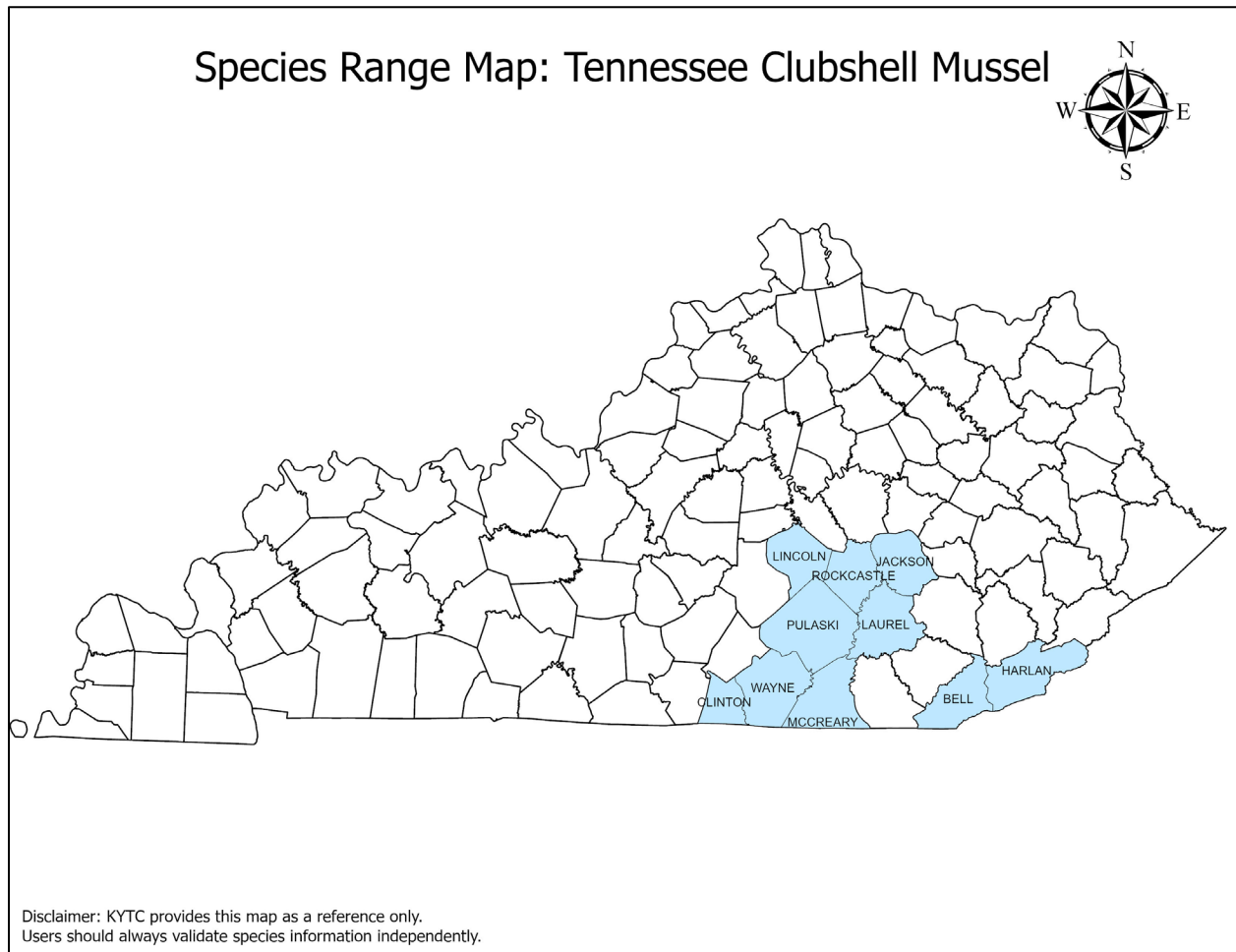
This species occurs in heterogeneous mixtures of sand and gravel in small streams to medium-sized rivers, although it historically occurred in the mainstem of the Upper Cumberland River.

Critical Habitat

None

Range

It is a Cumberland River drainage endemic species.



Decision Key

- 1) Does the project include any direct or indirect effects to any **small streams to large rivers or their nearby tributaries**? (e.g. – remove riparian vegetation, alter stream banks, change water levels/flow, dredge, construct/remove bridge piers, etc.)
 - a. Yes: Contact SME
 - b. No: Prepare NE finding

Extirpated Mussel Species

The following endangered mussels are considered extirpated in Kentucky. As a result, these are not identified as potentially existing within any Kentucky County. Surveys specifically for these mussels will not be conducted. However, should a specimen be found as a result of survey efforts for other listed species, they will be considered in the consultation with the USFWS.

White Catpaw Mussel (*Epioblasma perobliqua*)

The white catpaw mussel (formerly *Epioblasma obliquata perobliqua*) was listed as **endangered** in 1976. This mussel is considered a medium-to-large river mussel that may have occurred in the Ohio River.



Figure 31 Photo Credit:
http://www.fws.gov/midwest/endangered/clams/white_fc.html

Yellow Blossom (*Epioblasma florentina*)

The yellow blossom mussel (formerly *Epioblasma florentina florentina*) was listed as **endangered** in 1976. This mussel exists in medium sized to large rivers in sand and gravel. It is formerly of the upper Cumberland River below Cumberland Falls. A non-essential, experimental population has been established in Alabama.



Figure 32 Photo Credit:
<http://musselproject.uwsp.edu/db/db/php?p=div&l=spp&n=1055>

Tubercled Blossom (*Epioblasma torulosa*)

The tubercled blossom (formerly *Epioblasma torulosa torulosa*) was listed as **endangered** in 1976. This is a medium to large river mussel that lived in substrates of sand and gravel. It is formerly of the Ohio, Tennessee, Cumberland, Green, Salt, Licking, and Kentucky Rivers in Kentucky. A non-essential, experimental population has been established in Alabama.



Figure 33 Photo Credit:
<http://www.illinois.edu/collections/>

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<http://ecos.fws.gov/speciesProfile>

Braun's Rock-cress (*Arabis perstellata* var. *perstellata*)

Species Description

Braun's rock-cress (*Arabis perstellata* var. *perstellata*) was listed as **endangered** on January 3, 1995.

A member of the Mustard family (*Brassicaceae*), Braun's rock-cress is a relatively short, perennial herb that grows in calcareous, mesophytic, and sub-xeric forest. The plant can reach a height of 30 inches but is generally much shorter. It can be recognized in the field during all seasons since it maintains a rosette of small leaves all year-round. The rosette is formed the first year following germination and remains green during the winter months. The following year a stem is produced from the rosette and a taproot becomes established. In subsequent years, new growth is produced, especially additional branching and stems. Plants are reported to live up to five years. The elongate raceme has many flowers. Each flower has four petals 3-4 mm in length, white to lavender in color. This species is most easily recognized when blooming, usually from April through May. Fruits mature from mid-May to early June.



Habitat Description

Braun's rock-cress is typically found in mesic or xeric deciduous forest on calcareous slopes with limestone outcroppings. The occurrence of this species does not appear to be limited to a particular slope aspect or moisture regime. It is, however, sun intolerant and always occurs in at least partial shade. The largest and most vigorous populations occur on moist mid-to-upper slope sites. Recent studies have shown that the species elevation range is from 520 feet to 868 feet, and the average elevation of known occurrences was 661.1 feet.



Braun's rock-cress growing on a rock outcropping

Plants are often found around rock outcrops and can even be found growing from the strata lines and joints of outcrops. It is rarely found growing in leaf litter or in dense herbaceous cover of the forest floor. Localized and usually



Braun's rock-cress showing bare ground around



Figure 2 Photo Credits: Third Rock Consultants, Lexington, KY.

Braun's rock cress, showing nearly bare ground only scattered leaf litter

natural disturbance, such as animal trails, scouring, or even turkey scratching that reduces leaf litter or create bare ground appears to be necessary for this species germination and survival. Often the species can be found on the down-slope side of tree trunks where the leaf litter has been washed away and continues to be swept clean by trunk-flow.

With one exception, all Kentucky occurrences have been found on either the Grier or Tanglewood members of the Lexington Limestone Formation. Even where other members of the formation, those with a more substantial shale component (Clays Ferry), occur immediately adjacent, the plants are still confined to the Grier and Tanglewood. The exception is a population in Henry County, occurring on what is mapped as the Kope and Clays Ferry members that have a higher shale component than Lexington Limestone. The plants at this site occur on limestone outcrops, however, and the Calloway Creek limestone (75 to 85 percent limestone) is mapped at a slightly higher elevation on the slope above, so this habitat may be consistent with other sites in its higher limestone component. This geologic habitat is associated with the entrenched Kentucky River and the lower end of its direct tributaries. Such habitat only occurs within 6 miles of the River.



Sub-xeric (west aspect) slope habitat



Slope habitat with limestone outcroppings



Figure 3 Photo Credits: Third Rock Consultants, Lexington, KY.

Typical, partially shaded wooded slope

Braun's rock-cress is never a common component of the forest floor community. It usually occurs in small groups (especially around and on rock outcrops) or as scattered individuals. The small size of the populations, the species' specialized habitat, and its apparent inability to expand into available or similar habitats suggest that Braun's rock-cress is a poor competitor. Although its habitat is usually disturbance-mediated, Braun's rock-cress is adapted to a highly specialized set of environmental conditions. It appears that this species cannot withstand vigorous competition from invasive weed or even native herbaceous species.

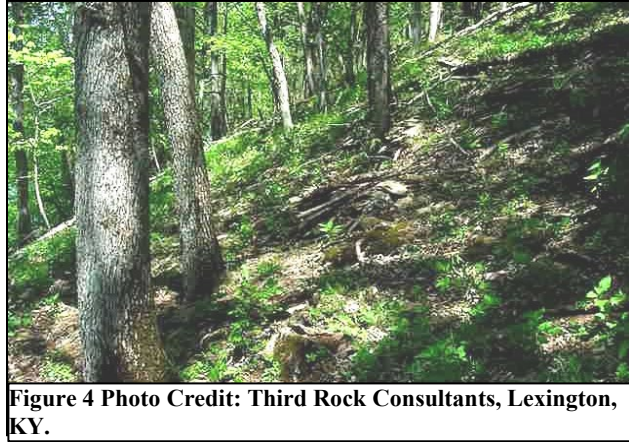


Figure 4 Photo Credit: Third Rock Consultants, Lexington, KY.

Partially shaded, mesic wooded slope habitat

Common tree species associated with the slope forests where Braun's rock-cress habitat occurs include: sugar maple (*Acer saccharum*), chinquapin oak (*Quercus muhlenbergii*), northern hackberry (*Celtis occidentalis*), and Ohio buckeye (*Aesculus glabra*).

The most likely impacts associated with transportation projects are road cuts along steep slopes next to the Kentucky River or its tributaries. New corridor construction, widening that requires clearing, bridge replacements that require alteration of wooded, slope habitat, and borrow or fill areas that are located on wooded slopes (or ravines) are all activities that could also impact Braun's rock-cress. A change in surface or groundwater drainage may also affect plants occurring down-slope of a project by scouring or reducing soil moisture. Roadcuts typically intercept subsurface drainage, leaving the down-slope soils drier.

Critical Habitat

Yes – (See more detailed information and maps provided after decision key)

In 2004, the USFWS designated 17 units as critical habitat in Franklin and Owen Counties, KY.

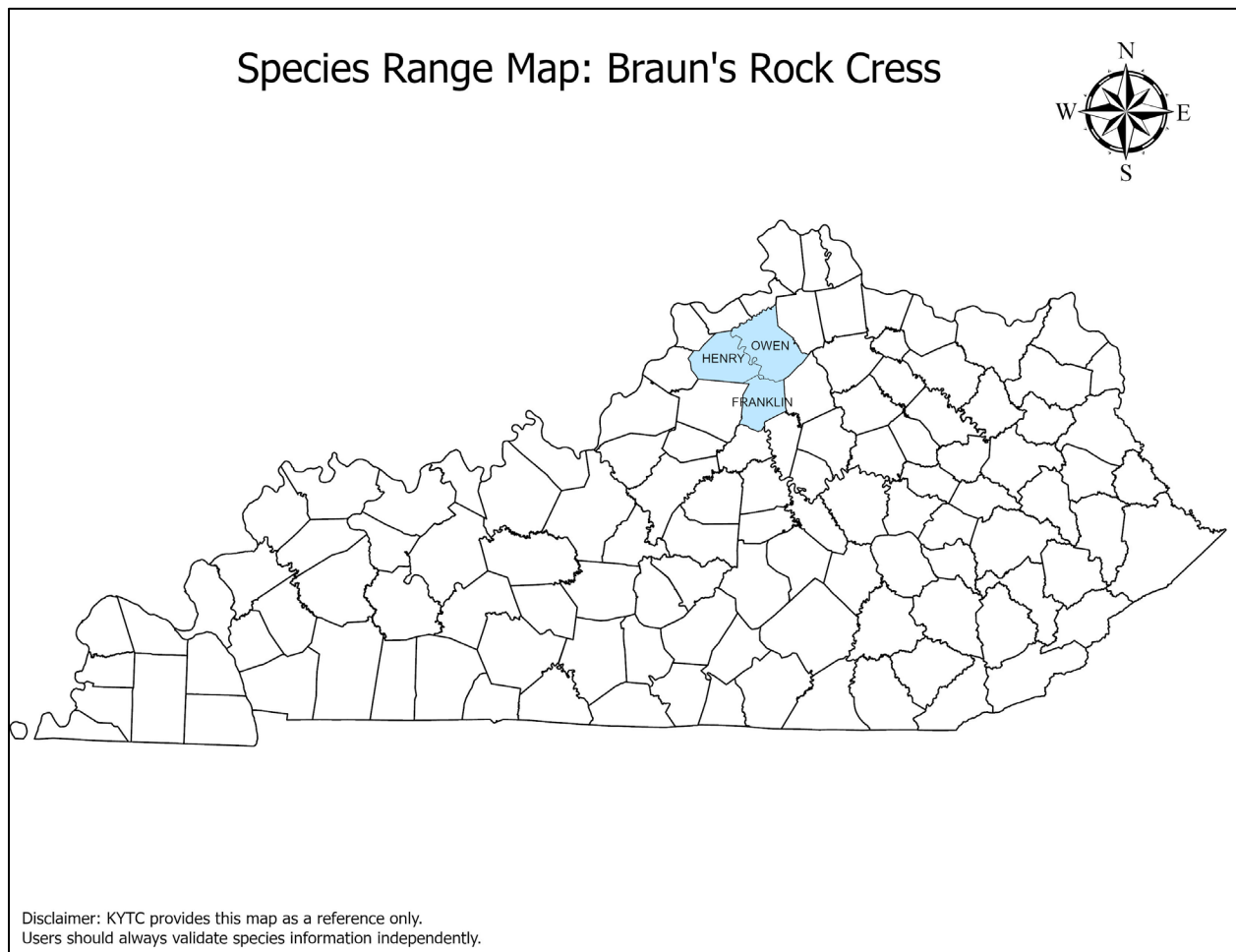
Primary constituent elements of critical habitat for this species include:

- 1) Relatively undisturbed, closed canopy mesophytic and sub-xeric forest with large, mature trees (such as sugar maple (*Acer saccharum*), chinquapin oak (*Quercus muhlenbergii*), hackberry (*Celtis occidentalis*), or Ohio buckeye (*Aesculus glabra*)), and
- 2) Open forest floors with little herbaceous cover and leaf litter accumulation with natural disturbance to allow for *Arabis perstellata* germination and seedling germination, and
- 3) Areas with few introduced weed species such as garlic mustard (*Alliaria petiolata*) or amur honeysuckle (*Lonicera maackii*), and
- 4) Rock outcrops on moderate to steep calcareous slopes defined by:
 - a) Ordovician limestone, in particular the Grier, Tanglewood, and Macedonia Bed Members of the Lexington Limestone in Kentucky and the Lebanon Carters, Leipers, and Catheys, and Bigby-Cannon Limestones in Tennessee; and
 - b) Limestone soils such as the Fairmont Rock outcrop complexes in Kentucky and the Mimosa Rock outcrop complexes in Tennessee.

Critical Habitat Unit	County/State	Land Ownership	Hectares	Acres
1. Sky View Drive	Franklin/Kentucky	Private	22	54
2. Benson Valley Woods	Franklin/Kentucky	Private	37	91
3. Red Bridge Ridge	Franklin/Kentucky	Private	6	15
4. Trib. to South Benson Creek	Franklin/Kentucky	Private	10	25
5. Davis Branch	Franklin/Kentucky	Private	3	7
6. Onans Bend	Franklin/Kentucky	Private	12	30
7. Shadrock Ferry Road	Franklin/Kentucky	Private	15	37
8. Hoover Site	Franklin/Kentucky	Private	83	205
9. Longs Ravine Site	Franklin/Kentucky	Private	30	74
10. Strohmeiers Hills	Franklin/Kentucky	Private	20	49
11. U.S. 127	Franklin/Kentucky	EXTIRPATED	11	27
12. Camp Pleasant Branch	Franklin/Kentucky	Private	14	35
13. Saufley	Franklin/Kentucky	Private	8	20
14. Clements Bluff	Owen/Kentucky	State	11	27
15. Monterey U.S. 127	Owen/Kentucky	Private	12	30
16. Craddock Bottom	Owen/Kentucky	Private	23	57
17. Backbone North	Franklin/Kentucky	Private	11	27
18. Scales Mountain	Rutherford/Tennessee	Private	103	255
19. Sophie Hill	Rutherford/Tennessee	Private	53	132
20. Indian Mountain	Rutherford/Tennessee	Private	87	214
21. Grandfather Knob	Wilson/Tennessee	Private	43	106
22. Versailles Knob	Rutherford/Tennessee	Private	34	83
Total	-----	-----	648	1,600

Range

Braun's rock-cress is presently known from the Interior Plateau Level 3 ecoregion of Kentucky and Tennessee. These regions are geologically similar in that both are underlain with Ordovician limestones, the oldest geologic substrates in each of the states. In Kentucky, it is found in the Hills of the Bluegrass and Inner Bluegrass Level IV ecoregions. Currently, this species is listed for three counties in Kentucky.



Decision Key

Office Review:

- 1) Is the project located within a 6 mile buffer of the Kentucky River?
 - a. Yes: Continue to Step 2
 - b. No: Prepare NE finding
- 2) Is the project area within ¼ mile of a critical habitat unit?
 - a. Yes: Contact SME
 - b. No: Continue to Step 3
- 3) Is the project area on or adjacent to a steep slope (20 percent or more) and/or adjacent to the Grier, Tanglewood, Kope, or Clays Ferry members of the Lexington limestone?
 - a. Yes: Continue to Step 4
 - b. No: Prepare NE finding

Field Assessment:

- 4) Is the project area located on or where it may affect wooded slopes?
 - a. Yes: Contact SME
 - b. No: Prepare NE finding

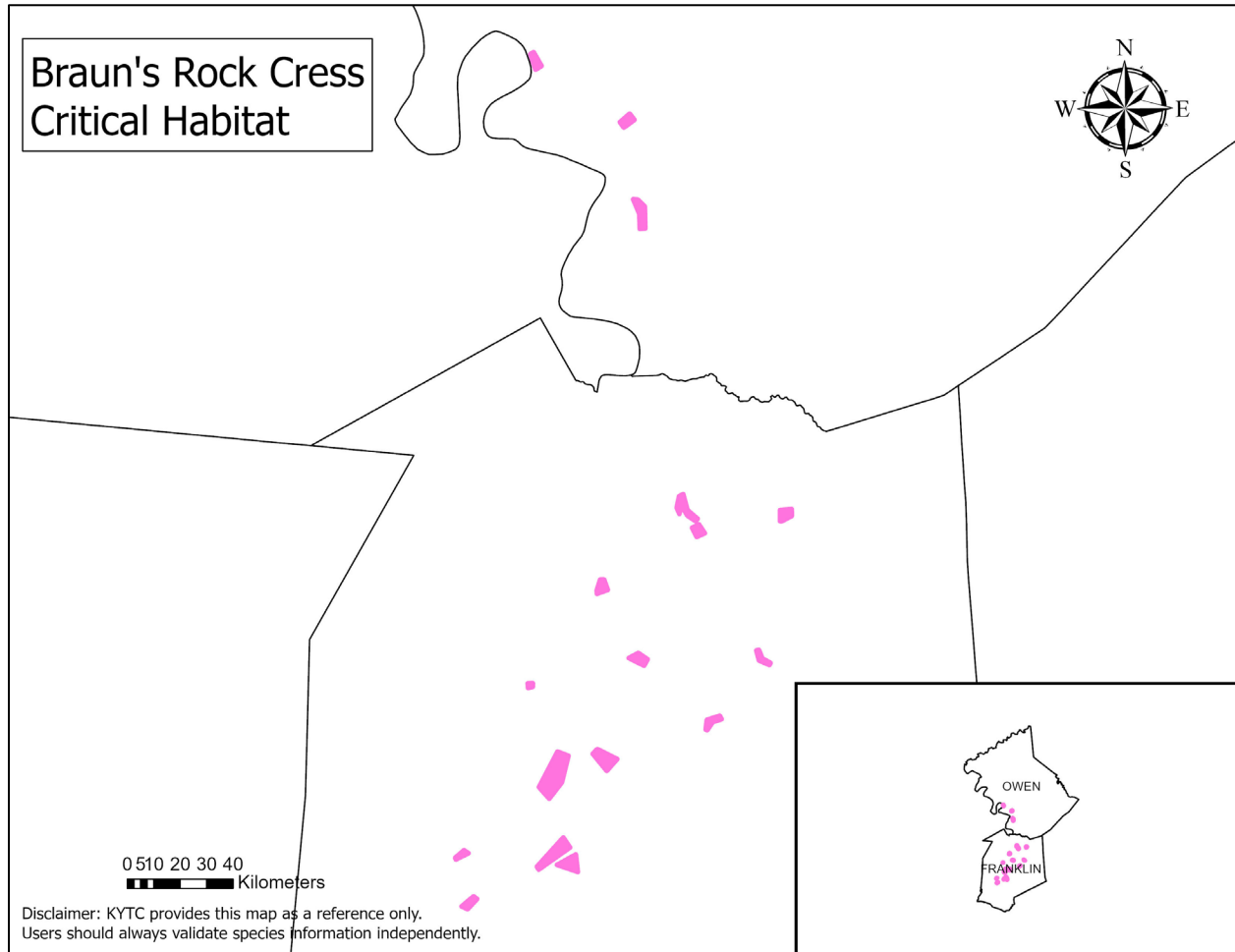


Figure 5 Overview of all the CH units in KY.

Unit 1. Sky View Drive – Franklin County, KY.

Unit 1 is located on the west side of the City of Frankfort. It occurs along U.S. 127 and Skyview Drive on the slopes of the first large ravine system due west of the confluence of Benson Creek and the Kentucky River. It contains approximately 22 ha (54 ac), all of which are privately owned. This site was first observed to have *Arabis perstellata* in 1979. In 2001, surveys conducted by the KSNPC found over 150 plants, but not all habitat was surveyed. The majority of the plants occur on the west- and south-facing sloped and are associated with bare soil on trails and tree bases.

Unit 2. Benson Valley Woods – Franklin County, KY.

Unit 2 is located west of the City of Frankfort. The unit lies southeast of Benson Valley Road on the south side of Benson Creek. It is privately owned and contains approximately 37 ha (91 ac). The plants occur on the southeast-facing slope. They were first observed in 1979. KSNPC

personnel last observed more than 200 plants in 2001. The site is threatened by trampling and competition by weeds.

Unit 3. Red Bridge Ridge – Franklin County, KY.

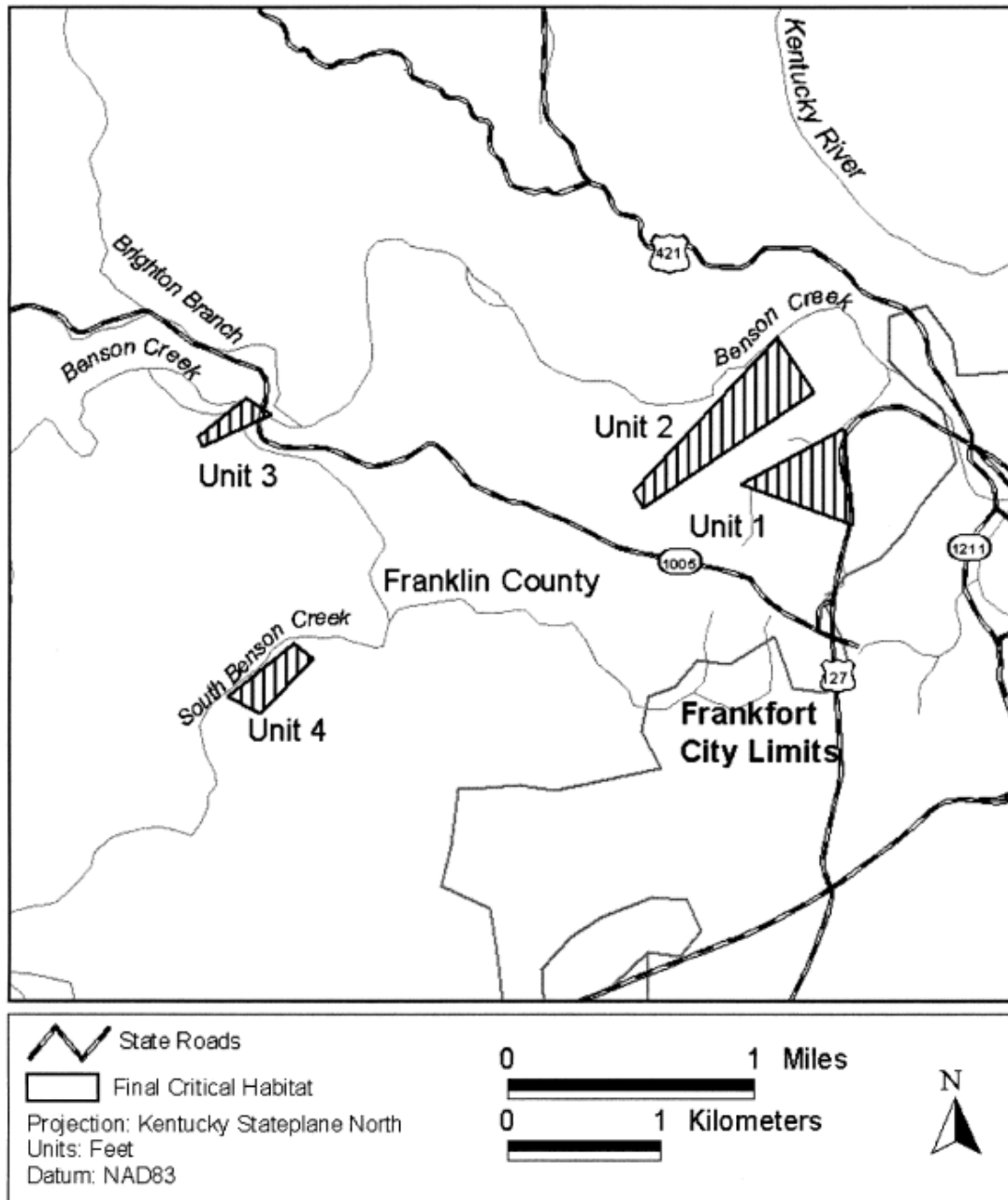
Unit 3 is located west of Kentucky (KY) Highway 1005, at the confluence of South Benson and Benson Creeks. The site is privately owned. It is approximately 6 ha (15 ac) in size. Plants at this site were first observed in 1987. In 1990, 75 plants were found along the southeast- and northwest-facing slopes.

Unit 4. Tributary to South Benson Creek – Franklin County, KY.

This unit is located northeast of the City of Frankfort. It occurs along the southeast side of South Benson Creek and the north and south slopes of an unnamed tributary. The site is in private ownership and is 10 ha (25 ac) in size. In 1996, over 1,000 plants were found along the northwest-facing lower, mid, and upper slopes, making this one of the best sites in Kentucky for *Arabis perstellata*.

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Map 2 - Units 1, 2, 3 and 4: critical habitat for Braun's rock-cress in Kentucky.



Unit 5. Davis Branch – Franklin County, KY.

This unit occurs along the east side of Harvieland Drive and Davis Branch. This unit contains approximately 3 ha (7 ac) and is privately owned. Plants were first observed at this site in 1990. In 2001, hundreds of plants were found along the south-facing slope throughout the ravine system.

Unit 6. Onans Bend – Franklin County, KY.

Unit 6 occurs north of Onans Bend Road and east of KY Highway 12. The unit lies along the banks of an unnamed stream near its mouth with the west bank of the Kentucky River. This unit is privately owned and contains approximately 12 ha (30 ac). Plants at this unit were first observed in 1979. In 1990, more than 100 plants were found on the south-facing slope. The plants were exceptionally vigorous. The site is threatened by weed competition.

Unit 7. Shadrock Ferry Road – Franklin County, KY.

This unit is located along the north side of Shadrock Ferry Road (KY Highway 898). Property at this location is in private ownership. This unit is approximately 15 ha (37 ac) in size. Plants were first observed at this site in 1996. In 2001, several hundred plants were found on the south-facing slope.

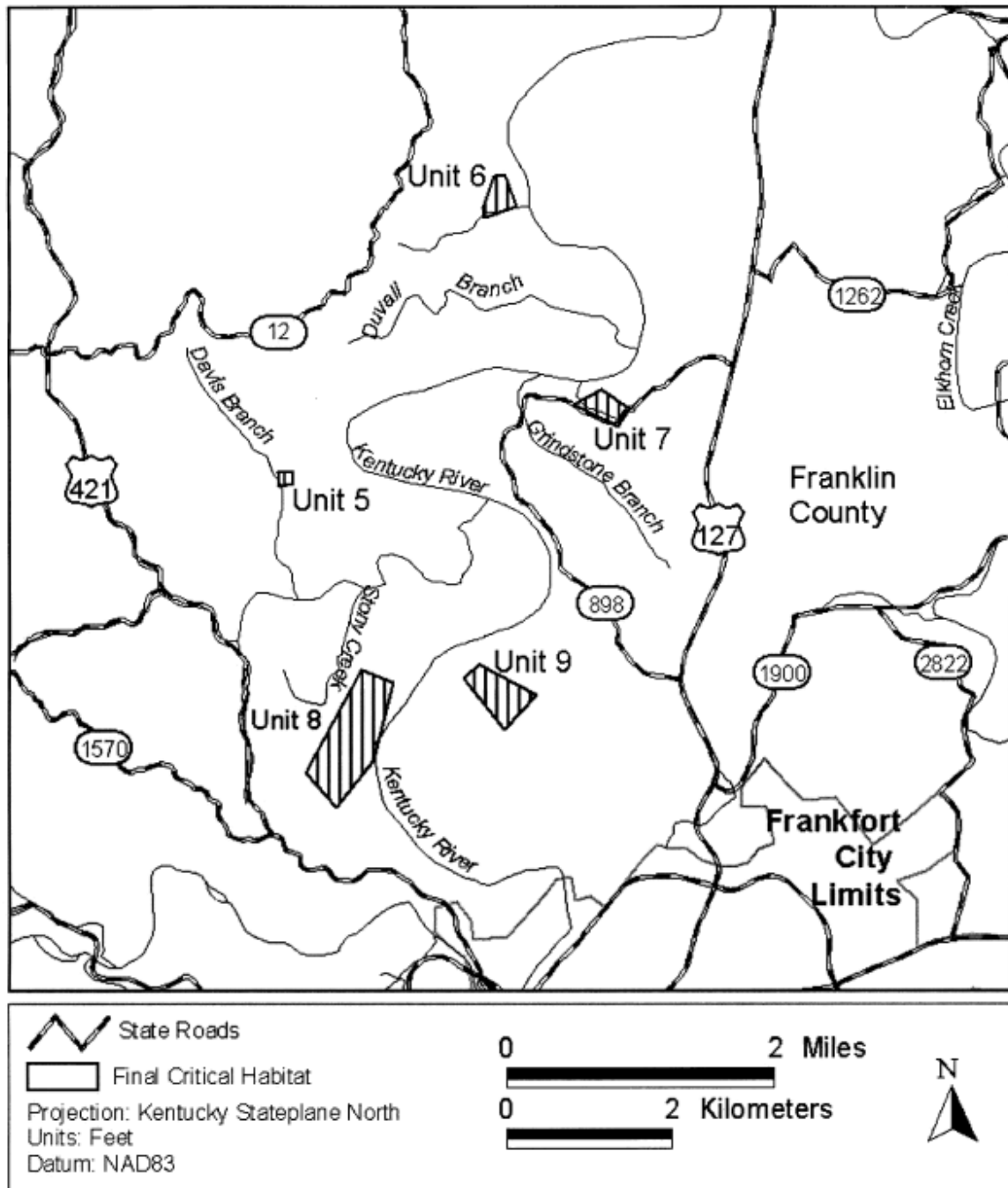
Unit 8. Hoover Site – Franklin County, KY.

This unit lies northwest of the City of Frankfort, along the west side of the Kentucky River on slopes bordering two unnamed tributaries. Plants are widely scattered in small groups along the Kentucky River bluff from river kilometer (km) 98.6 to 101.7 (river mile 61.3 to 63.2). This unit is in private ownership and contains approximately 83 ha (205 ac). The plants were first observed in 1990. In 1996, hundreds of plants were found.

Unit 9. Longs Ravine Site – Franklin County, KY.

Unit 9 is located north of the City of Frankfort and Lewis Ferry Road. This unit lies east of the Kentucky River in a large ravine and along the steep slopes above the river. This unit is privately owned. There is approximately 30 ha (74 ac) in this unit. In 1990, more than 250 plants were found on the northeast, southwest, and northwest-facing slopes.

Map 3 - Units 5, 6, 7, 8 and 9: critical habitat for Braun's rock-cress in Kentucky.



Unit 10. Strohmeiers Hill – Franklin County, KY.

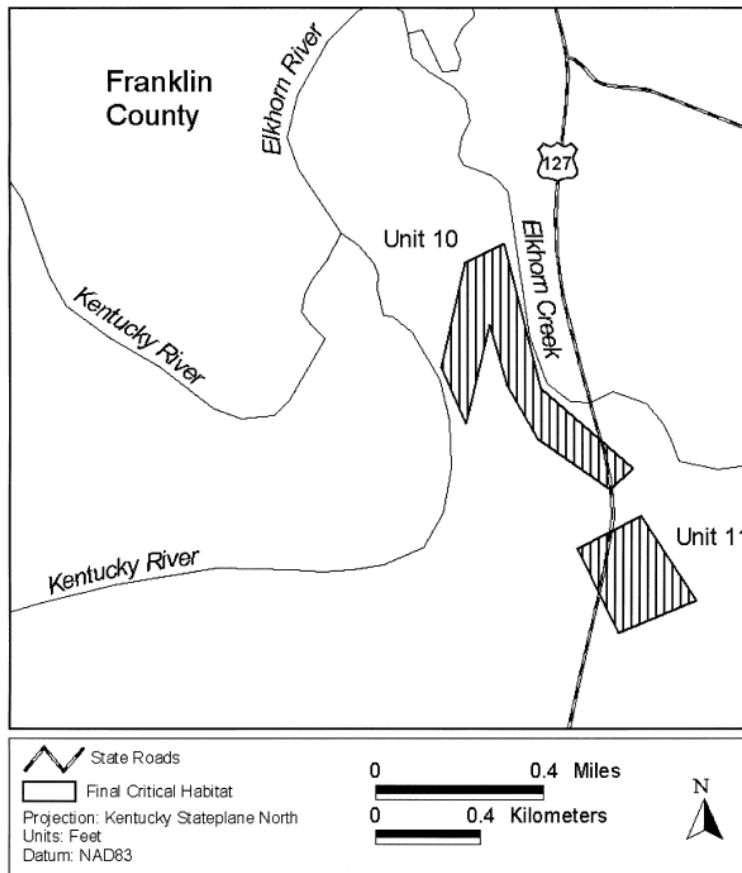
This unit is located south of the Town of Swallowfield and adjacent to Strohmeier Road and U.S. 127. It occurs on steep slopes on the south side of Elkhorn Creek and on the east bank of the Kentucky River, south of the confluence with Elkhorn Creek. The plants at the site were first observed in 1930. The property is privately owned. The site is approximately 20 ha (49 ac) in size. In 1994, the site contained more than 200 flowering plants. The plants were exceptionally vigorous and occurred throughout a large area, making this one of the best populations of *Arabis perstellata* in Kentucky.

Unit 11. U.S. 127 – Franklin County, KY.

Unit 11 is located along the east side of U.S. 127 in a ravine just southeast of Elkhorn Creek. The site is privately owned. This unit is approximately 11 ha (27 ac) in size. The plants were first observed in 2001, at which time approximately 100 plants were found on the west-facing slope. This population [#39, Unit 11] is now considered extirpated by KSNPC.

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Map 4 - Units 10 and 11: critical habitat for Braun's rock-cress in Kentucky.



Unit 12. Camp Pleasant Branch Woods – Franklin County, KY.

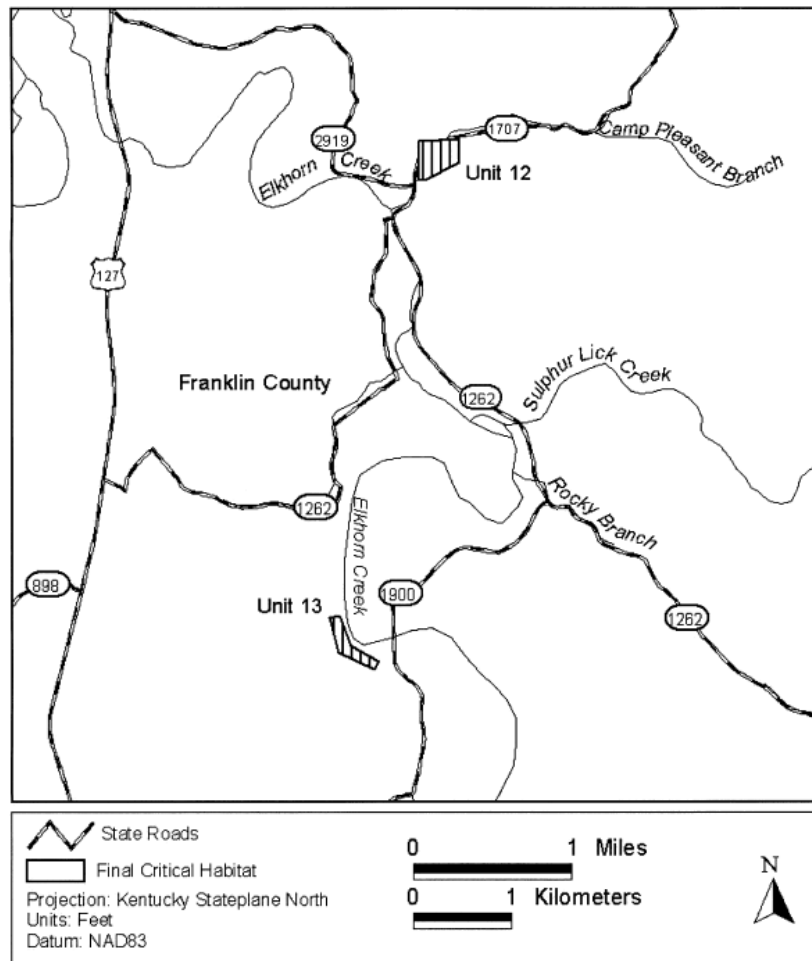
Unit 12 is located along the south side of Camp Pleasant Road (KY Highway 1707). This site is privately owned and contains approximately 14 ha (35 ac). The first observance of plants at this site was in 1987. In 2001, over 100 plants were found along the lower northwest-facing slope. Plants at this site are threatened by competition from weeds.

Unit 13. Saufley – Franklin County, KY.

Unit 13 occurs west of the KY Highway 1900 bridge over Elkhorn Creek on the hillside above the creek. The land ownership for this unit is private. The site is approximately 8 ha (20 ac) in size. Plants were first observed in 1988. In 1996, more than 100 hundred plants were found along the top of the ridge on the northeast-facing slope.

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Map 5 - Units 12 and 13: critical habitat for Braun's rock-cress in Kentucky.



Unit 14. Clements Bluff – Owen County, KY.

This unit is located in a ravine facing the Kentucky River along the east side of KY Highway 355. The site is owned by the State of Kentucky and is part of the Kentucky River Wildlife Management Area. This unit is approximately 11 ha (27 ac) in size. The plants were first observed at this site in 1980 on the north-facing slope. In 1996, approximately 100 plants occurred at the site.

Unit 15. Monterey U.S. 127 – Owen County, KY.

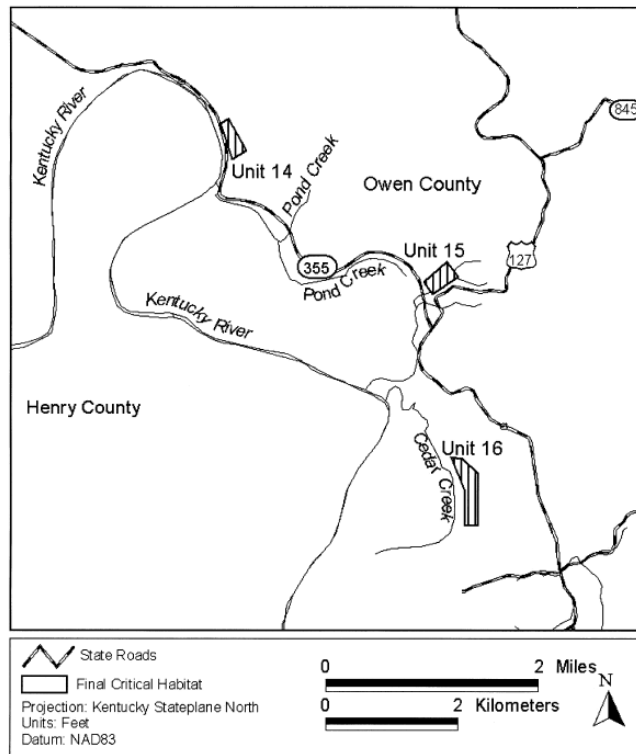
Unit 15 is located 1.6 km (1 mile) north of the City of Monterey, just north of the junction of U.S. 127 and KY Highway 355. The property is privately owned. It is approximately 12 ha (30 ac) in size. Plants were first observed at this site in 1996. In 1997, 150 plants were found along the southwest-facing slope of an unnamed tributary to the Kentucky River. The site is being threatened by weedy competition.

Unit 16. Craddock Bottom – Owen County, KY.

This unit is located south of the City of Monterey. It occurs along the west side of Old Frankfort Pike on the west-facing slope just east of Craddock Bottom. Property at this site is privately owned. The site contains approximately 23 ha (57 ac). In 1996, over 150 plants were found. In 1996, there was evidence of logging in the surrounding area.

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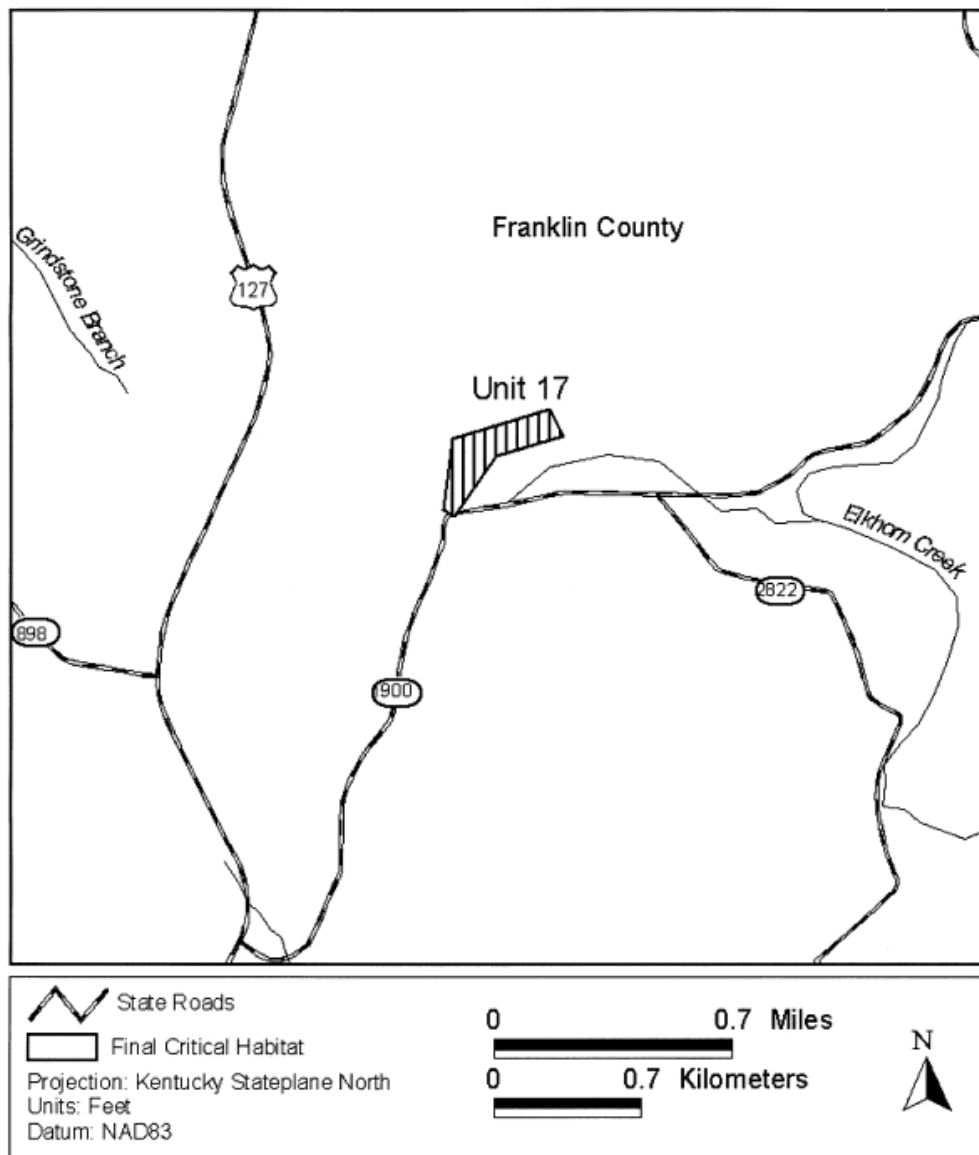
Map 6 - Units 14, 15 and 16: critical habitat for Braun's rock-cress in Kentucky.



Unit 17. Backbone North – Franklin County, KY.

Unit 17 is located north of KY Highway 1900. It occurs in an old river oxbow west of the existing Elkhorn Creek and is privately owned. The unit size is approximately 11 ha (27 ac). Plants were first observed at this site in 1981. In 1990, more than 200 plants were found on the southeast-facing slope.

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Map 7 - Unit 17: critical habitat for Braun's rock-cress in Kentucky.

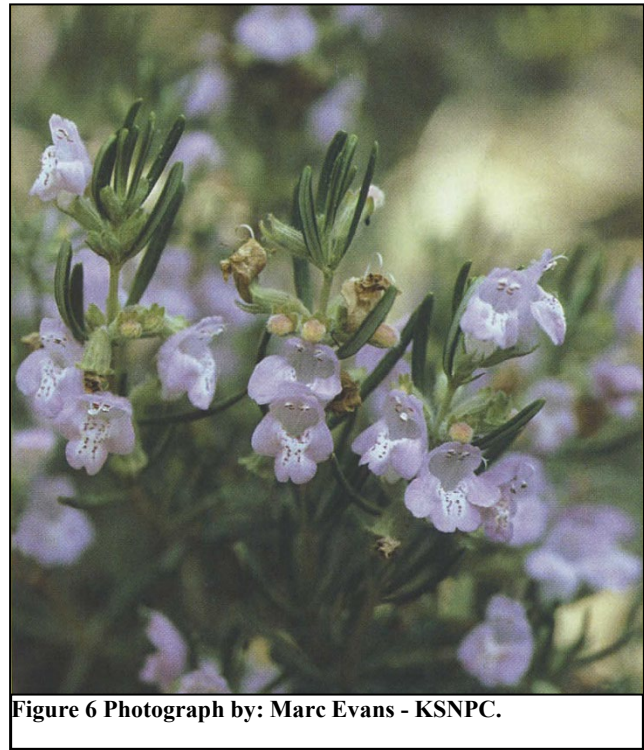
Cumberland Rosemary (*Conradina verticillata*)

AKA: Cumberland False Rosemary; Upland Rabbitbane

Species Description

Cumberland rosemary (*Platanthera integrilabia*) was listed as a **threatened** species on November 29, 1991.

A member of the Mint family (*Lamiaceae*), Cumberland rosemary is a small evergreen, perennial shrub with small needle-like, whorled leaves. The leaves are noted for their aromatic scent (which smell like the culinary herb rosemary). The very narrow leaves are about 1 inch long and appear to be in whorls along the stems. Individual plants are about 1.5 feet high with reclining branches, which often take root where they touch the ground.



This rooting at the nodes produces clones and an entire population of plants on a sandbar may be a single plant genetically.

Cumberland rosemary produces abundant small, pink to lavender colored flowers which are spotted inside with white. Flowers typically bloom from May to June. Pedestrian surveys should be conducted during this time in areas of favorable habitat.

No other plants are likely to be mistaken for it when it is in flower, usually from mid-May to early June. Without flowers, however, it resembles stiff aster (*Ionactis linariifolius*), bushy St. John's-wort (*Hypericum densiflorum*), or slender mountain mint (*Pycnanthemum tenuiflorum*), all which have needlelike leaves and grow in the same habitat but do not have the distinctive rosemary aroma.

A cultivated variety of Cumberland rosemary does exist and is used in yard landscaping; however, wild Cumberland rosemary cannot survive being transported from its natural habitat and thus has resulted in its endangered status.

Habitat Description

This species grows in full to moderate sunlight in the floodplain of major streams flowing over sandstone. The substrate varies from expanses of deep, pure sand to densely rocky areas that are always well drained and devoid of organic matter. Essential habitat requirements for Cumberland rosemary include periodic flooding to maintain openness, micro-topographic features to enhance sand deposition, and periods of inundation of at least two weeks to induce rooting at the lower nodes of the stems.

Although Cumberland rosemary tolerates extended periods of submersion and thrives in full sunlight, it seldom, if ever, grows directly beside the normal pool level, probably because of the soil saturation associated with the higher water table at these locations. With few exceptions, the only place where Cumberland rosemary is found in any abundance is on wide gravel/boulder point-bars of river bends, outwash bars, or low-



River bank boulders and gravel bars



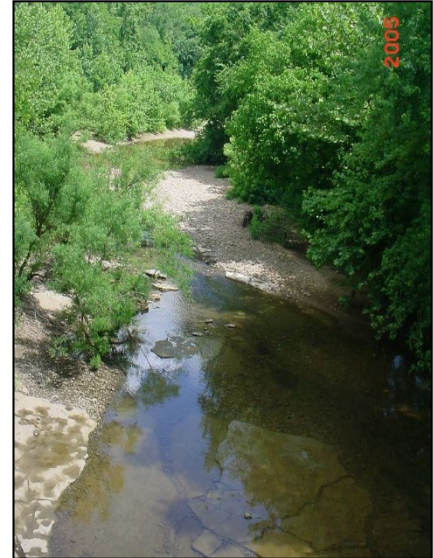
Figure 7 Photo Credits: Third Rock Consultants, Lexington, KY.

Treeless outwash gravel bar

lying islands. Outwash bars and islands frequently occur downstream of where major tributaries enter the main channel, depositing sediments and widening the floodplain.

Specific areas supporting the species include: boulder bars, boulder/gravel bars, sand bars, terraces of sand on gradually sloping river banks and islands, and pockets of sand between large boulders on islands and stream banks.

The bars on which it is found tend to be dominated by grasses such as big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), and Indian grass (*Sorghastrum nutans*). Associated flowering species are smooth phlox



Flood scoured gravel bar on right, less scoured tree covered bar on left



Figure 8 Photo Credits: Third Rock Consultants, Lexington, KY.

Gravel bar exposed to full sun

(*Phlox glaberrima*), wild indigo (*Baptisia tinctoria*), and Virginia goat's-rue (*Tephrosia virginiana*).



Figure 9 Photo Credits: Third Rock Consultants, Lexington, KY.

Gravel bar (right side) with large boulders allowing sand deposition and protection from flooding forces

Large boulders on stream margins and boulder islands

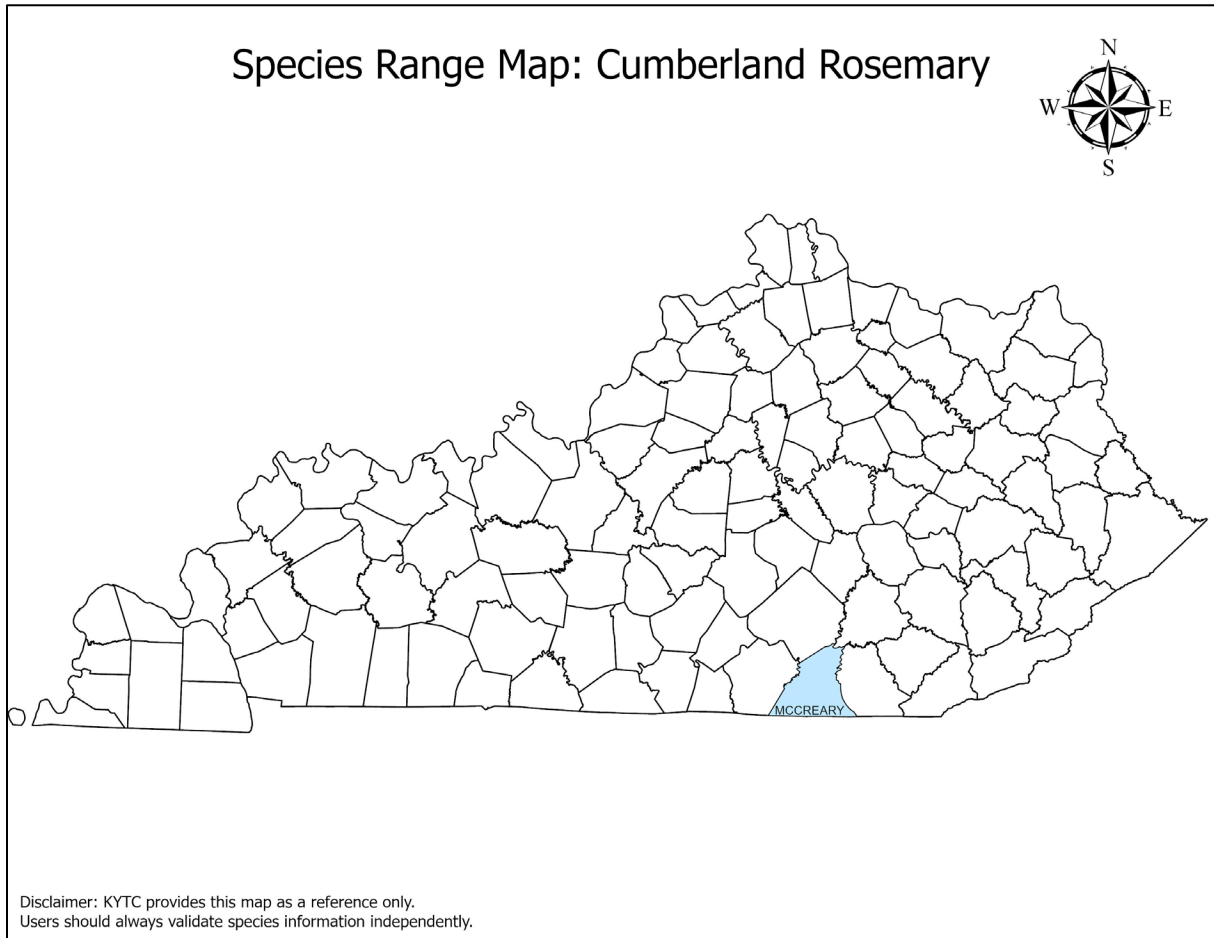
The most likely impacts associated with transportation projects are loss of habitat due to placement of bridge piers along stream banks and on small islands. New bridge piers, in-stream or near banks, could also alter the normal flow pattern and current velocity, causing erosion of downstream habitats. The removal or placement of boulders either in stream or on banks could alter or completely destroy existing habitat. An additional threat includes invasive exotic plants.

Critical Habitat

None

Range

Cumberland rosemary is known from five counties in north-central Tennessee and one county in southeastern Kentucky. At present, 91 occurrences (colonies) are thought to be extant. In Kentucky there are 12 known occurrences, all on the Big South Fork of the Cumberland River and within the Big South Fork National River and Recreation Area in McCreary County. Currently, this species is listed for in only this single county in Kentucky.



Decision Key

- 1) Will any part of the project impact the Big South Fork of the Cumberland River (south of KY 92)?
 - a. Yes: Contact SME
 - b. No: Prepare NE finding

Kentucky glade cress (*Leavenworthia exigua* var. *laciniata*)

Species Description

On June 5, 2014, the U.S. Fish and Wildlife Service formally listed Kentucky glade cress as a **threatened** species and designated critical habitat for the species within two Kentucky counties.

This plant is about 2-4 inches in height. Small white to lilac colored flowers with four petals appear usually beginning in mid to late March. The fruit are flat and pod-shaped. The leaves are somewhat square at the end and appear as disconnected pieces along the main leaf vein. The leaves may be mostly gone when the plant is in fruit.



Figure 10 Photo Credit: Thomas Barnes, University of Kentucky.

Habitat Description

Kentucky glade cress is shade intolerant and grows on areas of flat soil, usually the thin soils and gravel around the dolomite rock outcrops. It is typically found in cedar or limestone glades. It is also found in lawns and pastures where moist bare soil is predominant in the spring. Some populations have also been observed in gravel driveways. Kentucky State Nature Preserve Commission developed a model to identify areas with potential habitat for this species. Mapping of this KSNPC modeling is provided at the end of the discussion of this species.

The natural rock outcrops in areas with thin soils are another important habitat for glade cress. The surface dolomitic limestone has created unusual conditions for plant growth, generally wet in the spring when water is held near the surface and then very dry due to the lack of soil and other vegetation throughout the summer. Glade cress takes advantage of this moist spring by flowering in March and dispersing its seed in May and June, before other plants can establish. However, agricultural crops and even lawns have done poorly where rock is near the soil surface and in many areas it has been broken up and removed.

Critical Habitat

Yes – (See more detailed information and maps provided after decision key)

In 2014, the USFWS designated 6 units, consisting of 18 subunits, (total of 2,053 acres) as critical habitat in Jefferson and Bullitt Counties, KY.

Primary Constituents Elements:

- 1) Cedar glades and gladelike areas within the range of *L. exigua* var. *laciniata* that include:
 - a) Areas of rock outcrop, gravel, flagstone of Silurian dolomite or dolomitic limestone, and/or shallow (1 to 5 cm (0.393 to 1.97 in)), calcareous soils;
 - b) Intact cyclic hydrologic regime involving saturation and/or inundation of the area in winter and early spring, then drying quickly in the summer;
 - c) Full or nearly full sunlight; and
 - d) An undisturbed seed bank.
- 2) Vegetated land around glades and gladelike areas that extends up and down slope and ends at natural (e.g., stream, topographic contours) or manmade breaks (e.g., roads).

Critical habitat unit	Sub unit	Land ownership by type	Acres	Hectares
1	-----	Louisville/Jefferson County Metro Government	18	7
2	2A	Private	102	41
2	2B	Private	870	352
2	2C	Private	42	17
3	3A	Private	25	10
3	3B	Private	7	3
3	3C	Private	10	4
4	4A	Private	91	37
4	4B	KSNPC; Private; Private with KSNPC easement	69	28
4	4C	Private	83	34
4	4D	Private	46	19
4	4E	Private	102	41
4	4F	Private	120	49
4	4G	Private	20	8
4	4H	Private	16	6
5	5A	Private	8	3
5	5B	Private	50	20
6	-----	Private	374	151
Total	-----	-----	2,053	830

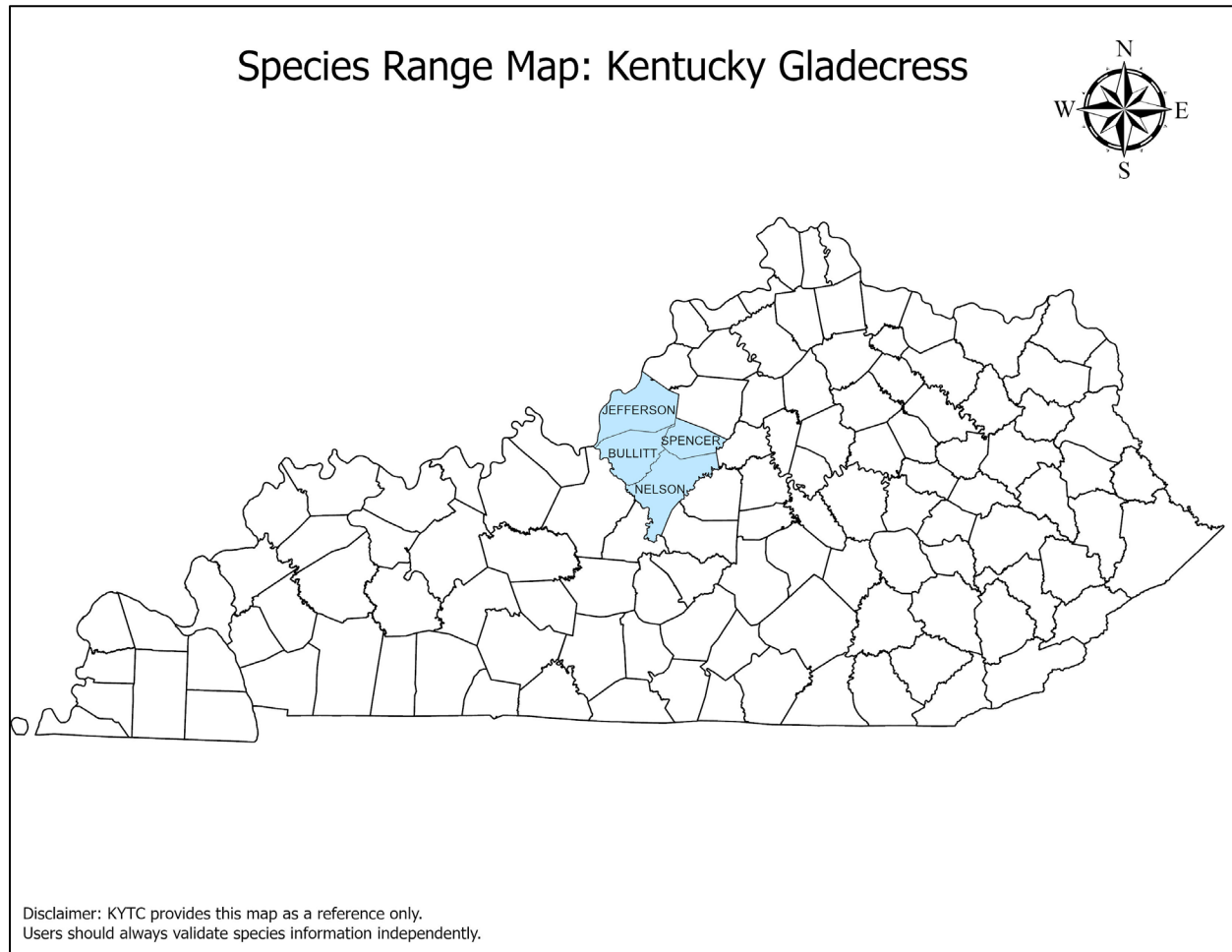
*Table data provided within Federal Register Vol. 79 No. 87; Tuesday, May 6, 2014; Rules and Regulations.

Range

Kentucky glade cress is currently listed for Bullitt, Jefferson, Nelson, and Spencer Counties.

All known populations and critical habitat units occur in Bullitt and Jefferson Counties only.

There are no current population records within Spencer or Nelson Counties.



Decision Key

- 1) Does the project area occur within ¼ mile of a critical habitat unit, in cedar glades, or have areas with thin, rocky soil underlain by limestone (refer to county soil survey map and attached habitat modeling map)?
 - a. Contact SME
 - b. No: Prepare NE finding

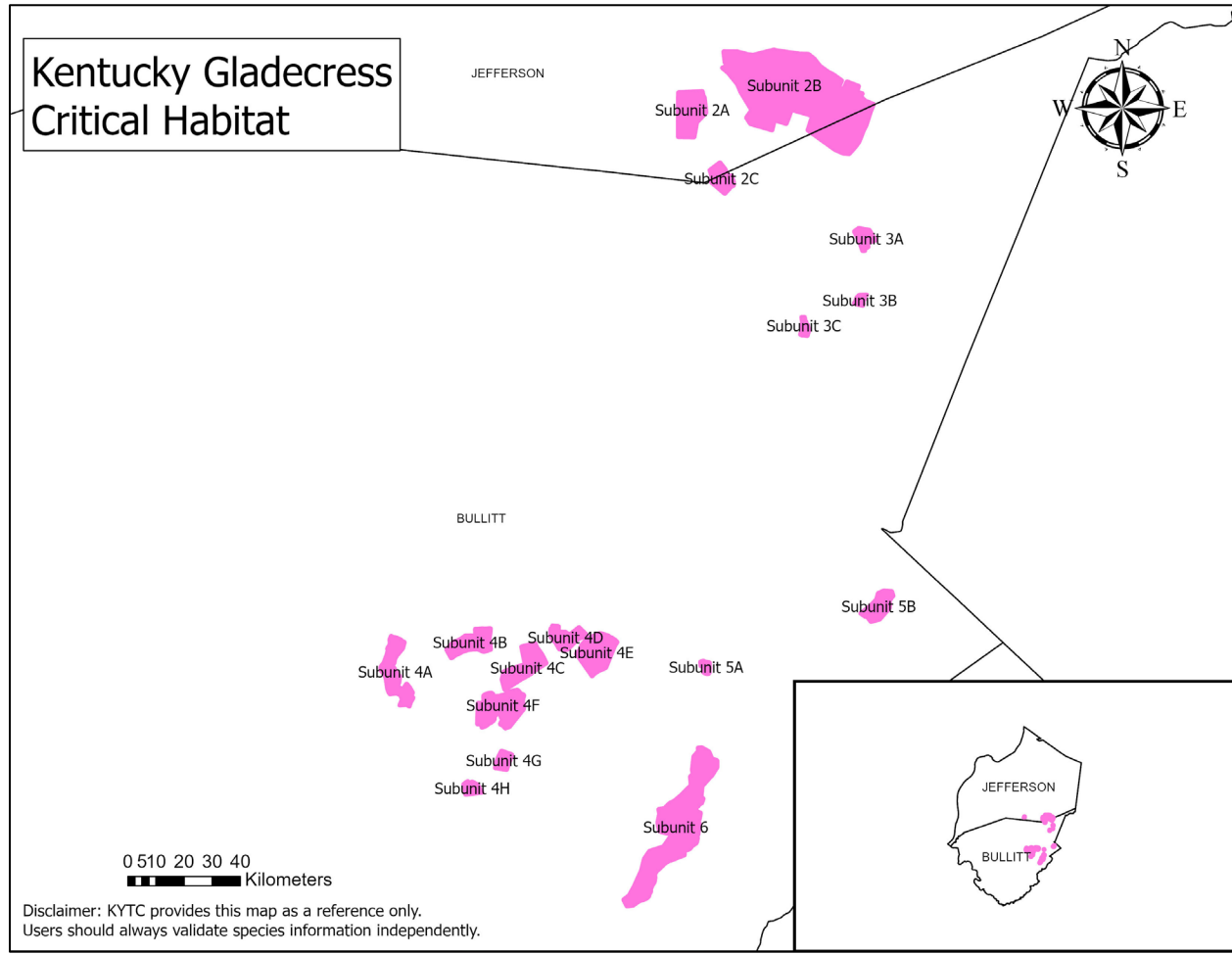


Figure 11 Overview of all CH units.

Unit 1. McNeely Lake – Jefferson County, KY.

Unit 1 consists of 18 acres (ac) (7 hectares (ha)) within McNeely Lake Park in Jefferson County, Kentucky. This critical habitat unit is under county government ownership. This critical habitat unit occurs at the northwestern edge of the species' range, where there is little remaining habitat and few occurrences, and therefore this unit is important to the distribution of the species. Habitat degradation (e.g., erosion, invasive species) is impacting the species' ability to persist within this unit; however, the landowner has received funding and is working with the Service and KSNPC to develop a management plan for the site and to implement habitat improvement practices. These planned activities are expected to improve population numbers and viability at this important site. This unit helps to maintain the geographical range of the species and provides opportunity for population growth. Within Unit 1, the features essential to the conservation of the species may require special management considerations or protection to address potential adverse effects associated with encroachment by nonnative plants or forage species, and forest encroachment due to fire suppression.

Unit 2. Subunits A, B, and C: Old Mans Run – Jefferson and Bullitt Counties, KY.

Unit 2 consists of three subunits totaling 1,014 ac (410 ha) in Bullitt and Jefferson Counties, Kentucky. It is located just south of the Jefferson/Bullitt County line and extends north of Old Mans Run. This critical habitat unit includes for element occurrences. Subunit 2B represents the best remaining populations and habitat for *L. exigua* var. *laciniata* in Jefferson County. Subunits 2A and 2C are important areas at the northern extent of the species' range. These three subunits represent the northeastern extent of the population's range and increase population redundancy within the species' range. The features essential to the conservation of the species in Unit 2 may require special management considerations or protection to address potential adverse effects associated with development on private land, incompatible agricultural or grazing practices, ORV or horseback riding, competition from lawn grasses, and forest encroachment.

Subunit 2A is 102 ac (41 ha) in size and is located west of US 150 and northwest of Floyds Fork. It is in private ownership. While all PCEs are present within this subunit, it contains few native plant associates for *L. exigua* var. *laciniata*, and the increased competition from lawn grasses may decrease the ability of *L. exigua* var. *laciniata* to persist. This subunit is important for maintaining the northern distribution of *L. exigua* var. *laciniata*.

Subunit 2B is 870 ac (352 ha) in size and is located east of US 150 and extends north and south of Old Mans Run. It is in private ownership. This is the largest of the subunits and contains the two highest ranked (1-B and 1-C) occurrences in Jefferson County. It represents the best remaining habitat in this portion of the range and may contain more than 20,000 individuals at 4 sites within this subunit. In this subunit, competition from lawn grasses impacts *L. exigua* var. *laciniata* and may decreased the plant's ability to persist.

Subunit 2C is 42 ac (17 ha) in size and is located west of US 150 and east of Floyds Fork, extending into both Bullitt and Jefferson Counties. It is in private ownership. This subunit is primarily pasture, and habitat for *L. exigua* var. *laciniata* is impacted by competition from lawn grasses. Habitat management within this subunit to improve habitat for *L. exigua* var. *laciniata* is important for maintaining the northern distribution of the species.

Unit 3. Subunits A, B, and C: Mount Washington – Bullitt County, KY.

Unit 3 consists of 42 ac (17 ha) and includes three subunits in Bullitt County, Kentucky, primarily within or adjacent to the city limits of Mount Washington. This critical habitat unit includes three element occurrences and provides an important link between the northern and southern portions of the species' range. Within Unit 3, the features essential to the conservation of the species may require special management considerations or protection to address potential adverse effects associated with development on private land, incompatible agricultural or grazing practices, ORV or horseback riding, competition from lawn grasses, and forest encroachment due to fire suppression.

Subunit 3A is 25 ac (10 ha) in size and is located northeast of Mount Washington. It is in private ownership. Habitat for *L. exigua* var. *laciniata* within this subunit is degraded and would improve with management. It represents important habitat on the eastern extent of the species' range. In this subunit, habitat conversion and ORV use impact *L. exigua* var. *laciniata* habitat and may decrease the species' ability to persist at this site.

Subunit 3B is 7 ac (3 ha) in size and located east of Hubbard Lane and south of Keeneland Drive. It is in private ownership. The glade habitat has been degraded by adjacent

land use and would benefit from improved management. The subunit represents an important link between other subunits.

Subunit 3C is 10 ac (4 ha) in size and is located east of US 150 and south of Highway 44E. It is in private ownership. The subunit represents an important and high quality cedar glade in an area of ongoing, intensive development. Land use surrounding the glade remnant appears stable and the glade contains several native plant species associated with *L. exigua* var. *laciniata*.

Unit 4. Subunits A, B, C, D, E, F, G, and H: Cedar Creek – Bullitt County, KY.

Unit 4 consists of 547 ac (221 ha) and includes eight subunits, all in Bullitt County, Kentucky. This unit is located south of the Salt River and northeast of Cedar Grove and seems to represent the core of the remaining high-quality habitat for *L. exigua* var. *laciniata*. It includes eight element occurrences. In addition to being a stronghold for the species, these subunits are generally within close proximity (less than 0.5 miles (0.8 km)) to each other and represent the best opportunity for genetic exchange between occurrences.

With Unit 4, the features essential to the conservation of the species may require special management considerations or protection to address potential adverse effects associated with development on private land, incompatible agricultural or grazing practices, ORV and horseback riding, competition from lawn grasses, and forest encroachment due to fire suppression.

Subunit 4A is 91 ac (37 ha) in size and is located south of Cedar Creek and west of Pine Creek Trail. This subunit is owned by The Nature Conservancy and encompasses most of the Pine Creek Barren Preserve. This excellent-quality glade represents the only remaining “A” rank occurrence for *L. exigua* var. *laciniata*.

Subunit 4B is 69 ac (28 ha) in size and is located along an unnamed tributary to Cedar Creek, and south of KY 1442. This good-quality glade includes the Apple Valley Glade State Nature Preserve, owned by KSNPC (approximately 30 percent of subunit) as well as private land, including some under permanent conservation easement (approximately 41 percent of subunit) to protect *L. exigua* var. *laciniata*. Approximately 29 percent of this subunit is under private ownership without any protections for *L. exigua* var. *laciniata*.

Subunit 4C is 83 ac (34 ha) in size and located north of Cedar Creek and south of Apple Valley State Nature Preserve. It is in private ownership. This subunit contains high-quality glades with a community of native plants present.

Subunit 4D is 46 ac (19 ha) in size and is located north of Cedar Creek and south of Victory Church. It is in private ownership. This subunit has been degraded and would benefit from improved management. Native plants associated with *L. exigua* var. *laciniata* occur within this subunit, but competition from lawn grasses, as well as forest encroachment due to fire suppression, impacts *L. exigua* var. *laciniata* and may decrease its ability to persist.

Subunit 4E is 102 ac (41 ha) in size and is located southeast of subunit 4D and across Cedar Creek. It is in private ownership. It contains a large number of *L. exigua* var. *laciniata* (several thousand), but the habitat has been degraded by adjacent land use and would benefit from improved management. Competition from lawn grasses, as well as forest encroachment due to fire suppression, affects *L. exigua* var. *laciniata* and may decrease the plant’s ability to persist.

Subunit 4F is 120 ac (49 ha) in size and is south of the confluence of Cedar Creek and Greens Branch. It is in private ownership. This is a degraded glade that still contains native plants associated with *L. exigua* var. *laciniata*. The subunit is disturbed by existing and surrounding land uses, as well as utility line maintenance and ORV use, which may decrease the species’ ability to persist.

Subunit 4G is 20 ac (8 ha) in size and is located along either side of KY 480 near White Run Road. It is in private ownership. This site contains a large number of plants; however, improved habitat conditions are needed for long-term viability of the *L. exigua* var. *laciniata* occurrence. Impacts to *L. exigua* var. *laciniata*, which may decrease its ability to persist at the site, include incompatible agricultural or grazing practices, ORV use, competition from lawn grasses, and forest encroachment due to fire suppression.

Subunit 4H is 16 ac (6 ha) in size and is located 0.95 miles southeast of the KY 480/KY 1604 intersection. It is in private ownership. Within this subunit, several patches of good habitat for *L. exigua* var. *laciniata* remain as well as a good diversity of native plant associates. However, competition from lawn grasses, as well as forest encroachment due to fire suppression, affects *L. exigua* var. *laciniata* and may decrease its ability to persist.

Unit 5. Subunits A and B: Cox Creek – Bullitt County, KY.

Unit 5 consists of 58 ac (23 ha) and includes two subunits, both in Bullitt County, Kentucky. It includes two element occurrences, representing the most easterly occurrences south of the Salt River. These subunits are important for maintaining the distribution and genetic diversity of the species. With Unit 5, the features essential the conservation of the species may require special management considerations or protection to address potential adverse effects associated with illegal waste dumps, development on private land, incompatible agricultural and grazing practices, ORV or horseback riding, competition from lawn grasses, and forest encroachment due to fire suppression.

Subunit 5A is 8 ac (3 ha) in size and is located east of Cox Creek and west of KY 1442. It is in private ownership. This site is threatened by ORV use and would benefit from improved habitat management.

Subunit 5B is 50 ac (20 ha) in size and is located west of Cox Creek near the Bullitt/Spencer County line. It is in private ownership. Incompatible agricultural practices and ORV use impacts *L. exigua* var. *laciniata* and may decrease its ability to persist. The native flora is mostly intact, and *L. exigua* var. *laciniata* would benefit from improved habitat management.

Unit 6. Rocky Run – Bullitt County, KY.

Unit 6 consists of 374 ac (151 ha) in Bullitt County, Kentucky. This critical habitat unit includes habitat that is under private ownership, including one 16-acre registered natural area. It includes one element occurrence. This unit appears to represent the largest intact glade habitat remaining within the range of the species. Within Unit 6, the features essential to the conservation of the species may require special management considerations or protection to address potential adverse effects associated with development on private land, incompatible agricultural or grazing practices, competition from lawn grasses, and forest encroachment due to fire suppression.

Price's Potato Bean (*Apios priceana*)

AKA: Ground nut; Price's ground nut; Traveler's Delight

Species Description

Price's potato bean (*Apios priceana*) was listed as **threatened** on January 5, 1990.

A member of the Pea family (*Fabaceae*), price's potato bean is a herbaceous, perennial vine legume that grows from a single, large tuber (5 to 7 inches in diameter). Although the dispersal mechanism of Price's potato bean have not been studied, common groundnut (*Apios americana*) is frequently found near streams and produces many small tubers that are dispersed by water. It is relatively unknown whether tubers and seeds of Price's potato bean may be dispersed by water as well.

Plants of Price's potato bean are dicots that do not flower during their first year, but may grow as much as 5 to 6 feet in their first season. Observations also indicate that the tuber can remain dormant during one growing season yet still show vigorous growth the following year. Price's potato bean is most easily recognized when blooming, usually from mid-July through mid-August. Pedestrian surveys should be conducted during this time in areas of favorable habitat.

The flowers have a distinctive thick appendage at the apex of its standard (the usually large, upper petal of a papilionaceous (pea-like) flower). The species does not flower every year and is difficult to identify without its flowers; therefore, populations may have gone unrecognized in their vegetative state.

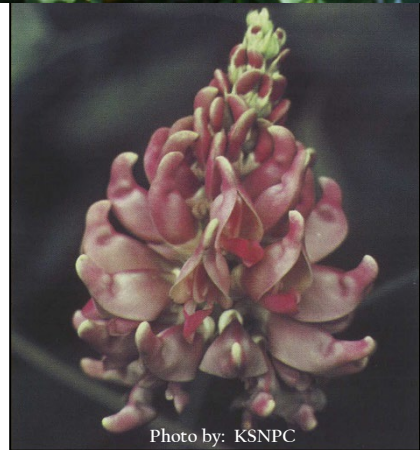


Figure 12 Photo Credit:
<http://www.fws.org>.

Habitat Description

The species is often found in low open, woods near streams or along the transition area from floodplain to hillside. It will grow in second growth timber as well as in older, more mature forest. Price's potato-bean thrives in open woods (often in tree gaps or along forest edges associated with power lines or roadside rights-of-way) and will not tolerate heavy shade. The species may also be found near the base of small limestone bluffs. This species grows in well-drained calcareous loams or alluvium over limestone on floodplains or on open, rocky, wooded slopes. The species can survive a broad range of pH from less than five to greater than eight.

There are a number of woody and herbaceous species that are commonly found associated with Price's potato bean including: cane (*Arundinaria gigantea*), hog peanut (*Amphicarpa bracteata*), tall bellflower (*Campanula americana*), poison ivy (*Toxicodendron radicans*),



Wooded rocky slopes near a stream. The colluvial material at the base of the slope is potential habitat.



At the base of wooded rock ledges is habitat for this species.



Powerline right-of-way habitat

redbud (*Cercis canadensis*), spicebush (*Lindera benzoin*), chestnut oak (*Quercus muhlenbergii*), basswood (*Tilia americana*), sugar maple (*Acer saccharum*), and slippery elm (*Ulmus americana*).

New corridor construction in wooded areas, widening that requires tree clearing, bridge replacements that require altering floodplain habitats or selective tree removal, disturbance of borders of power line corridors, and borrow or fill areas that are located in partially wooded or open wooded areas prior to use, are all activities that could impact Price's potato-bean. Opening up the forest canopy during the growing season, which exposes the plant to increased direct sunlight, has been shown to damage the plant. Canopy thinning during the dormant season does not have a similar damaging effect.

Critical Habitat

None



Stream terrace in open woods



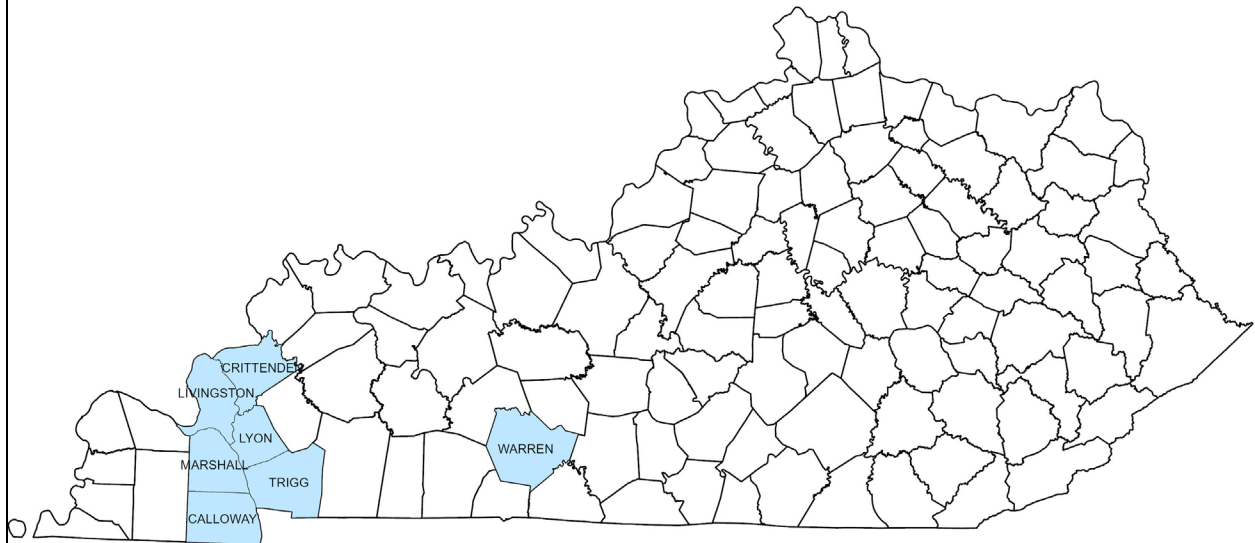
Figure 14 Photo Credit: Third Rock Consultants, Lexington, KY.

Habitat for this species can be found along powerline rights-of-ways along floodplains.

Range

Sadie Price discovered this species in Warren County, Kentucky in 1896, and B.L. Robinson published its description in 1898, but the Warren County population has not been seen since 1920. Since its discovery, 36 populations of Price's potato bean have been found in 22 counties of five states: Alabama, Illinois, Kentucky, Mississippi, and Tennessee. Twenty-five populations are still extant in 15 counties of four states; eleven are thought to be extirpated, including the only two populations in Illinois. Price's potato-bean is found or has been found within the Interior Plateau, and Southwestern Appalachian Plateau Level 3 ecoregions. Kentucky's extant populations are closely identified with the Western Highland Rim Level 4 ecoregion (within the larger Interior Plateau level 3 ecoregion) and are found in Livingston, Lyon and Trigg counties. Price's potato bean also occurs in Stewart and Montgomery counties in Tennessee, counties adjacent to Trigg and Christian County, Kentucky. Currently, this species is listed for 7 counties in Kentucky.

Species Range Map: Price's Potato Bean



Disclaimer: KYTC provides this map as a reference only.
Users should always validate species information independently.

Decision Key

Office Assessment:

- 1) Are there soils underlain by limestone in a floodplain area?
 - a. Yes: Continue to Step 2
 - b. No: Prepare NE finding

Field Assessment:

- 2) Are there wooded hillsides, wooded limestone bluffs, or wooded floodplains along the banks of streams or rivers in the project area?
 - a. Yes: Contact SME
 - b. No: Prepare NE finding

Short's Bladderpod (*Physaria globosa*)

AKA: *Lesquerella globosa*, Lesquereux's bladderpod, Globe's bladderpod

Species Description

Short's bladderpod (*Physaria globosa*) was listed as **endangered** species on August 1, 2014.

A member of the Mustard family (*Brassicaceae*), Short's bladderpod is a short-lived, perennial herb with slender, leafy stems that spread from the base and are 30-50 cm tall. This form can occasionally give vigorous plants a bushy appearance. The leaves are densely hairy which results in a grayish-green color. The leaves are simple, oblong-shaped and alternate on the stem.

Short's bladderpod is a dicot with small flowers bright yellow to yellow-orange in color. The flowers are cross-shaped with each having 4 spoon/spatula-shaped petals about 5mm long. Flowers typically bloom from approximately March to May. Pedestrian surveys should be conducted during this time in areas of favorable habitat. Fruit produced is a nearly globe-shaped capsule, about 3 mm in diameter, with 1 or 2 seeds in each cell.

Little is known about the ecological life cycle of the species. Populations may vary greatly from year to year, and flowering events may or may not occur every year.



Figure 15 Photo Credit: Lucille McCook, Center for Plant Conservation.

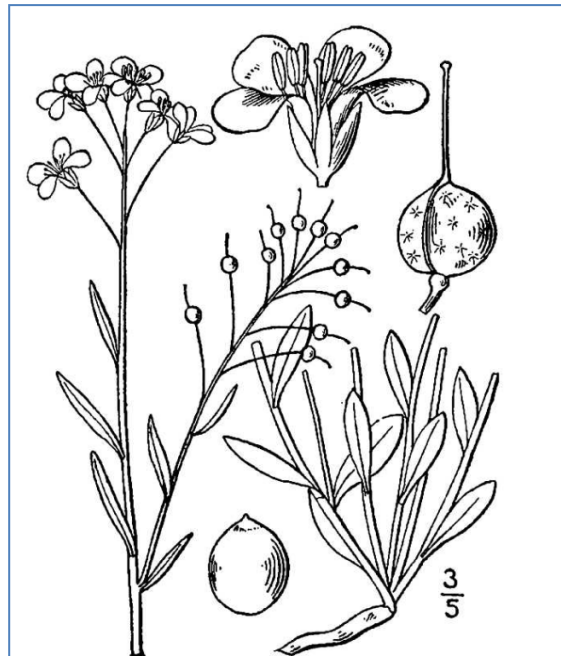


Figure 16 Photo Credit: USDA-NRCS PLANTS Database.

Habitat Description

Short's bladderpod is a native species that is distributed throughout Indiana, Kentucky, and Tennessee. Short's bladderpod inhabits steep, rocky, wooded slopes and talus areas (rocky debris at the base of a slope) at the base of cliffs, and often occurs in areas on or along major waterways (e.g. Cumberland River). It prefers dry limestone rocks and open rock ledges, or calcareous soils in cedar glades. Short's bladderpod can also be found in shale at the base of cliffs, and on artificial surfaces (e.g. roadcuts).

Common woody species associated with Short's bladderpod habitat include boxelder (*Acer negundo*), red maple (*Acer rubrum*), Ohio buckeye (*Aesculus glabra*), sugarberry (*Celtis occidentalis*), redbud (*Cercis canadensis*), white ash (*Fraxinus americana*), eastern red cedar (*Juniperus virginiana*), Japanese honeysuckle (*Lonicera japonica*), Virginia creeper (*Parthenocissus quinquefolia*), coralberry (*Symphoricarpos orbiculatus*), and American elm (*Ulmus americana*). Common herbaceous associates include garlic mustard (*Alliaria petiolata*), wild hyacinth (*Camassia scilloides*), spreading chervil (*Chaerophyllum procumbens*), dwarf larkspur (*Delphinium tricornis*), cleavers (*Galium aparine*), deadnettle (*Lamium* spp.), fernleaf phacelia (*Phacelia bipinnatifida*), Solomon's seal (*Polygonatum biflorum*), widows cross (*Sedum pulchellum*), firepink (*Silene virginica*), and common mullein (*Verbascum thapsus*).

Threats to Short's bladderpod habitat may include activities such as road construction, roadside mowing and maintenance, trash dumping, grazing, competition with invasive species, and possible excessive shade.

Critical Habitat

Yes – (See more detailed information after the decision key)

In 2014, the USFWS designated 20 units as critical habitat for this species. Only six of these units occur within Kentucky (units #14 – 19).

Primary constituent elements of critical habitat for this species include:

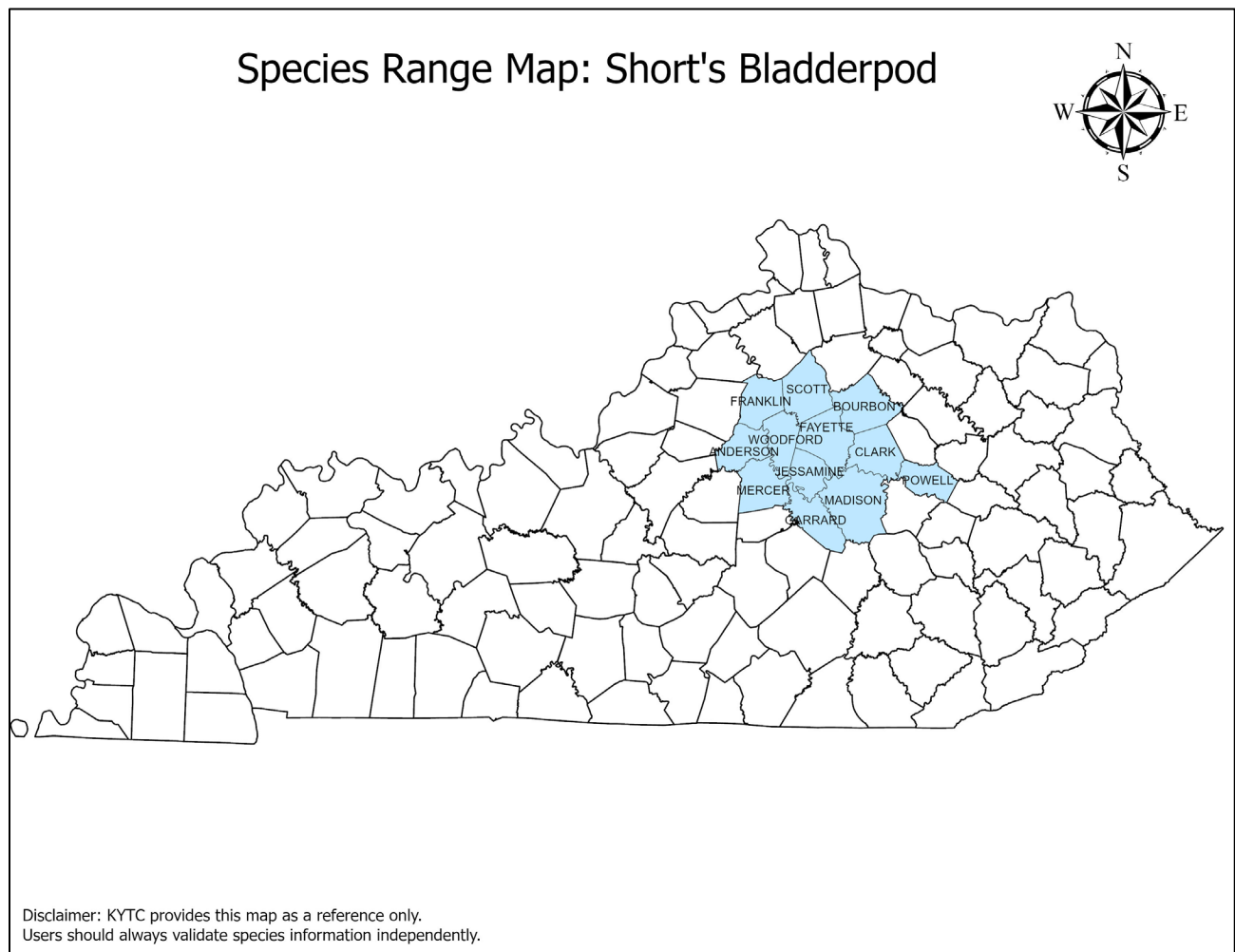
1. Bedrock formations and outcrops of calcareous limestone, sometimes with interbedded shale or siltstone, in close proximity to the main stem or tributaries of the Kentucky and Cumberland rivers. These outcrop sites or areas of suitable bedrock geology should be located on steeply sloped hillsides or bluffs, typically on south- to west-facing aspects.
2. Shallow or rocky, well-drained soils formed from the weathering of underlying calcareous bedrock formations, which are undisturbed or subjected to minimal disturbance, so as to retain habitat for ground-nesting pollinators and potential for maintenance of a soil seed bank.
3. Forest communities with low levels of canopy closure or openings in the canopy to provide adequate sunlight for individual and population growth. Invasive, nonnative plants must be absent or present in sufficiently low numbers to not inhibit growth or reproduction of Globe's bladderpod.

1. Kings and Queens Bluff (TN)	7.6 (18.9)	-----	*3.0(7.3)	7.6 (18.9)
2. Lock B Road (TN)	10.1 (25.0)	-----	*0.3 (0.8)	10.1 (25.0)
3. Jarrel Ridge Road (TN)	5.2 (12.8)	-----	*0.4 (1.1)	5.2 (12.8)
4. Cheatham Lake (TN)	19.1 (47.2)	3.4 (8.3)	4.9 (12.0)	27.3 (67.5)
5. Harpeth River (TN)	8.2 (20.3)	-----	17.3 (42.8)	25.5 (63.1)
6. Montgomery Bell Bridge (TN)	2.1 (5.3)	-----	9.0 (22.3)	11.2 (27.7)
7. Nashville & Western R.R. (TN)	20.8 (51.4)	8.1 (20.0)	1.5 (3.8)	30.5 (75.3)
8. River Trace (TN)	42.8 (105.7)	-----	*5.6 (13.8)	42.8 (105.7)
9. Old Hickory Lake (TN)	1.9 (4.8)	-----	2.9 (7.1)	4.8 (11.9)
10. Coleman-Winston Bridge (TN)	4.1 (10.1)	-----	3.3 (8.1)	7.4 (18.2)
11. Cordell Hull Reservoir (TN)	-----	-----	12.3 (34.2)	12.3 (34.2)
12. Funns Branch (TN)	-----	-----	20.8 (51.3)	20.8 (51.3)
13. Wartrace Creek (TN)	-----	-----	37.5 (92.6)	37.5 (92.6)
14. Camp Pleasant Branch (KY)	17.4 (42.9)	-----	-----	17.4 (42.9)
15. Kentucky River (KY)	83.7 (206.7)	9.4 (23.3)	-----	93.1 (230.0)
16. Owenton Road (KY)	1.3 (3.3)	1.5 (3.7)	-----	2.8 (7.0)
17. Little Benson Creek (KY)	9.4 (23.3)	-----	-----	9.4 (23.3)
18. Boone Creek (KY)	5.0 (12.4)	-----	-----	5.0 (12.4)
19. Delaney Ferry Road (KY)	0.6 (1.4)	-----	-----	0.6 (1.4)
20. Bonebank Road (IN)	-----	1.7 (4.3)	-----	1.7 (4.3)

*Indicates U.S. Army Corps of Engineers easements, which are not added to Size of Unit because these lands are included in ha (ac) figure given for the private lands on which easements are held.

Range

Short's bladderpod is a native species that is distributed throughout Indiana, Kentucky, and Tennessee. Currently, this species is listed for 12 counties in northeastern Kentucky. Shea (1993) and Cranfill et al. (1985) list populations of an uncertain status, historic populations, or incomplete listings in Jessamine, Fayette, Madison, Mercer, and Powell Counties within Kentucky. As of 2011, only 8 populations were extant in Kentucky.

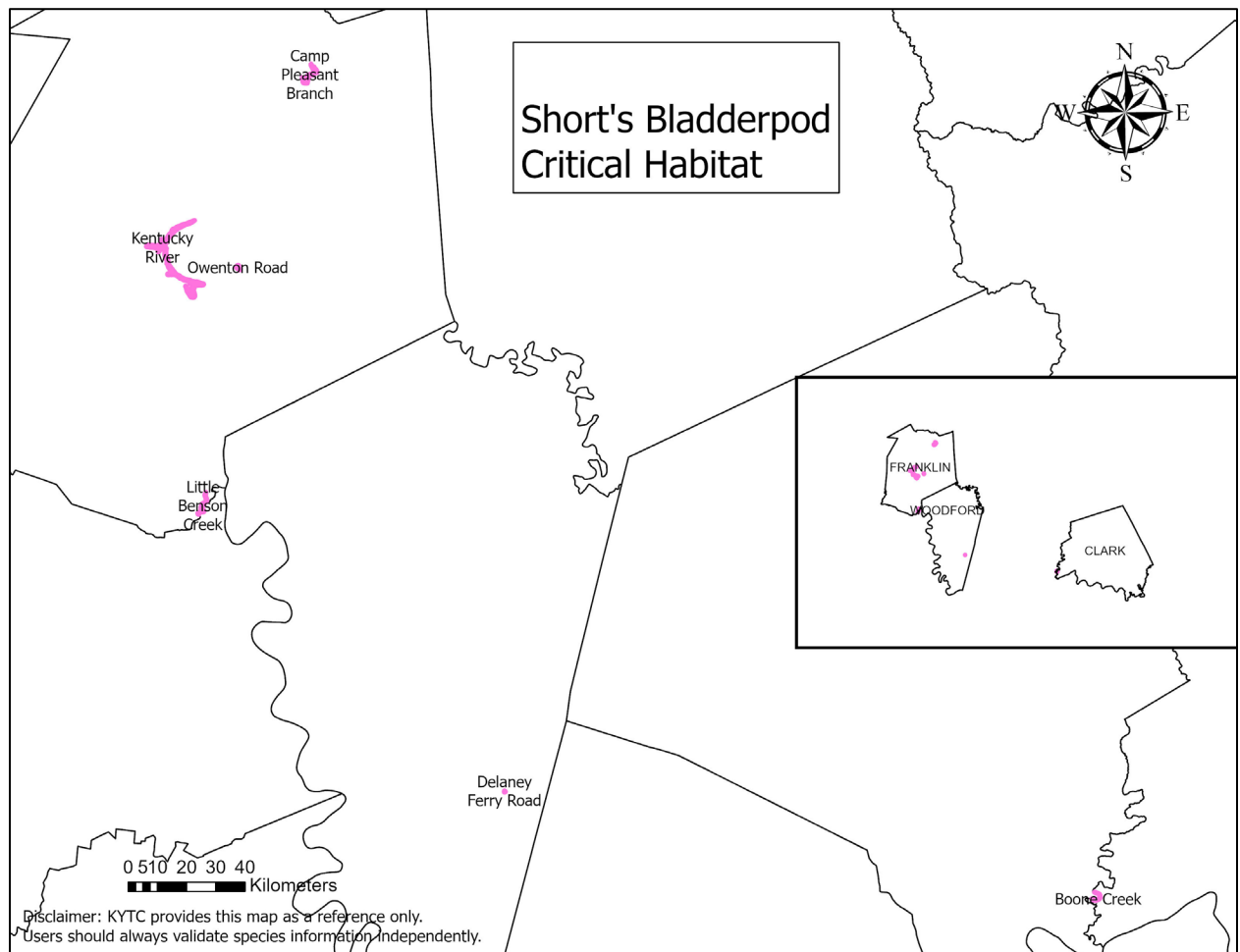


Decision Key

- 1) Does the project area contain calcareous limestone bedrock or outcrops, (sometimes with interbedded shale or siltstone) near the Kentucky River or its tributaries?
 - a. Yes: Continue to Step 2
 - b. No: Prepare NE finding

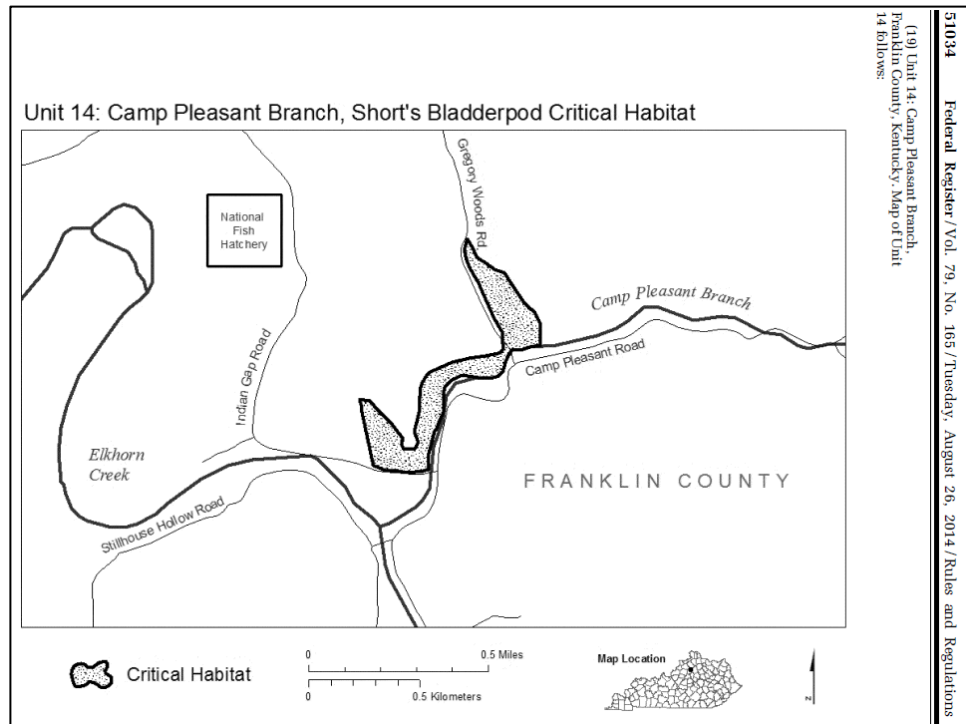
- 2) Does the project area contain shallow or rocky, well-drained soils? These soils should be undisturbed or subjected to minimal disturbances.
 - a. Yes: Continue to Step 3
 - b. No: Prepare NE finding

- 3) Does the project area contain open areas with limited shade??
 - a. Yes: Contact SME
 - b. No: Prepare NE finding



Unit 14. Camp Pleasant Branch – Franklin County, KY.

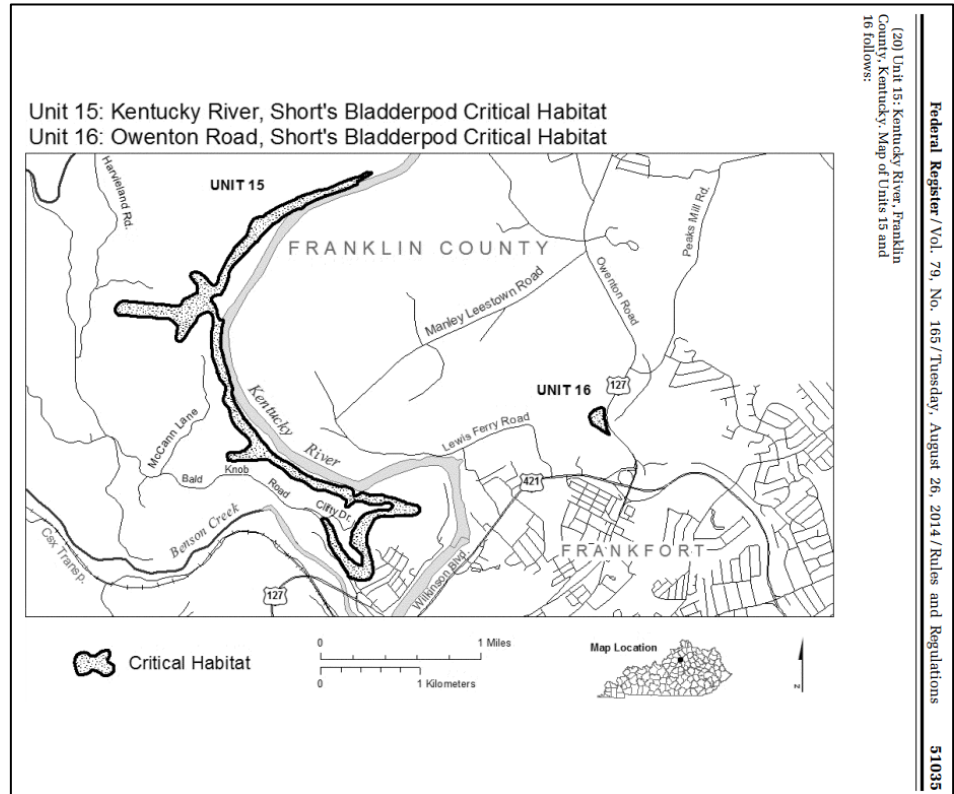
Unit 14 consists of 17.4 ha (42.9 ac) of privately owned lands in Franklin County, Kentucky. This unit is located approximately 8.3 km (5.8 mi) north of the city limits of Frankfort, on the hillsides near Camp Pleasant Branch, a tributary to Elkhorn Creek. Beginning approximately 0.29 km (0.81 mi) west of the intersection of Indian Gap Road and Camp Pleasant Road, the unit begins in a hollow north of Indian Gap Road and extends to the east and north along hillsides above the right descending bank of Camp Pleasant Branch for approximately 0.75 km (0.5 mi) to the intersection of Camp Pleasant Road and Gregory Woods Road. Here the unit crosses Gregory Woods Road and extends north for a distance of approximately 0.58 km (0.36 mi), encompassing the hillside to the east of the road.



Unit 15. Kentucky River – Franklin County, KY.

This unit consists of 93.1 ha (230.0 ac) of privately owned and State land in Franklin County, Kentucky. This unit begins within the northwestern city limit of Frankfort, on a hillside that parallels US-421 on its east side from approximately 0.21 km (0.13 mi) southeast of its junction with Clifty Drive to approximately 0.23 km (0.15 mi) northwest with its junction with US-127. Here the unit follows the topography of the hillside as it turns away from the road to the east, leaving the city

limits, and then arcs to the northeast, before abruptly turning back in a westerly direction. From this point, the hillside and this unit extend in a westerly direction for approximately 0.7 km (0.4 mi) and then parallel the Kentucky River in a downstream direction in an arc approximately 5.3 km (3.3 mi) in length on its left descending bank, encompassing hillsides in two hollows that extend from the river to the west. Approximately 90 percent of the land in this unit is privately owned, and the Commonwealth of Kentucky owns approximately 10 percent, which is part of a State nature preserve.

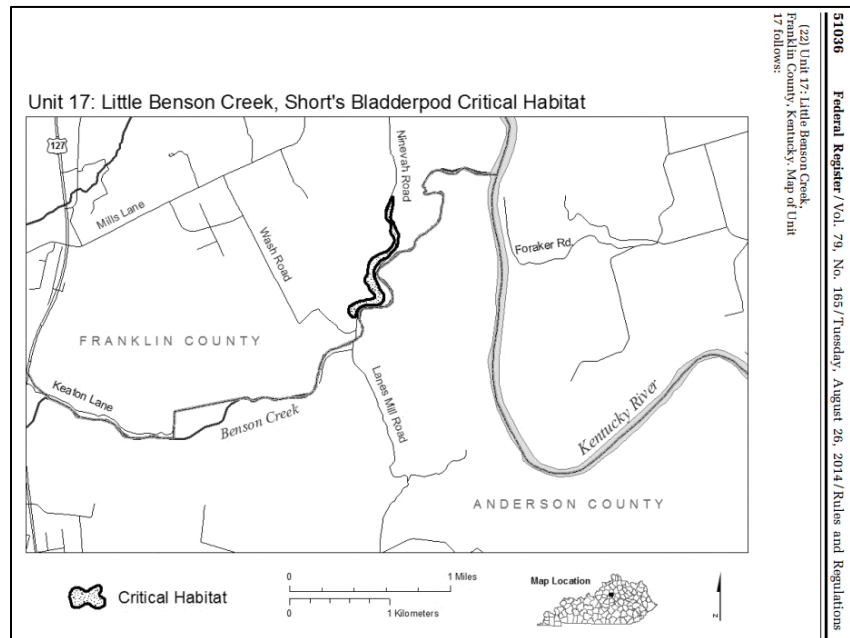


Unit 16. Owenton Road – Franklin County, KY.

Unit 16 consists of 2.8 ha (7.0 acres) of privately owned and City of Frankfort municipal park lands in Franklin County, Kentucky. The unit is located approximately 0.1 km (0.08 mi) north of the city limits of Frankfort on a hill that is adjacent to and west of US-127 (Owenton Road), approximately 0.6 km (0.4 mi) north of the intersection of US-127 and US-421. The land within this unit is approximately 46 percent privately owned, and 54 percent is owned by the city of Frankfort.

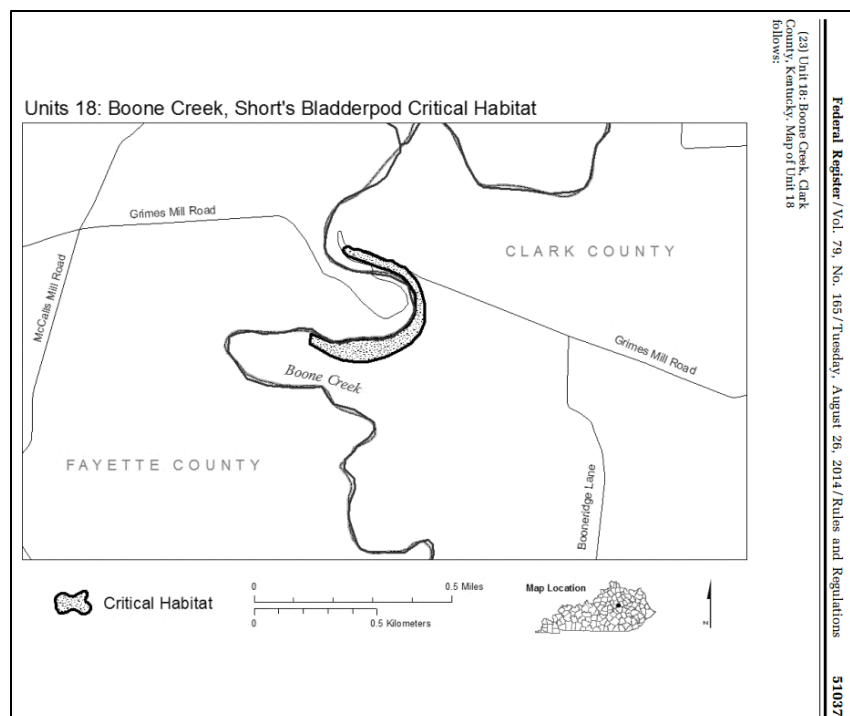
Unit 17. Little Benson Creek – Franklin County, KY.

Unit 17 consists of 9.4 ha (23.3 ac) of privately owned lands in Franklin County, Kentucky, located within the city limits of Frankfort. Beginning approximately 1.1 km (0.7 mi) south of the intersection of Mills Lane and Ninevah Road, the unit lies on a hillside on the east side of Ninevah Road and extends to the south for approximately 0.5 km (0.3 mi), where it crosses Ninevah Road and follows a hillside that parallels Ninevah Road for approximately 1.0 km (0.65 mi) on its west side.



Unit 18. Boone Creek – Clark County, KY.

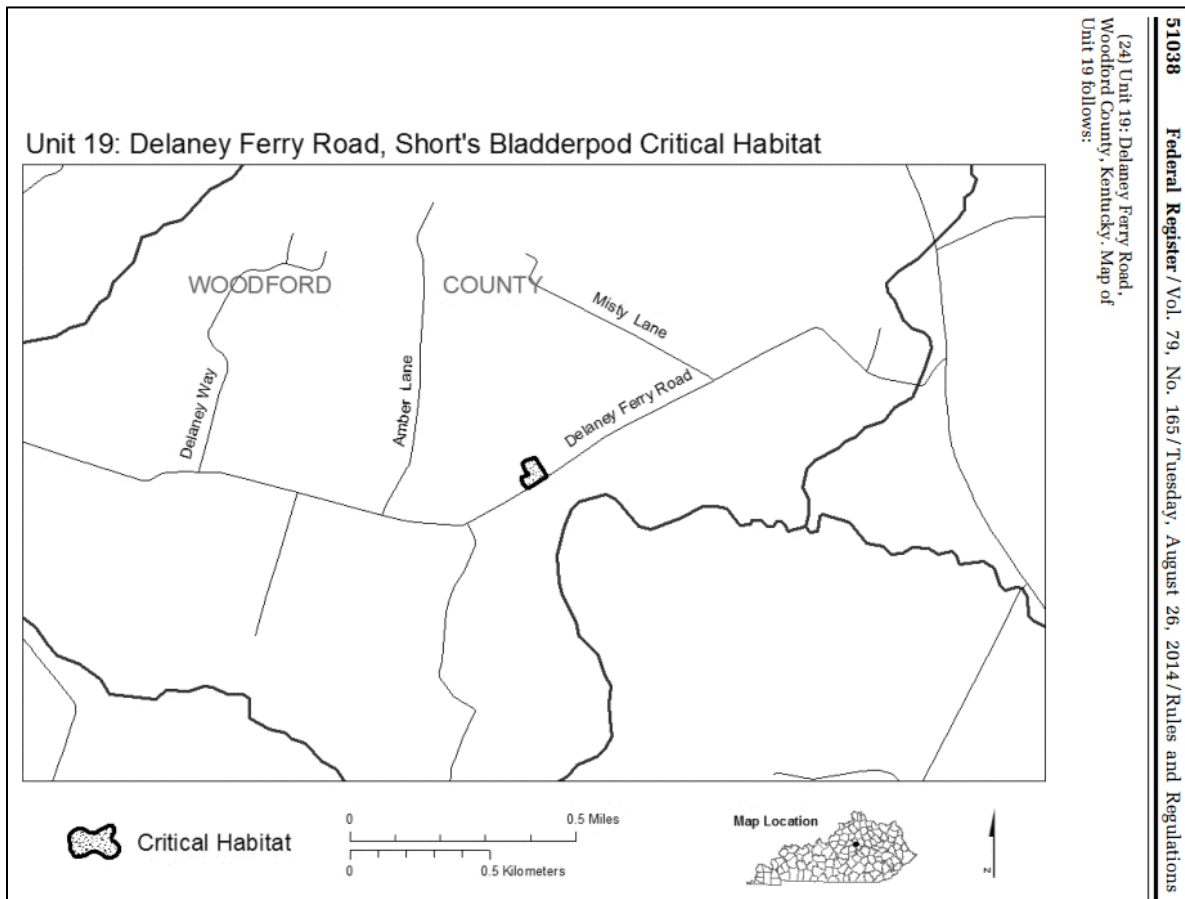
Unit 18 consists of 5.0 ha (12.4 ac) of privately owned lands in Clark County, Kentucky. This unit is located approximately 13.2 km (8.2 mi) southwest of the city limits of Winchester, and begins adjacent to Grimes Mill Road approximately 0.17 km north of the Fayette and Clark County line. From here, the unit extends on a hillside to the east for a distance of approximately 0.21 km (0.13 mi), where the unit and hillside then parallel a bend in Boone Creek on its left descending bank for a distance of approximately 0.68 km (0.42 mi).



Unit 19. Delaney Ferry Road – Woodford County, KY.

Unit 19 consists of 0.6 ha (1.4 ac) of privately owned lands in Woodford County, Kentucky. This unit is located approximately 7.8 km (4.8 mi) south of the city of Versailles. Beginning approximately 2.1 km (1.3 mi) east of the intersection of Troy Pike and Delaney Ferry Road, this unit extends approximately 0.08 km (0.05 mi) northeast along Delaney Ferry Road, where the unit boundary turns to the northwest for approximately 0.8 km (0.05 mi). From this northeast corner of the unit, the boundary extends to the southwest approximately 0.05 km (0.03 mi), where it turns to the southeast, paralleling a driveway for 0.05 km (0.03 mi) before turning to the southwest for approximately 0.03 km (0.02 mi). From this point the unit boundary turns to the southeast for approximately 0.05 km (0.03 mi), returning to the starting point.

The features essential to the conservation of the species in this unit may require special management considerations or protection to address threats of shading or competition due to encroachment of native and invasive, nonnative plants. The current landowner manages encroaching vegetation to prevent shading and competition where Short's bladderpod occurs within the unit.



Short's Goldenrod (*Solidago shortii*)

Species Description

Short's goldenrod (*Solidago shortii*) was listed as **endangered** on September 5, 1985.

A member of the Aster family (*Asteraceae*), Short's goldenrod is a terrestrial herb less than 1 meter (39 inches) tall. The leaves are alternate, narrow, 50-10 cm (2-4 inches) long, and 0.6-1.5 cm (0.24-0.60 inches) wide.

Short's goldenrod has small, yellow flowers. Flowers typically bloom from approximately mid-August to early November. Pedestrian surveys should be conducted during this time in areas of favorable habitat. Its fruit is light brown and matures several weeks after the flowers wither.



Figure 17 Photo Credit: Third Rock Consultants, Lexington, KY.

Several studies on this species ability to compete with other plants indicate that its major competitive advantage is its root structure that allows it to survive in very dry, thin soils, the roots actually penetrate cracks in the underlying limestone

Habitat Description

Short's goldenrod has historically been associated with buffalo and buffalo traces. It was suggested by Lucy Braun (1941) that bison could have been its primary dispersal vector. The Blue River, Falls of the Ohio, and Blue Licks populations all occur along or near the same historic east-west buffalo trace. Major buffalo traces ran from Blue Licks to the Falls of the Ohio and another, north to the Ohio River where Maysville, Kentucky is now located (Sames 1985). It is plausible that Short's goldenrod could occur anywhere along these routes.

All occurrences of this species are located on small remnant patches of glade/forest complex and none cover more than an acre. These small and highly localized populations are vulnerable to catastrophic impacts such as fire or disease. Buchele *et al.* (1989) counted over 73,000 stems in the Blue Licks area but noted that since the species reproduces vegetatively, this large number of stems may represent relatively few individual genotypes.

The most likely impacts associated with transportation projects are land clearing and subsequent habitat destruction resulting in loss of cedar-glade habitats (grassy openings where the bedrock, most often limestone, is exposed or covered in patches by only a thin layer of soil). New corridor construction, widening that requires clearing, bridge replacements that require clearing or tree removal, and borrow or fill areas that are located in forest openings, open glades, or pastures prior to use, are all activities that could impact Short's goldenrod. Threats to Short's goldenrod may also include exotic plants, trampling and fire.



Figure 18 Photo Credit: Jim McCormac, <http://jimmccormac.blogspot.com>.

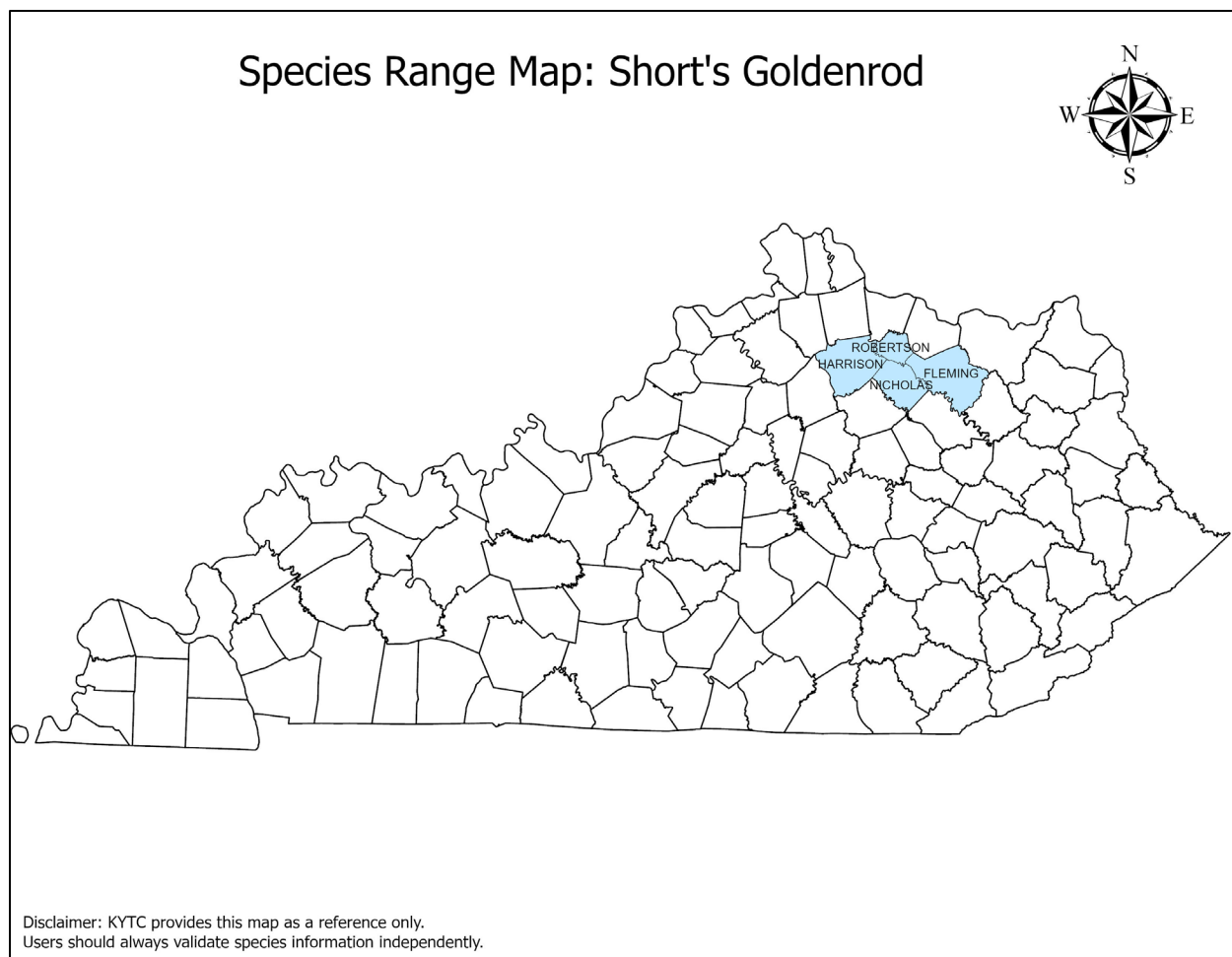
Cedar glade habitat. Notice thin soils with exposed rock, lack of overstory trees.

Critical Habitat

None

Range

Short's goldenrod is currently known only from north-central Kentucky and the lower Blue River in southern Indiana. The Kentucky occurrences are all clustered in a small area near the juncture of Fleming, Nicholas, and Robertson counties, centered around Blue Licks Battlefield State Park. A historical record for Short's goldenrod exists from Rock Island adjacent to the Falls of the Ohio in Jefferson County. Two occurrences are associated with the right-of-way fencelines of US 68 and KY 165. This site was later inundated in the early 1900s by dam construction. Currently, this species is listed for four counties in Kentucky.



Decision Key

Office Assessment:

- 1) Is the project area located on Grier, Tanglewood, Kope, or Clays Ferry members of the Lexington Limestone Formation?
 - a. Yes: Continue to Step 2
 - b. No: Prepare NE finding
- 2) Does the project involve right-of-way near US 68 or KY 165?
 - a. Yes: Contact SME
 - b. No: Continue to Step 3

Field Assessment:

- 3) Will the project impact cedar glades, other glade-like habitat, over-grazed rocky pastures, or existing road-cuts?
 - a. Yes: Contact SME
 - b. No: Prepare NE finding

Virginia Spiraea (*Spiraea virginiana*)

Species Description

Virginia spiraea (*Spiraea virginiana*) was listed as **threatened** on June 15, 1990.

A member of the Rose family (*Rosaceae*), Virginia spiraea is a shrub that reaches 2-8 feet tall. It is clonal and considered to be a prolific sprouter (evident by its dense clumps that spread into rock crevices and around boulders).



Figure 19 Photograph by: Nick Drozda KSNPC.

The leaves are alternate and vary in characteristics of size, shape and degree of serration. The flowers are cream-colored and form in branched, flat-topped inflorescences with a width of 4-8 inches. Virginia spiraea is best recognized in the field in June and July when it flowers, but can be identified by its leaves from May through late summer.

Because there are so few isolated populations, it is thought that it currently only reproduces vegetatively. This vegetative reproduction is by underground stem extension or by portions of the plant breaking off in a flood and being re-deposited and rooting in another location downstream. As a result, the plants of an isolated population are actually clones of a single genotype. Despite profuse flowering, most populations do not produce viable seed (thought to be caused by a lack of cross-pollination). The restriction to a single method of reproduction makes these isolated populations much more vulnerable to extirpation.

Competition appears to be the most important variable related to the survival of this species. Shading by trees, vines, or fast-growing herbaceous vegetation is tolerated for a time, but will eventually eliminate Virginia spiraea. Flood scour is necessary to topple the larger, heavier trees

and wash out many herbs and vines, without being so extreme to wash out the spiraea's fine fibrous root mass or heavy lateral rhizomes. Even though a great deal of aboveground plant material may be lost during scour episodes, the below-ground portions of Virginia spiraea are usually capable of regenerating the clone (Harper 1977). Senescence, observed in some older clones, may decrease the risk of a plant being washed out during flood events by decreasing the above-ground vegetative mass.

Habitat Description

Virginia spiraea is found along the banks of fourth order or larger streams, on point bars, natural levees, braided features of lower stream reaches, and along rocky, flood-scoured banks. The banks, terraces, and gravel bars where the majority of the populations are found, are associated with the mouths of tributaries or on the outside of bends. The bedrock surrounding Virginia spiraea can be either sandstone or limestone and soils are acidic and moist. This species is associated with sites that are rocky, have thin soils, and are not generally conducive to the growth of other plants.

Nearly all of the Kentucky occurrences are found on high gradient streams with good water quality. Stream gradient is important for the flood regime that establishes and maintains the open habitat that supports this species. The gradient and storm flow, which are conducive to flood scouring, maintain the necessary canopy openings along the shoreline. The floods must have enough volume and enough turbulence to remove tree species that would eventually shade this shrub species. It grows best in full sun, but can tolerate partial shade. Streams with a mature, stable closed canopy over the watercourse would not have sufficient light to support this species.

The most likely impacts associated with transportation projects are loss of habitat due to the placement of bridge piers along stream banks and on islands. New bridge piers, in-stream or near the banks, can also alter the normal flow pattern and current velocity, causing increased erosion or deposition on existing downstream bar habitat. The removal or placement of boulders either in stream or on banks could also alter or destroy existing habitat.

(See Species Description for further information on Competition)

Critical Habitat

None

Range

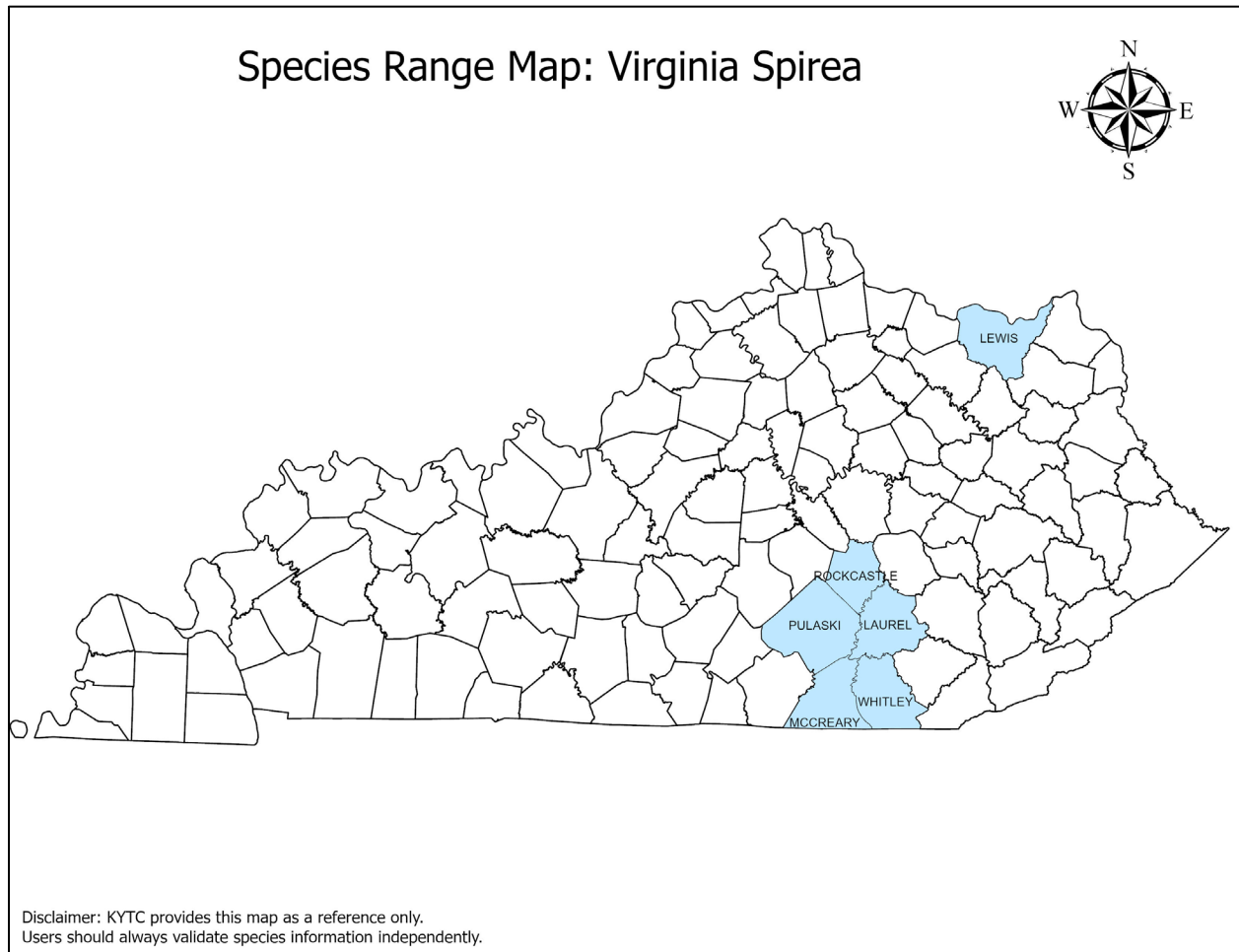
There are 24 known populations in seven states – West Virginia, Virginia, Tennessee, North Carolina, Kentucky, Ohio and Georgia, down from 39 populations in eight states. Thirteen of the 24 populations contain less than 10 plant clumps; eight sites have 10 to 50 clumps, and only three sites have more than 50 clumps (Department of Interior 1990). West Virginia has the largest population with 5,700 plants (Rawinski 1988).

In Kentucky, the range of *Virginia spiraea* is disjunct since the southern distribution includes drainages in five counties on the Cumberland Plateau while the northern part is exclusively from Kinniconick Creek, a Lewis County stream that drains directly into the Ohio River. There are 20 known occurrences cited in the recovery plan on three Kentucky streams (USFWS 1992). J.N. Campbell, in 1987, located this species on the Rockcastle River in Pulaski County, and additional plants were located along Sinking Creek in Laurel County, a tributary of the Rockcastle River. There are eight sites on Kinniconick Creek in Lewis County that were discovered in 1992. M. Shea located additional populations on both the Rockcastle River and Sinking Creek in 1992. There are now three known sites located on the Rockcastle (Pulaski County) and nine known sites located along Sinking Creek (Laurel County). Additional occurrences of this species, discovered since the recovery plan was written, are from Marsh Creek in McCreary County, the Laurel River in Whitley County, and the Rockcastle River in Rockcastle County.

A population is known from the Russell Fork on the Virginia side of Breaks Interstate Park, but no plants have been found downstream in Pike County, Kentucky to date.

There are two literature citations for occurrences of *Virginia spiraea* from Edmonson and Barren Counties in 1876. However, these citations are not backed up with voucher specimens and there are no populations currently known in the area.

Currently, this species is listed for six counties in Kentucky.



Decision Key

Office Assessment:

- 1) Are there blueline streams in the project area?
 - a. Yes: Continue to Step 2
 - b. No: Prepare NE finding

Field Assessment:

- 2) Are the blueline streams in the project area wide enough so that most of the stream is unshaded and/or have banks or gravel bars that are flood scoured and unshaded?
 - a. Yes: Contact SME
 - b. No: Prepare NE finding

White Fringeless Orchid (*Platanthera integrilabia*)

AKA: Monkey-face orchid

Species Description

White fringeless orchid (*Platanthera integrilabia*) was listed as **threatened** on October 13, 2016.

A member of the Orchid family (*Orchidaceae*), white fringeless orchid is a terrestrial, perennial herb 50-80 cm tall with tuberous roots. The leaves are simple, lanceolate- or elliptical-shaped, alternate, and restricted to the base of the stem.



Figure 20 Photo Credit: http://www.fs.fed.us/wildflowers/plant-of-the-week/Platanthera_integrilabia.



Figure 21 Photo Credit: Thomas G. Barnes, USDA-NRCS PLANTS Database.

Orchids are known for their diversity and specialization. White fringeless orchid is a monocot with showy, white flowers. The flowers have oblong, spoon/spatula-shaped petals. Flowers are nocturnally sweet-scented and typically bloom from approximately late June to early September (Flora of North America Website; Ladybird Johnson Wildflower Center Website; United States Forest Service Website). Pedestrian surveys should be conducted during this time in areas of favorable habitat.

The ovules of orchids do not develop until fertilization. Mature airborne seed are very small and numerous. These seeds lack endosperm and so for germination to occur, the seed requires nutrients which are supplied by a

mycorrhizal relationship with a specific fungus. The spongy layer around the roots (velamen) commonly harbors mycorrhizal fungi (e.g. Sphagnum moss).

Habitat Description

White fringeless orchid is a native species that is distributed throughout Alabama, Georgia, Kentucky, Mississippi, South Carolina, and Tennessee. Currently, there are approximately 60 extant sites supporting this species.

White fringeless orchid habitat occurs in areas of black, mucky, acidic, organic soil that are wet and remain wet most of the year, all years. Several white fringeless orchid populations have been located in or adjacent to powerline right-of-way areas. Most of the known sites for this species occur in or near areas that are managed for timber production, which often provides the partially shaded habitat areas which white fringeless orchid requires. Maintenance of a streamside management zone (SMZ) may be beneficial in attempts to retain white fringeless orchid habitat. One of the largest remaining populations of white fringeless orchid occurs within the wet meadow wetland at the source of the stream at Marsh Branch, Daniel Boone National Forest, Jackson County, Kentucky.

Common species associations include *Sphagnum* species, *Osmunda cinnamomea*, *Woodwardia areolata*, and *Thelypteris novaboracensis* in acidic muck or sand. Species associations also include red maple-gum swamps and peaty seeps and stream banks with *Parnassia asarifolia* and *Oxypolis rigidior*.

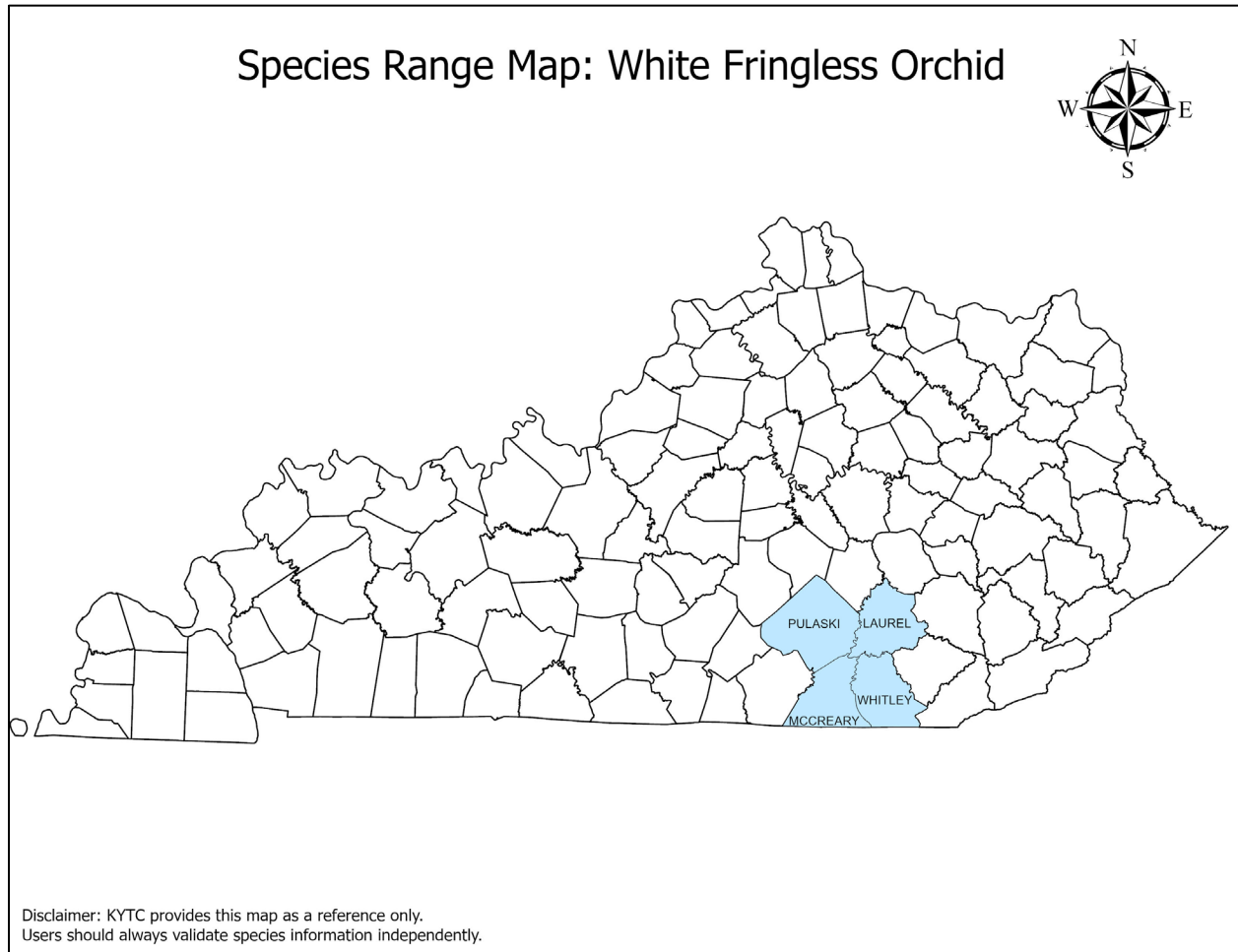
Because of the species' dependence on moderate to high light conditions, active management may be necessary to avoid the development of closed canopy conditions and its associated reduction of available light. Threats to white fringeless orchid habitat may include activities such as road, residential, and commercial construction, herbicide application, commercial collection, herbivory (primarily deer), all-terrain vehicle use, and invasive, nonnative species competition. Additionally, it is important that the soil and site hydrology of the bogs that support this species is not drastically altered, thus preserving necessary habitat conditions.

Critical Habitat

None

Range

White fringeless orchid is a native species that is distributed throughout Alabama, Georgia, Kentucky, Louisiana, Mississippi, South Carolina, Tennessee, and Texas. It is presumed extirpated from North Carolina and Virginia. Currently, this species is listed for four counties in southeastern Kentucky.



Decision Key

- 1) Does the project area contain wet, boggy areas at the heads of streams or on seepage slopes?
 - a. Yes: Continue to Step 2
 - b. No: Prepare NE finding
- 2) Does the area contain partial shade and limited competition by other plant species?
 - a. Yes: Continue to Step 3
 - b. No: Prepare NE finding
- 3) Does the project involve alteration of the soil or hydrology of the project area?
 - a. Yes: Contact SME
 - b. No: Prepare NE finding

Monarch Butterfly (*Danaus plexippus*)

Species Description

The monarch butterfly was listed as *proposed endangered* on December 12th, 2024.

The monarch (*Danaus plexippus* (Linnaeus, 1758)) is a species of butterfly in the order Lepidoptera (family Nymphalidae). Adult monarch



Figure 1 Taken from SSA.

butterflies are large and conspicuous, with bright orange wings surrounded by a black border and covered with black veins. The black border has a double row of white spots, present on the upper side and lower side of forewings and hindwings (Bouseman and Sternburg 2001, p. 222). Adult monarchs are sexually dimorphic, with males having narrower wing venation and scent patches (CEC 2008, p. 11; Figure 2.0). The bright coloring of a monarch is aposematic, as it serves as a warning to predators that eating them can be toxic.

Habitat Description

Whether it's a field, roadside area, open area, wet area or urban garden, milkweed and flowering plants are needed for monarch habitat. Adult monarchs feed on the nectar of many flowers during breeding and migration, but they lay eggs on milkweed plants as that is the only food the caterpillars can eat.

For overwintering monarchs, habitat with a specific microclimate is needed for protection from the elements, as well as moderate temperatures to avoid freezing. These conditions vary between populations.

For the eastern North American population, most monarchs overwinter in oyamel fir tree roosts located in mountainous regions of central Mexico, at an elevation of about 8,000 to nearly 12,000 feet (2,400 to 3,600 meters) - over two miles up!

Monarchs living west of the Rocky Mountains in North America primarily overwinter in California at sites along the Pacific Coast, roosting in eucalyptus, Monterey pines and Monterey cypress trees.

Critical Habitat

None in Kentucky.

Range

Monarchs are native to North and South America but have since spread to many other locations where milkweed and suitable temperatures exist, including Australia, New Zealand and portions of the Iberian Peninsula. In Kentucky, the monarch butterfly is considered to be present statewide.

Decision Key

- 1) Is the project impacting field, roadside area, open fields, wet area, or urban gardens that may provide access to milkweed and flowering plants that could be used by monarch butterflies?
 - a. Yes: Contact your SME.
 - b. No: Prepare NE finding.

Eastern Hellbender (*Cryptobranchus alleganiensis* *alleganiensis*)

Species Description

The eastern hellbender was listed as *proposed endangered* on December 13th, 2024.

The eastern hellbender is a large, entirely aquatic salamander that commonly exceeds 50 centimeters (cm) (20 inches (in)) in

length (Green and Pauley 1987, p. 45). Large adults may grow up to 74 cm (29 in) (Fitch 1947, p. 210; Petranka 1998, p. 140). Eastern Hellbenders have a large, flat head; small, lidless eyes; a wide neck; heavily wrinkled body; and a keeled tail (Green and Pauley 1987, pp. 45–46). Their short limbs have four toes on the front feet and five toes on the hind feet (Green and Pauley 1987, p. 46). A fold of skin extends along the side of the body between the fore and hind limbs (Green and Pauley 1987, p. 45; Petranka 1998, p. 140). Coloration is variable but is generally dark green, olive, or gray. Irregular, dark spots, brownish or black in color, are often present on the dorsal surface (Cope 1889, p. 41; Bishop 1941, pp. 41, 49; Green and Pauley 1987, p. 46; Petranka 1998, p. 140).



Figure 1 Taken from SSA.

Habitat Description

Eastern hellbenders are commonly found in perennial streams described as fast-flowing, cool, and highly oxygenated (Green 1934, p. 28; Bishop 1941, pp. 50–51; Green and Pauley 1987, p. 46). Some notable exceptions to fast flow include an Ohio stream with a yearly low flow of 0.04 cubic meters per second (m³ /s) (1.31 cubic feet per second (ft³ /s)) (Pfingsten 1988, p. 12), and

a Kentucky stream with little to no surface flow in some portions during low-flow periods (Lipps 2009b, p. 9). Exceptions to cool water include a recorded daytime stream temperature of 33° Celsius (C) (91° Fahrenheit (F)) in an Ohio stream (Pfingsten 1988, pp. 9–10), although some streams in North Carolina may not exceed 20° C during the summer (Nickerson et al. 2003, p. 622). In addition, recent research suggests that water conductivity may be a limiting factor, and that low conductivity is an important habitat requirement (Bodinof Jachowski and Hopkins 2018, pp. 220–221). Eastern hellbenders occupy streams of orders 2 to 8, and thus, stream order may represent a range of hellbender adaptive diversity. Typically found in rivers and large-medium sized perennial cool streams with sand, gravel, or rock substrates. Uses submerged boulders and/or rock ledges for retreats and nesting. Needs streams with good to excellent water quality, cool water temperatures, low silt/sediment loads, and swift-moderate current.

Critical Habitat

None

Range

Historically, the Eastern Hellbender was widespread across 15 states from northeastern Mississippi, northern Alabama, and northern Georgia northeast to southern New York, with disjunct populations occurring in east-central Missouri (Figure 3.1). Early population studies (e.g., from the 1970's) estimate densities ranging from 1.0 to 6.3 hellbenders per 100 m² (328 ft²) (Hillis and Bellis 1971, pp. 121, 223; Peterson 1985, p. 46), although these numbers were likely less than what was present prior to European settlement (Foster 2018, pp. 37–38). Many populations were skewed towards larger, mature individuals (Taber et al. 1975, p. 636; Peterson 1985, p. 47; Wheeler et al. 2003, p. 155). Larvae and smaller individuals (e.g., total length < 20 cm (7.8 in)) were not captured frequently, presumably due to their low detectability. However, these smaller size classes did comprise a portion of the samples in many studies (Taber et al. 1975, p. 636; Peterson 1985, p. 47; Pfingsten 1988, p. 9; Wheeler et al. 2003, p. 155) and outnumbered adults in one Appalachian stream (Hecht-Kardasz et al. 2012, p. 232).

Since 2000, the Eastern Hellbender has been documented from the four ACUs across 15 states (Figure 4.1). The number of populations varies among ACUs, with 1% of the extant populations occurring in the MACU, 41% in OACU, 48% in TACU, and 10% in KACU.

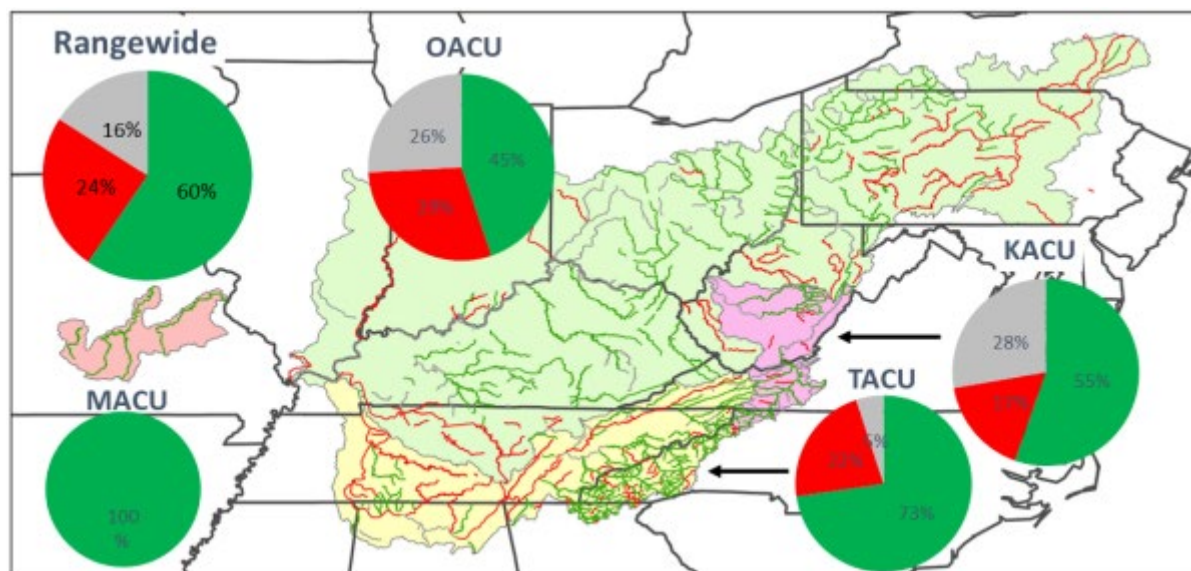


Figure 2 Taken from SSA. Current distribution and status of historical (n=626) Eastern Hellbender populations rangewide and per adaptive capacity unit (ACU). Green = extant, Gray = Unknown, Red = functionally or presumed extirpated.

Range Map

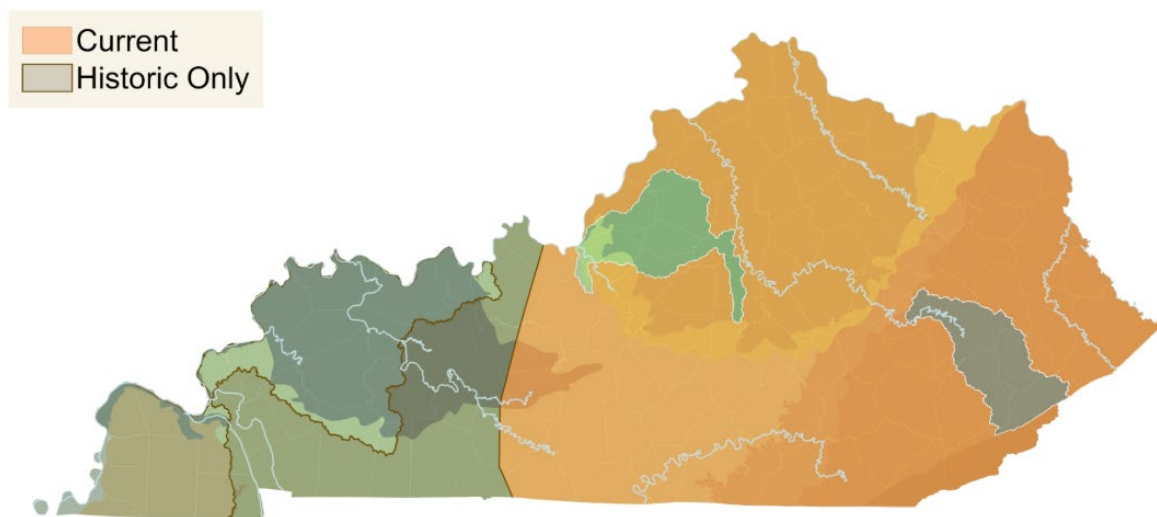
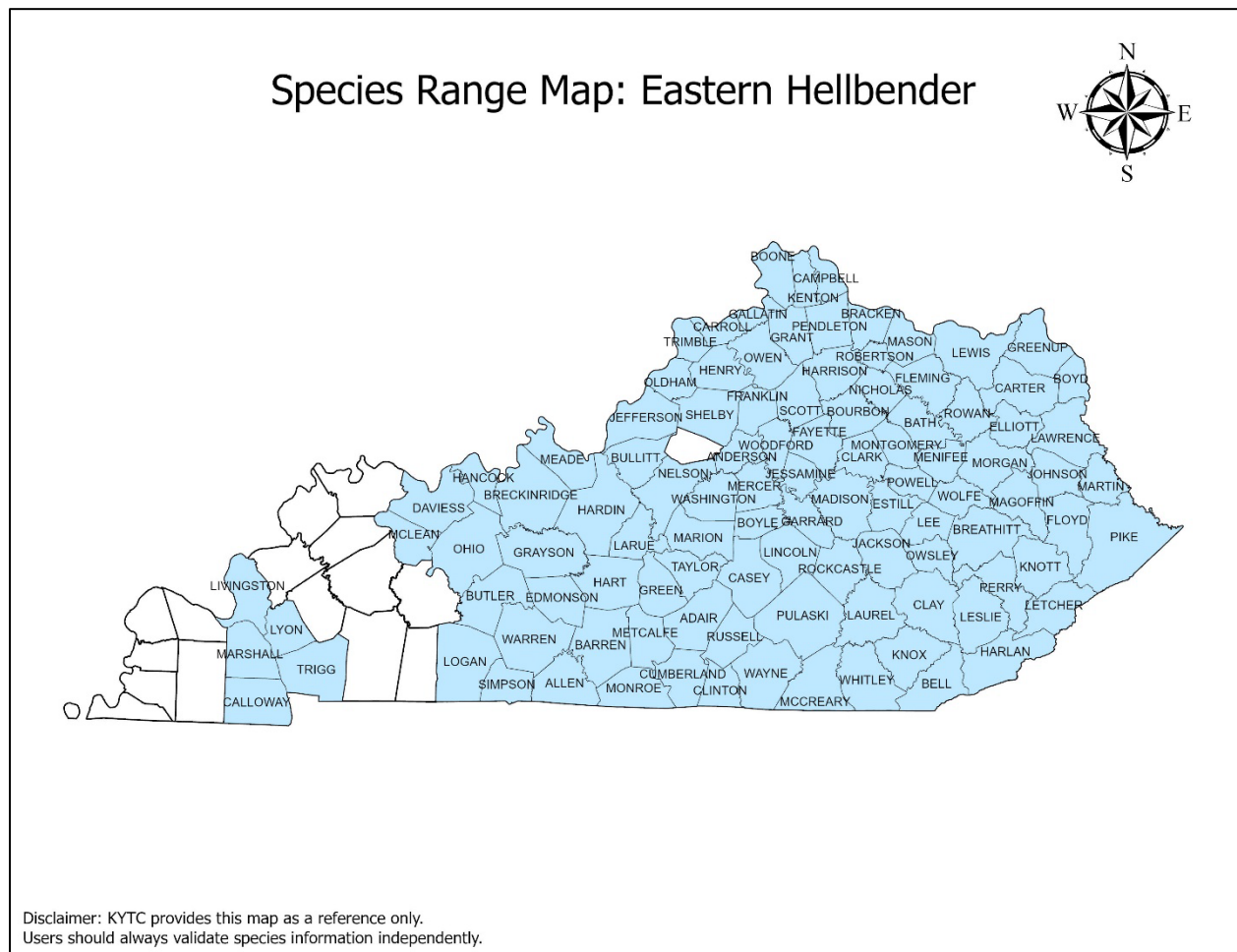


Figure 3 Range map taken from KDFWR.

Current occupied watersheds: Barren, Big Sandy, Blue-Sinking, Licking, Little Sandy, Little Scioto-Tygarts, Lower Kentucky, Lower Levisa, Middle Fork Kentucky, Middle Ohio-Laughery, Obey, Ohio Brush-Whiteoak, Powell, Raccoon-Symmes, Rockcastle, Rolling Fork, Rough, Salt, Silver-Little Kentucky, South Fork Cumberland, South Fork Kentucky, South Fork Licking, Tug, Upper Cumberland, Upper Cumberland-Lake Cumberland, Upper Green, Upper Kentucky, Upper Levisa.



Decision Key

- 1) Is the project impacting a 2-8 order stream in Barren, Big Sandy, Blue-Sinking, Licking, Little Sandy, Little Scioto-Tygarts, Lower Kentucky, Lower Levisa, Middle Fork Kentucky, Middle Ohio-Laughery, Obey, Ohio Brush-Whiteoak, Powell, Raccoon-Symmes, Rockcastle, Rolling Fork, Rough, Salt, Silver-Little Kentucky, South Fork Cumberland, South Fork Kentucky, South Fork Licking, Tug, Upper Cumberland, Upper Cumberland-Lake Cumberland, Upper Green, Upper Kentucky, or Upper Levisa watersheds?
 - a. Yes: Contact your SME.
 - b. No: Prepare NE finding.

Alligator Snapping Turtle (*Macrochelys temminckii*)

Species Description

The alligator snapping turtle was listed as ***proposed threatened*** on November 9th, 2021.

The alligator snapping turtle is the largest species of freshwater turtle in North America and is highly aquatic and somewhat secretive. They are primitive in appearance and are characterized by a



Figure 1 Taken from SSA.

large head, long tail, and an upper jaw with a strongly hooked beak. They have muscular legs and webbed toes with long, pointed claws. They have three keels with posterior elevations on the scutes of the carapace, which is dark brown and often has algal growth that adds to the alligator snapping turtle's camouflage. Their hinge-less plastron is significantly smaller than their carapace and is narrow and cross-shaped with a long, narrow bridge. The plastron is greyish-brown in color in adults; in juveniles it may be somewhat mottled with small whitish blotches. Their eyes are positioned on the side of the head and are surrounded by small, fleshy, pointed projections. Numerous epidermal projections are also present on the side of the head, chin and neck (Ernst and Lovich 2009, p. 138-139). Hatchlings look very similar to adults (Ernst and Lovich 2009, p. 146).

Habitat Description

Alligator snapping turtles are generally found in deeper water of large rivers and their major tributaries; however, they are also found in a wide variety of habitats, including small streams, bayous, canals, swamps, lakes, reservoirs, ponds, and oxbows (a lake that forms when a meander of a river is cut off). Alligator snapping turtles more often select structure (e.g., tree root masses, stumps, submerged trees, etc.) than open water and may select sites with a high percentage of canopy cover (Howey and Dinkelacker 2009, p. 589; Harrel et al. 2006, p.66; Carr et al. 2007,

p.37; Carr et al. 2010, p.43). Sloughs, slow-moving streams and rivers, large rivers, backwaters, reservoirs - may ascend into small streams.

Critical Habitat

None

Range

Due to the aquatic nature of the species, the alligator snapping turtle is confined to river systems that flow into the Gulf of Mexico, extending from the Suwannee River in Florida to the San Antonio River in Texas. In the Mississippi Alluvial Valley, it is widely distributed from the Gulf to as far north as Indiana, Illinois, southeastern Kansas and eastern Oklahoma. In the Gulf Coastal Plain, its range extends from eastern Texas to southern Georgia and northern Florida. Historically, the alligator snapping turtle occurred over eastern Oklahoma, but today it is believed to be restricted to the east central and southeastern portion of the state (Ernst and Lovich 2009, p. 139). In Kentucky, alligator snapping turtles are typically associated with the Jackson Purchase and LBL region.

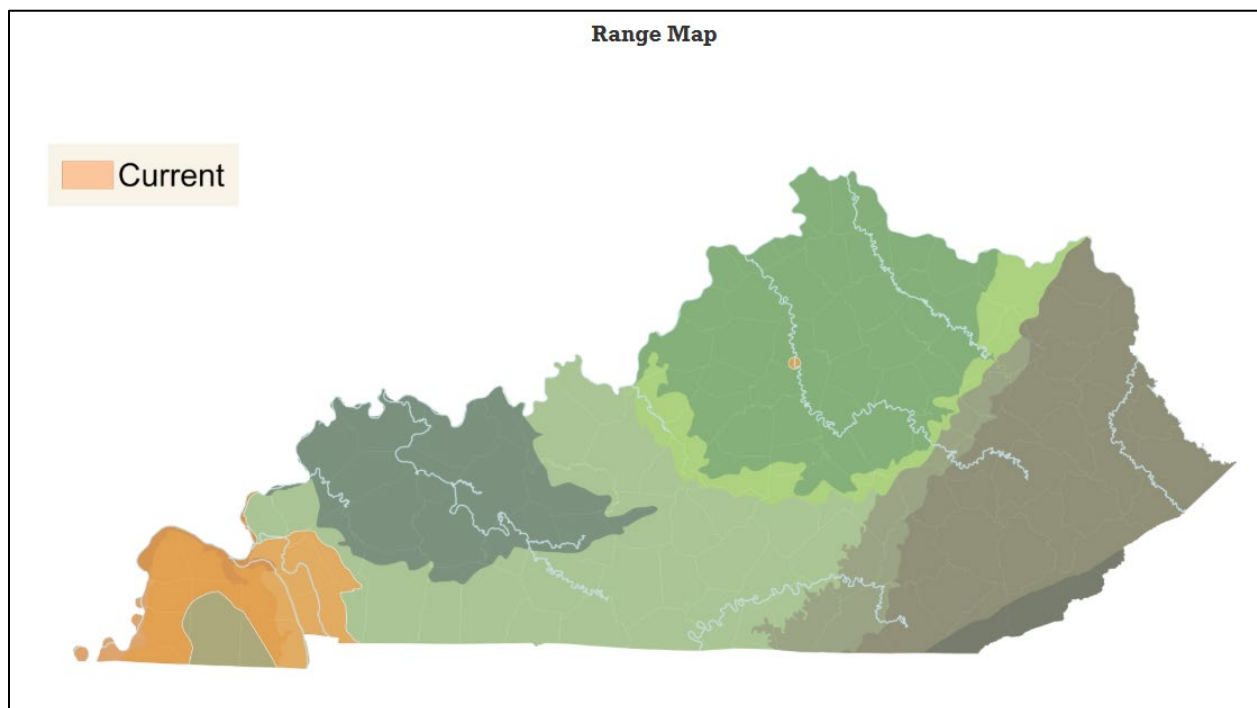
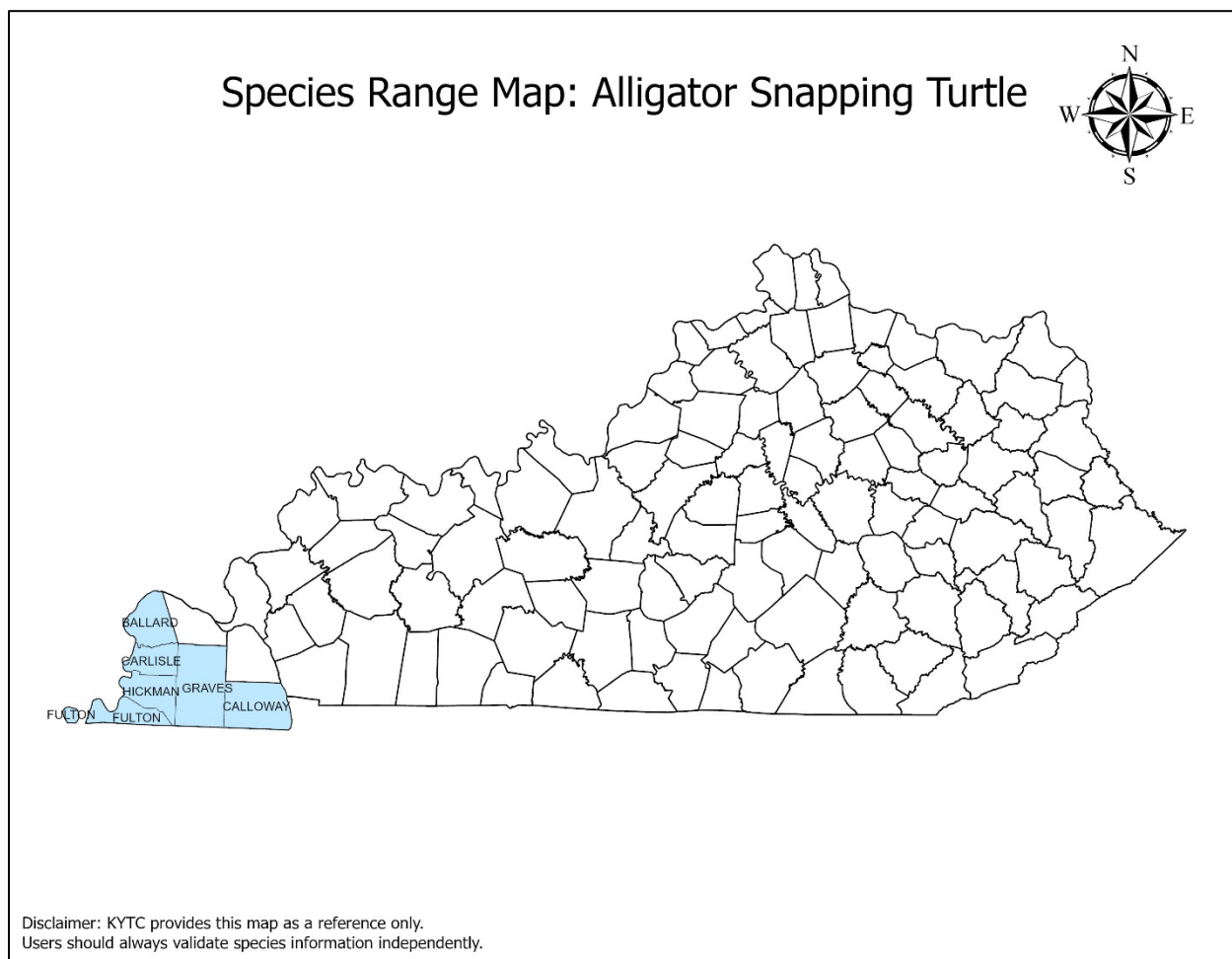


Figure 2 Rangemap taken from KDFWR.



Decision Key

- 1) Is the project impacting the Mississippi River Watershed in Ballard, Carlisle, Hickman, Fulton, Graves, or Calloway Counties?
 - a. Yes: Contact your SME.
 - b. No: Prepare NE finding.