Appendix E

Plants

PLANTS

American Hart’s Tongue Fern (*Asplenium scolopendrium* L. var. *americanum*)

Federal Listing: Threatened
State Listing within the AA: Threatened in Michigan

Species Description

The American Hart’s Tongue Fern has long, flat, entire (not serrated) fronds that are 20 to 40cm long. The frond apex is abruptly pointed to sometimes rounded, and the tip is never rooting. Sporangia are arranged in distinct elongated clusters (sori) with an elongated indusium. Plants are perennial with rhizomes with evergreen fronds (Michigan Flora Online, 2011).

Species Distribution

The distribution of American Hart’s Tongue Fern is very limited and discrete. It is found in two counties within the eastern Upper Peninsula of Michigan, Chippewa and Mackinac Counties (about 12 occurrences); a few isolated, tiny colonies in Alabama (on another karst feature: cave entrances), and in central New York, which harbors 90 percent of the United States population. In contrast, this fern is locally abundant on the Bruce Peninsula of Ontario, Canada, again on in the Niagara escarpment. Other varieties of this fern are distributed in Japan and Europe (USFS, 2021).

American Hart’s Tongue was first described by Linneaus in 1753 and is common in the British Isles and rare to frequent throughout Europe (USFWS, 1993). American Hart’s Tongue Fern is an epiphytic fern, growing in small cracks in larger dolomitic limestone (limestone high in magnesium) boulders no more than a foot above the moist soil (USFS, 2021) within moist deciduous forest understories (Michigan Flora Online, 2011).Habitat in Michigan and New York is within the Niagara escarpment on shaded, moist boulders and ledges. This epipetric fern requires Silurian limestone, a substrate of high magnesium content. The Niagara escarpment was formed approximately 450 million years ago by corals inhabiting a vast and tropical inland sea and slowly was transformed into a dolomitic limestone (USFS, 2021).

American Hart’s Tongue Fern is federally threatened in the United States (listed in 1989; USFWS, 2021), state endangered in Alabama, Michigan, and Tennessee, threatened in New York, and Sensitive or Special Concern in Ontario.

Distribution within Action Area

- Only occurs within Chippewa and Mackinac Counties in Michigan; 12 records have been described within these counties.
- The Hiawatha National Forest of the Eastern Region of the Forest Service is home to nine of the Michigan occurrences and is the only National Forest to harbor this species (USFS, 2021).

Critical Habitat

No critical habitat has been designated for the American Hart’s Tongue Fern; however, this species is restricted to dolomitic limestone habitat (USFWS, 2021).

Life History

American Hart’s Tongue Fern reproduces only via spores. Spores require cool, moist calcareous environments with an abundance of bryophytes (mosses, liverworts, hornworts) for seedling establishment. Seedlings have underdeveloped rhizomes and utilize the moisture associated with bryophyte beds to obtain resources. As seedlings mature and rhizomes get larger, they outcompete and replace bryophytes. Winter snow cover is necessary for long-term survival of a population by maintaining soil moisture and decreasing adverse effects from frost (USFWS, 1993).

Evergreen fronds remain green and functional throughout the winter. New fronds are produced at the start of each growing season and remain functional for two growing seasons. These fronds typically emerge in mid-June in Michigan. Spores are produced on 10-year-old fronds from May through August, and require moist habitat for fertilization, and protection from desiccation (USFWS, 1993).

Current Stressors and Threats

- Habitat loss
  Historical habitat loss has primarily occurred due to quarrying activities and tree removal. According to the Recovery Plan, quarrying activities have destroyed three of New York's populations and remans a threat to an additional site in New York and two southern sites. Logging activities that are concurrent with quarrying can exacerbate habitat destruction. Tree canopies provide increased humidity near the soil surface, a requirement of the American Hart's Tongue Fern. Removal of trees opens the canopy increasing light and decreasing humidity (USFWS, 1993).
- Development
- Potential trampling
- Climate change

Effects of climate change, especially in southern populations, limit this species to extremely rare sites (USFWS, 1993).

List of References

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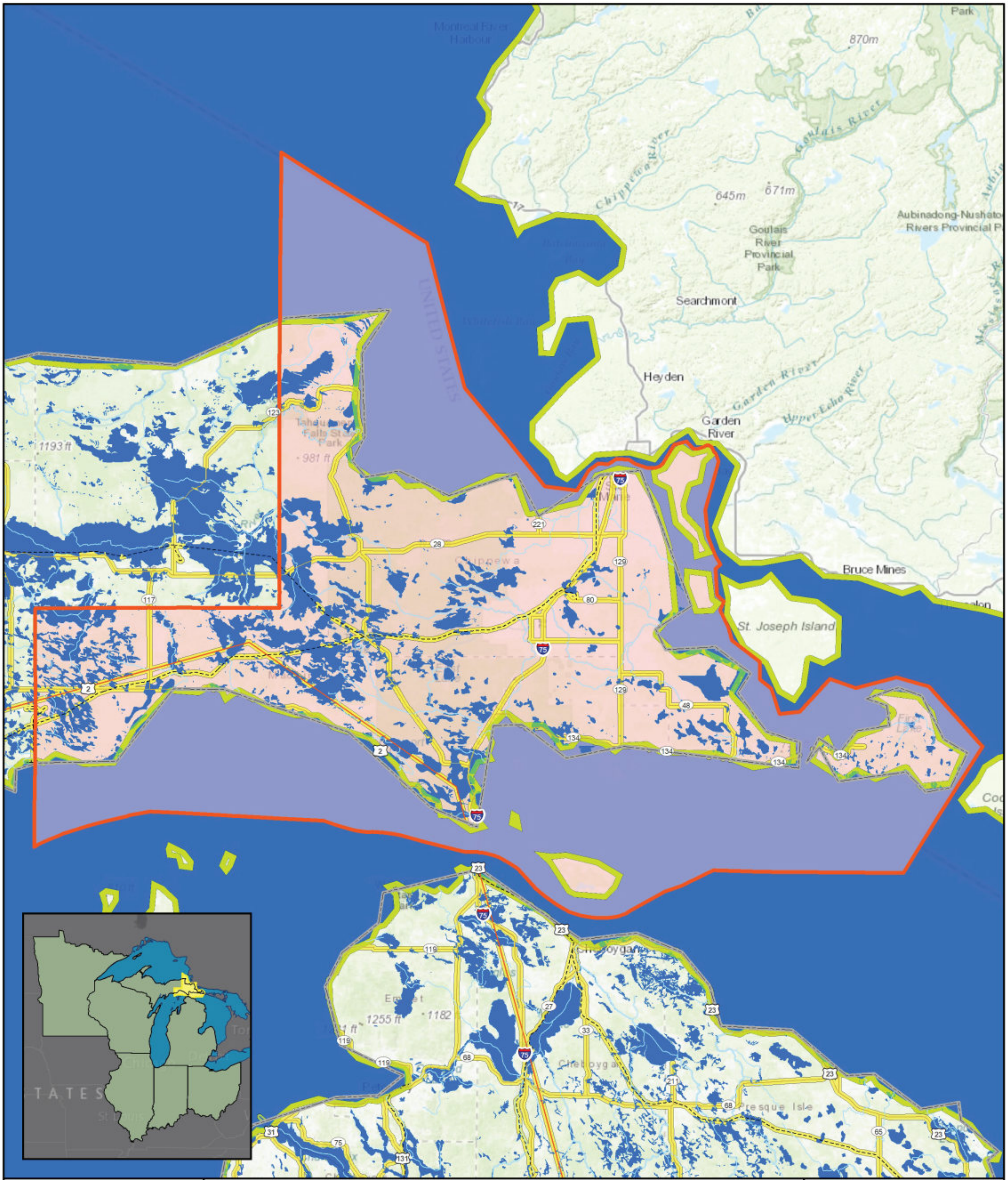

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Miles
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Kilometers

AMERICAN HART'S-TONGUE FERN (*ASPLENIUM SCOLOPENDRIUM VAR. AMERICANUM*) ACTION AREA OVERVIEW MAP

SCALE 1:1,500,000

- Petroleum Pipeline
- Major Road
- Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- Lakes & Ponds
- 1-Mile Coastal Inland Buffer
- Action Area
- American Hart's-Tongue Fern (*Asplenium scolopendrium var. americanum*) Counties of Occurrence

N

Basemap courtesy of Esri.   Date: 5/25/2021   Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS   Projection: WGS 1984 Web Mercator

Decurrent False Aster (*Boltonia decurrens*)

Federal Listing: Threatened
State Listing within AA: Threatened in Illinois

Species Description

The Decurrent False Aster is a perennial, herbaceous plant found in moist alluvial floodplains and prairie wetlands along the Illinois and Mississippi Rivers. It relies on periodic flooding to scour away other plants that compete for the same habitat (USFWS, 1990).

This herbaceous perennial plant becomes 3 to 7ft tall, forming either a solitary or a cluster of central stems that branch occasionally to abundantly. The central stems are light green, vertically veined, glabrous, and sometimes glaucous; they are terete (circular in circumference), except for the decurrent bases of the leaves. This latter characteristic causes them to appear heavily winged. Spreading to drooping alternate leaves occur along the entire length of these stems at regular intervals, becoming gradually smaller in size as they ascend. The leaves of the central stems are up to 7in long and 1.5in across; they are oblong-lanceolate in shape, while their margins are entire (toothless) and often slightly wavy (vertically) or undulate (horizontally). These leaves taper gradually, forming narrow acute tips, while their bases strongly clasp the central stems. The basal margins of these leaves extend downward 1 to 3in along their stems, forming pairs of wings up to 0.75in across. The upper leaf surface is medium to dark green and glabrous, while the lower leaf surface is a slightly lighter shade of green, glabrous, and sometimes glaucous. Leaf venation is pinnate; the central veins of these leaves are prominent, particularly toward their bases. Slender ascending lateral stems develop from the axils of the leaves, particularly along the middle to upper leaves of the central stems. The alternate leaves of these lateral stems are up to 3in long and 0.5in across; they are elliptic or linear-lanceolate in shape, entire along their margins, and either sessile or decurrent at their bases. When their bases are decurrent, the basal margins of these secondary leaves extend downward up to 1in along their stems, forming pairs of wings up to 0.25in across (Illinois Wildflowers, 2021).

The central stems terminate in large panicles of flowerheads (up to 2ft long and 2ft across) that are more or less dome-shaped. On robust plants, many lateral stems will also terminate in smaller panicles of flowerheads. The branches of these inflorescences are similar to the stems, except they are less winged from the decurrent bases of their leafy bracts. These bracts are up 3in long and 0.5in across and they are similar in appearance to the leaves of lateral stems, although they can become smaller in size. Each daisy-like flowerhead is 0.75 to 1in across, consisting of 40 to 60 ray florets that surround a dense head of 180+ disk florets. The ray florets are pistillate (female), while the disk florets are perfect (male and female). The petaloid rays of these flowerheads are linear-oblong in shape and white (rarely lavender or light purple). The corollas of the disk florets are about 2mm long, yellow, tubular in shape, and 5-lobed along their upper rims. Around the base of each flowerhead, light green phyllaries (floral scales) are arranged in about 3 overlapping series. These phyllaries are linear-oblanceolate in shape, membranous along their margins, and appressed together. When the flowerhead blooms, these phyllaries form an involucre that is shaped like a shallow plate or flat disk. The peduncles (basal stalks) of these flowerheads are up to 3in long (Illinois Wildflowers, 2021).

Species Distribution

The distribution of Decurrent False Aster includes the alluvial floodplain areas along the Illinois and Mississippi Rivers. In Illinois between 14 (USDA, 2021) and 20 counties (USFWS, 2021) support populations of Decurrent False Aster, and in Missouri between 4 counties (USDA, 2021) and 9 counties report populations along the Mississippi River (USFWS, 2021). However, counties supporting successful populations are likely to be much less. Additionally, known populations are likely not self-sustaining (USFWS, 2012).

Distribution within Action Area

- Counties within Illinois: Cass, Fulton, LaSalle, Logan, Marshall, Mason, Menard (not listed on ECOS), Morgan, Peoria, Pike, Schuyler, Scott, Tazewell, and Woodford (USDA, 2021)
- Additional counties include Brown, Bureau, Calhoun, Greene, Jersey, Madison, Putnam, and St. Clair (USFWS, 2021)

Critical Habitat

No critical habitat has been designated for the Decurrent False Aster.

Life History

Decurrent False Aster reproduces both vegetatively, by producing basal shoots, and sexually, by producing seeds. The typical blooming period begins late summer into autumn, lasting about 1 to 2 months. Mature achenes (seeds) are about 1.5 to 2.5mm in length. Achenes are obovoid, somewhat flattened, and slightly winged along their margins allowing them to be blown about by the wind or float on water. The root system is shallow and fibrous (Illinois Wildflowers, 2021).

Current Stressors and Threats

- Siltation
  Excessive silt deposition appears to be a major cause of the Decurrent False Aster's decline. Highly intensive agricultural practices create increased topsoil runoff, which smothers seeds and seedlings.
- Habitat destruction
  Habitat destruction is another threat and includes agriculture and building levees along the rivers. An increased need for agricultural land has eliminated wet prairies and marshes within the species' range. This includes draining natural lakes for conversion to row crops. Building levees along rivers and draining wetlands for cultivation has changed flood patterns, decreasing available habitat.
- Herbicides
  Herbicides also kill these plants and may be a factor in the decline of the species. Several communities of Decurrent False Asters have been found in areas of low-intensity agriculture. Biologists believe that the plant may actually benefit from occasional farming, which eliminates competitive plant species (USFWS, 2012).

List of References

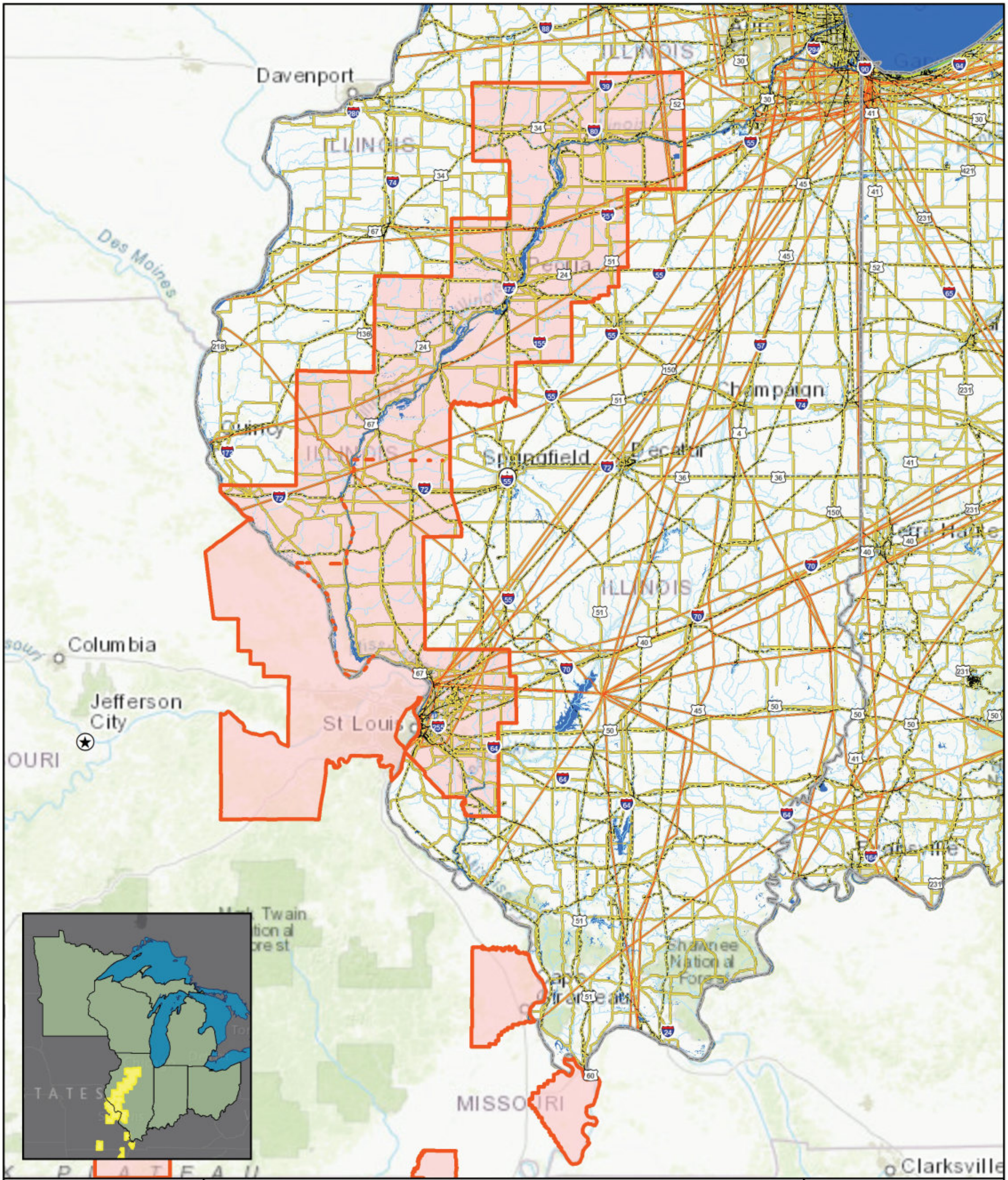
Illinois Wildflowers. (2021). Decurrent False Aster (*Boltonia decurrens*). Retrieved from https://www.illinoiswildflowers.info/wetland/plants/de_fsaster.html

U.S. Department of Agriculture (USDA). (2021). *Boltonia decurrens* plant profile. Retrieved from https://plants.usda.gov/core/profile?symbol=BODE2

U.S. Fish & Wildlife Service (USFWS). (1990). Decurrent False Aster recovery plan. Twin Cities, Minnesota. 26pp.

U.S. Fish & Wildlife Service (USFWS). (2012). Decurrent False Aster (*Boltonia decurrens*) 5-year review: summary and evaluation. Moline, Illinois. 15pp.

U.S. Fish & Wildlife Service (USFWS). (2021). Decurrent False Aster (*Boltonia decurrens*) species profile. Retrieved from https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=Q26A



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Miles
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Kilometers

DECURRENT FALSE ASTER (*BOLTONIA DECURRENS*) ACTION AREA OVERVIEW MAP

SCALE 1:3,500,000

- Petroleum Pipeline
- Major Road
- Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- ▆ Lakes & Ponds
- 🟩 1-Mile Coastal Inland Buffer
- 🟨 Action Area
- ▢ Decurrent False Aster (*Boltonia decurrens*) Counties of Occurrence

N

Basemap courtesy of Esri.

Date: 5/25/2021

Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS

Projection: WGS 1984 Web Mercator

Dwarf Lake Iris (*Iris lacustris*)

Federal Listing: Threatened
State Listing within AA: Threatened in Michigan and Wisconsin

Species Description

Plants are shorter in stature than most irises at less than 15cm (WIDNR, 2021) with leaves 1 - 2 cm wide (USFWS, 2019). Flowers 5 to 6cm wide (WIDNR, 2021) and are sky blue to deep blue to violet in color (USFS, 2021). Spreading sepals have white signal bordered by a deep purple color. Inflorescences typically contain one flower, although rarely two flowers can be observed. Leaves are stiff and upright arising from narrow creeping rhizomes that have an enlarged terminus with fibrous roots (USFS, 2021). These slender rhizomes distinguish Dwarf Lake Iris from small individual and juvenile plants of the widespread common blue flag (*Iris versicolor*; MNFI, 2004).

Species Distribution

The Dwarf Lake Iris occurs on the northern lakeshores of Lake Michigan and Lake Huron in Michigan and Lake Michigan in Wisconsin. This iris can be found in slightly acidic, shallow, moist, sandy, or rocky soils in sun-dappled, forested openings near the lakeshore where cool air flows off the lake creating this species-specific microclimate.

The dwarf lake iris is typically found near the shorelines of Lake Michigan and Lake Huron in Michigan and Lake Michigan in Wisconsin, but there are a few known inland populations found in Michigan's upper peninsula. The majority of dwarf lake iris populations occur in Michigan with approximately 80 known populations found in nine counties. The coastal range occurs from the Stonington Peninsula (Delta County) to Drummond Island (Chippewa County) and south to Wilderness State Park (Emmet County), Beaver Island (Charlevoix County), and Alpena (Alpena County) with the inland populations identified in Delta and Menominee counties (MNFI, 2004).

Distribution within Action Area

- Only occurs within the following Michigan Counties: Alpena, Charlevoix, Cheboygan, Chippewa, Delta, Emmet, Grand Traverse, Leelanau, Mackinac, Menominee, Presque Isle, and Schoolcraft (USFWS, 2021)
- Only occurs within Brown, Door, Kewaunee, and Oconto Counties in Wisconsin (USFWS, 2021)

Critical Habitat

No critical habitat has been designated for the Dwarf Lake Iris.

Life History

The blooming period occurs early May through early June. Fruiting occurs late June through late July. Seeds are dark brown in color (WIDNR, 2021)

Current Stressors and Threats

- Development
  Primary threats to this species habitat include the development of residential and vacation homes along the lakeshore.
- Habitat disturbance/destruction
  Chemical spraying, salting, and off-road vehicle use has caused disturbance and destruction of habitat (USFWS, 2019).
- Changes in hydrology
- Invasive species

List of References

Michigan Natural Features Inventory (MNFI). (2004). *Iris lacustris,* Dwarf Lake Iris. Retrieved from https://mnfi.anr.msu.edu/abstracts/botany/Iris_lacustris.pdf

U.S. Forest Service (USFS). (2021). Our native irises: dwarf woodland irises. Retrieved from https://www.fs.fed.us/wildflowers/beauty/iris/Dwarf_Woodland/iris_lacustris.shtml

U.S. Fish & Wildlife Service (USFWS). (2019). Dwarf Lake Iris fact sheet. Retrieved from https://www.fws.gov/midwest/endangered/plants/dwarflakeiris/dwarflak.html

U.S. Fish & Wildlife Service (USFWS). (2021). Dwarf Lake Iris (Iris lacustris) species profile. Retrieved from https://ecos.fws.gov/ecp/species/598

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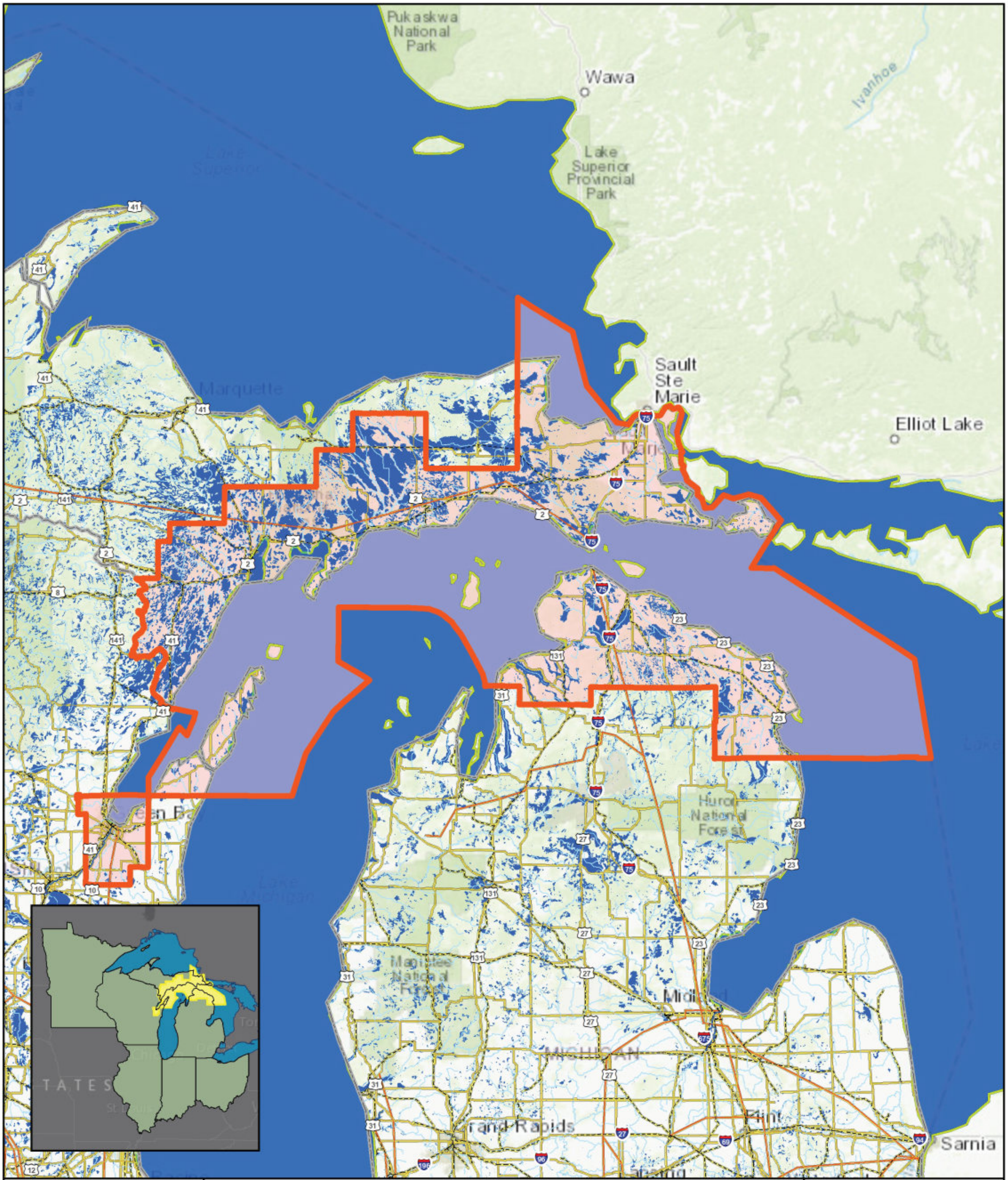

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Miles
0 12.5 25 50 75 100
Kilometers

DWARF LAKE IRIS (*IRIS LACUSTRIS*) ACTION AREA OVERVIEW MAP

SCALE 1:4,000,000

- Petroleum Pipeline
- Major Road
- Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- Lakes & Ponds
- 1-Mile Coastal Inland Buffer
- Action Area
- Dwarf Lake Iris (*Iris lacustris*) Counties of Occurrence.

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Basemap courtesy of Esri. Date: 5/25/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS Projection: WGS 1984 Web Mercator

Eastern Prairie Fringed Orchid (*Platanthera leucophaea*)

Federal Listing: Threatened
State Listing within the AA: Threatened in Illinois, Indiana, Michigan, Ohio, and Wisconsin

Species Description

This plant is 8 to 40in tall and has an upright leafy stem with a flower cluster called an inflorescence. The 3-to-8-in lance-shaped leaves sheath the stem. Each plant has one single flower spike composed of 5 to 40 white flowers. Each flower has a three-part fringed lip less than 1in long and a nectar spur (tube-like structure) which is about 1 to 2in long. The Eastern Prairie Fringed Orchid occurs in a wide variety of habitats, from mesic prairie to wetlands such as sedge meadows, marsh edges, even bogs. A symbiotic relationship between the seed and soil fungi, called mycorrhizae, is necessary for seedlings to become established. This fungi helps the seeds assimilate nutrients in the soil (USFWS, 2021).

Species Distribution

Eastern Prairie Fringed Orchid can be found in a wide variety of habitats, from wet to mesic prairie or wetland communities, including, but not limited to, sedge meadows, fens, marshes, and marsh edges. It requires full sun for optimal growth with little to no woody encroachment or canopy coverage (USFWS, 2019).

The Eastern Prairie Fringed Orchid formerly occurred from eastern Iowa, Missouri, and Oklahoma eastward across southern Wisconsin, northern and central Illinois, southern Michigan, northern Indiana and Ohio, and northwestern Pennsylvania to western New York and adjacent southern Ontario. Disjunct populations also occurred in New Jersey, Virginia and Maine (USFWS, 1999).

Current populations are known to occur in Arkansas, Illinois, Indiana, Iowa, Maine, Michigan, Minnesota, Missouri, Ohio, Pennsylvania, Virginia, West Virginia, and Wisconsin.

Distribution within Action Area

- Illinois: 86 counties with historic or known populations
- Indiana: 57 counties with historic or known populations
- Michigan: 55 counties with historic or known populations
- Minnesota: 2 counties with historic or known populations
- Ohio: 57 counties with historic or known populations
- Wisconsin: 40 counties with historic or known populations

A complete list of counties can be found on ECOS (USFWS, 2021).

Critical Habitat

No critical habitat has been designated for the Eastern Prairie Fringed Orchid.

Life History

Flowering occurs from late June to early July, lasting from 7 to 10 days. Flower clusters emerge and are not much taller than surrounding grasses and sedges (USFWS, 1999).

Current Stressors and Threats

- Habitat loss
  Early decline of this species is due to habitat loss through the conversion of natural habitats to cropland and pasture. Current declines are attributed to wetland drainage and development impacts to wetlands habitat. Additionally, habitat loss may also be due to habitat succession to woody habitats, competition from non-native species, and over-collection (USFWS, 1999).

List of References

U.S. Fish & Wildlife Service (USFWS). (1999). Eastern prairie fringed orchid (*Platanthera leucophaea* [Nuttall] Lindley) recovery plan. Fort Snelling, Minnesota. 57pp.

U.S. Fish & Wildlife Service (USFWS). (2019). Eastern Prairie Fringed Orchid (*Platanthera leucophaea*). Retrieved from https://www.fws.gov/midwest/endangered/plants/epfo/index.html

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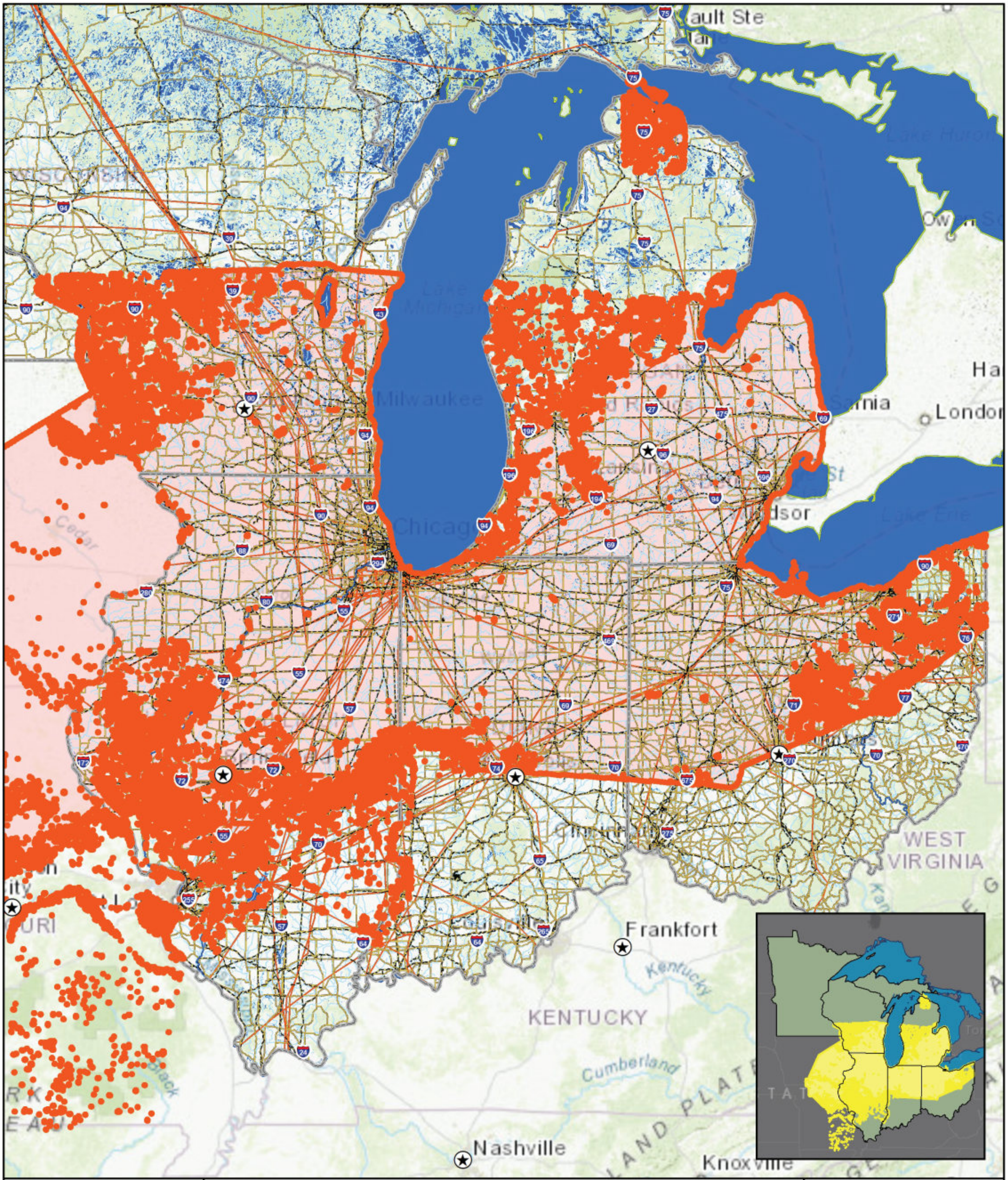

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Kilometers

EASTERN PRAIRIE FRINGED ORCHID (*PLATANTHERA LEUCOPHAEA*) ACTION AREA OVERVIEW MAP

SCALE 1:7,000,000

— Petroleum Pipeline	— Commercial Navigable Waterway	🟩 1-Mile Coastal Inland Buffer
— Major Road	— Rivers & Streams	🟨 Action Area
------ Railroad	▇ Lakes & Ponds	▭ Eastern Prairie Fringed Orchid (*Platanthera leucophaea*) Counties of Occurrence.

N

Basemap courtesy of Esri.

Date: 5/25/2021

Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS

Projection: WGS 1984 Web Mercator

Fassett's Locoweed (*Oxytropis campestris var. chartacea*)

Federal Listing: Threatened
State Listing within the AA: Threatened in Wisconsin

Species Description

Fassett's Locoweed is a 4- to 12-in tall perennial herb of the pea family. It appears silvery-grey in color because of white, silky hairs that cover most of the plant. The flowers are pea-like, 0.5 to 0.75in long, and rose-pink to violet. An individual plant produces 1 to 20 stems, and each stem can have 10 to 20 flowers. The flowers product numerous pale yellow pods that contain small black seeds. On a mature plant the leaves, which grow from a common base, are 3 to 8in long and are made up of 18 to 30 leaflets, each about an inch or less in length (USFWS, 2003).

Species Distribution

Fassett's Locoweed grows on gentle, sand-gravel shoreline slopes around shallow lakes fed by groundwater seepage. These landlocked lakes are subject to frequent, large fluctuations of water levels (USFWS, 2003).

Fassett's Locoweed is found along the lakes and open shoreline and, to a lesser extent, on higher ground under the partial shade of adjacent vegetation. Nearly all lakes with historical populations of the species are less than 15ha (37 acres) in size and occur at approximately 350m in elevation. This suggests the distribution of Fassett's Locoweed may be related to the glacial history of Wisconsin (USFWS, 1991).

Distribution within Action Area

- Only occurs within Bayfield, Portage and Waushara Counties in Wisconsin (USFWS, 2003), and ECOS lists these three counties along with Douglas County (USFWS, 2021).
- The recovery plan lists the following named lakes:
  - Bayfield County: Pigeon Lake
  - Portage County: Pickerel Lake
  - Waushara County: Mud Lake, Plainfield Lake, Second (Fox) Lake, Sherman (Marks) Lake, Shumway Lake, Weymouth Lake, and Lake Huron
- Wisconsin Department of Natural Resources (DNR) owns two State Natural Areas that support Fassett's Locoweed (USFWS, 2003).
- Wisconsin DNR also has a landowner contact program with numerous private landowners to have voluntarily agreed to protect the plants on private shorelines (USFWS, 2003).

Critical Habitat

No critical habitat has been designated for Fassett's Locoweed.

Life History

Fassett's Locoweed plants live for several years, reappearing each spring from underground perennial tap roots. The species reproduces entirely by seed. Flowers bloom from mid-May through mid-June. Both small and large bees have been observed visiting flowers, but the pollinator is not definitely known (USFWS, 2003). While uppermost flowers are still in bloom, legumes have begun to develop in the lower part of the plant. Seed dispersal from mature seed pods begin by mid-July (USFWS, 1991). Fassett's Locoweed apparently depends on the open habitat provided during times of low lake levels and a large seed bank of dormant seeds in the soil for long-term population maintenance (USFWS, 2003).

Current Stressors and Threats

- Habitat loss
  Historical and current habitat loss through development along the lakes have been a primary threat for Fassett's Locoweed. Low water levels within the lake may also contribute to population declines.

- Herbicide and pesticide use (USFWS, 1991)
- Cattle grazing and irrigation of surrounding agricultural lands which diminishes lake levels (USFWS, 2003).

List of References

U.S. Fish & Wildlife Service (USFWS). (1991). Fassett's Locoweed recovery plan. Twin Cities, Minnesota. 57pp.

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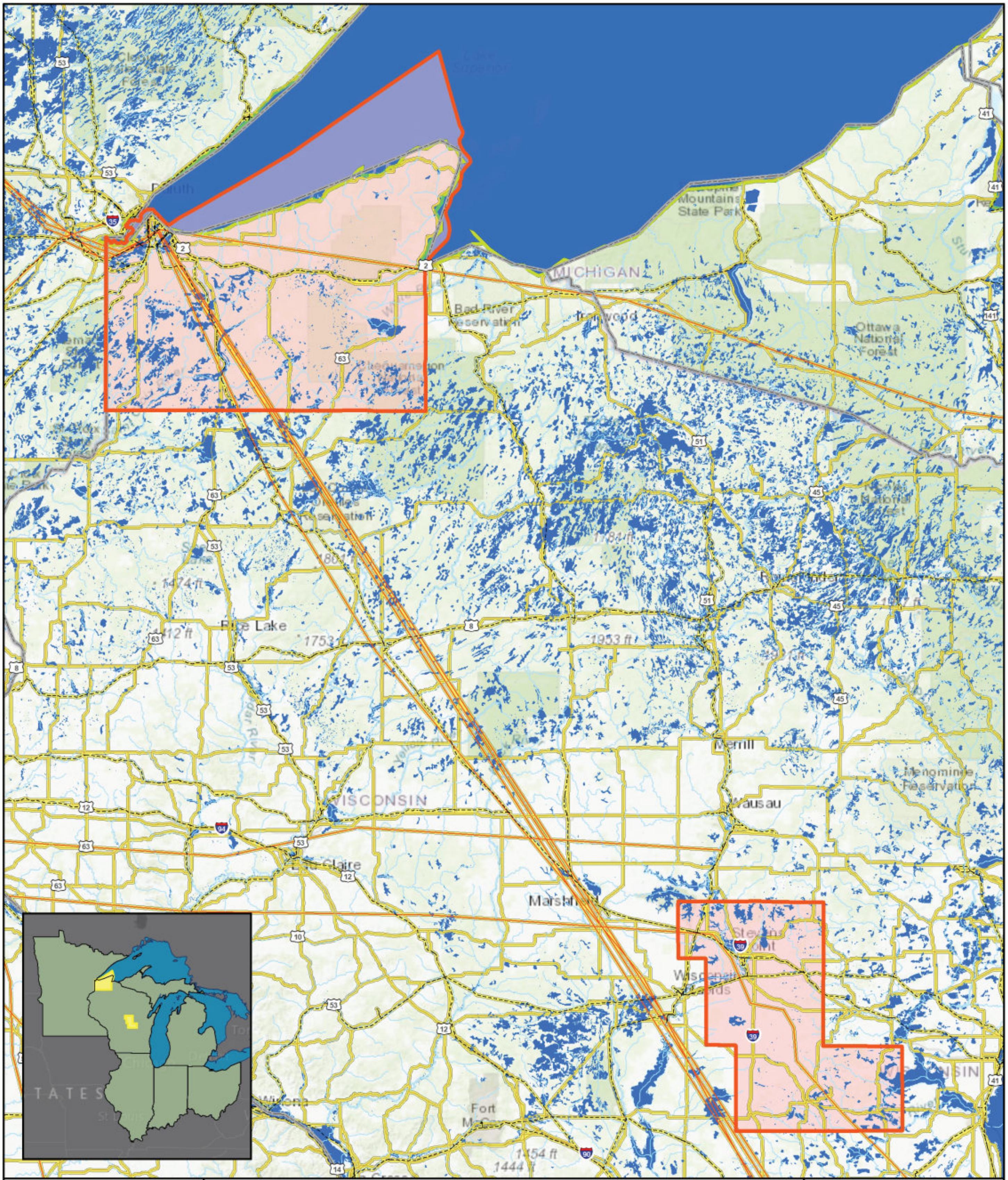

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Kilometers

FASSETT'S LOCOWEED (*OXYTROPIS CAMPESTRIS VAR. CHARTACEA*) ACTION AREA OVERVIEW MAP

SCALE 1:2,500,000

- — Petroleum Pipeline
- — Major Road
- ------ Railroad
- — Commercial Navigable Waterway
- — Rivers & Streams
- 🟦 Lakes & Ponds
- 🟩 1-Mile Coastal Inland Buffer
- 🟨 Action Area
- ▭ Fassett's Locoweed (*Oxytropis campestris var. chartacea*) Counties of Occurrence

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Basemap courtesy of Esri. Date: 5/25/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS Projection: WGS 1984 Web Mercator

Houghton’s Goldenrod (*Solidago houghtonii*)

Federal Listing: Threatened
State Listing within the AA: Threatened in Michigan

Species Description

Houghton’s Goldenrod is a perennial herbaceous member of the Asteraceae family. They are frequently tufted or clumped and can grow up to 75cm tall. Rhizomes are commonly produced from the caudex (thickened, branching, fibrous-rooted base). Stems are smooth and slender and sometimes reddish in color. Basal leaves are 20cm long and 20mm wide and slightly clasp at the base. Flat-topped inflorescence consists of relatively few (2 to 18), showy, large flower heads (USFWS, 1997).

Species Distribution

Houghton's Goldenrod is generally restricted to narrow bands of open, calcareous, lakeshore habitat requiring the natural dynamics of the Great Lakes system to maintain a suitable environment. Houghton's Goldenrod is primarily endemic to the Upper Great Lakes region, occurring on the northern shores of Lakes Michigan and Huron in Michigan and Ontario. Inland Houghton’s goldenrod populations were known to occur in Crawford and Kalkaska Counties but following genetic analysis have now been identified as a new species, *Solidago vossii*. Additionally, a disjunct population occurs in Genesee County in the Bergen Swamp Nature Preserve in New York (USFWS, 1997). ECOS also lists Monroe County, New York (USFWS, 2021).

Distribution within Action Area

- 58 occurrences in nine counties in Michigan: Charlevoix (4), Cheboygan (6), Chippewa (7), Crawford (2), Emmett (5), Kalkaska (1), Mackinac (23), Presque Isle (6), Schoolcraft (4)
- ECOS also lists Alpena, Delta, and Leelanau Counties (USFWS, 2021)
- Disjunct populations occur in Crawford and Kalkaska Counties and are not located along the lakeshore (USFWS, 1997)

Critical Habitat

No critical habitat has been designated for Houghton’s Goldenrod.

Life History

Flowering occurs from August to early September but can begin as early as late July. Houghton’s Goldenrod is insect pollinated. Fruiting and seed dispersal begins in August and lasts through November. Seeds remain viable within the seed bank for no more than one year (USFWS, 1997).

Current Stressors and Threats

- Residential development along narrow shoreline habitats of the Great Lakes
- Construction of beach retaining walls
  Construction of retaining walls may alter hydrology and prevent dune formation.
- Excessive foot and off-road vehicle traffic
- Marina construction
- Road construction
- Sand mining
- Changes in hydrology
- Invasive species

List of References

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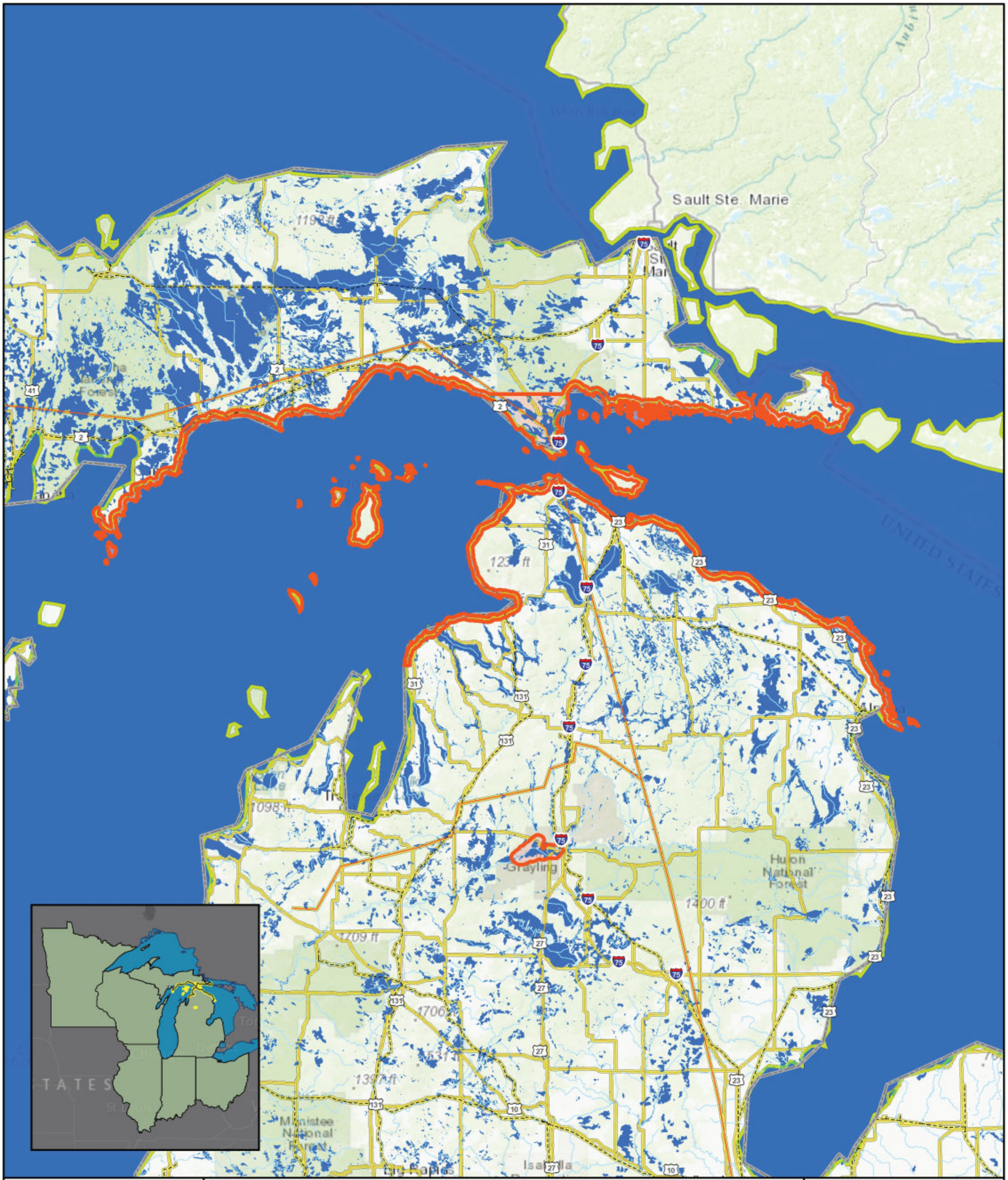

HOUGHTON'S GOLDENROD (*SOLIDAGO HOUGHTONII*) ACTION AREA OVERVIEW MAP

SCALE 1:2,500,000

Petroleum Pipeline
Major Road
Railroad
Commercial Navigable Waterway
Rivers & Streams
Lakes & Ponds
1-Mile Coastal Inland Buffer
Action Area
Houghton's Goldenrod (*Solidago houghtonii*) Counties of Occurrence

Basemap courtesy of Esri. Date: 5/25/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS Projection: WGS 1984 Web Mercator

Lakeside Daisy (*Hymenoxys herbacea*)

Federal Listing: Threatened
State Listing within the AA: Endangered in Illinois, Michigan, and Ohio

Also listed as *Tetraneuris herbacea* under the Integrated Taxonomic Information System (ITIS).

Species Description

Lakeside Daisy is an herbaceous spring-blooming perennial with a short, thick taproot and stout branching caudex. Basal rosette leaves are entire and range 0.6 to 16.7cm long and are 0.35 to 1.3cm wide. Stems are short and stout with whiteish hairs reaching a maximum height between 8.4 to 40cm and support a solitary inflorescence flower head. Both disc and ray florets are bright yellow and produce five-angled, hairy achenes.

Species Distribution

Lakeside Daisy historically occurred in dry prairies, on outcrops of dolomite or limestone bedrock, or on sand and gravel terraces of major river valleys. Nearly all original habitat has been destroyed and only in Ohio has the variety recolonized abandoned quarry habitat where nearly 98% of the essential habitat is in private ownership (USFWS, 1990).

The recovery plan lists Illinois, Ohio and southern Ontario as the only states supporting populations of the Lakeside Daisy (USFWS, 1990). A naturally-occurring population of Lakeside Daisy is known from the Marblehead Peninsula in Ohio, where there is now a state park: Lakeside Daisy State Park (ODNR, 2021). Additional Ohio populations have been established on Kelleys Island and at Castalia Quarry Metropark (both in Erie County). Two populations are known in Michigan, with an additional reserve population established and an introduced population established at an abandoned quarry. Lakeside Daisy was historically recorded in Tazewell and Will Counties in Illinois and populations have been re-established at three sites in these counties. In addition, new populations have been introduced into Cook and DuPage Counties, Illinois (USFWS, 2021a).

Distribution within Action Area

- Cook, DuPage, Tazewell, and Will Counties in Illinois
- Mackinac County in Michigan – 2 occurrences (MNFI, 2021)
- Erie and Ottawa County in Ohio (USFWS, 2021a, b), specifically on Marblehead Peninsula in Ottawa County, Kelleys Island in Erie County, and Castalia Quarry Metropark in Erie County

Critical Habitat

No critical habitat has been designated for Lakeside Daisy.

Life History

Inflorescence buds typically form in the fall and overwinter at the base of the rosette. Flowering occurs from late April to early June. Pollinators include bumble bees, small carpenter bees, and halictid bees. Achenes develop quicky and are wind-dispersed three to four weeks following fertilization (late May to early July) (USFWS, 1990).

Current Stressors and Threats

- Habitat destruction
  The primary threat to the Lakeside Daisy is habitat destruction. Past quarrying activities have eliminated natural habitat; however abandoned quarries provide the only remaining suitable habitat (USFWS, 1990).
- Overgrowth by woody species through natural succession

- Trampling and soil compaction
- Over-collection and raiding of wild populations for gardens (ODNR, 2021).

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0 15 30 60 90
Miles
0 15 30 60 90 120
Kilometers

LAKESIDE DAISY (*HYMENOXYS HERBACEA*)
ACTION AREA OVERVIEW MAP

SCALE 1:5,500,000

— Petroleum Pipeline
— Major Road
------ Railroad
— Commercial Navigable Waterway
— Rivers & Streams
🟦 Lakes & Ponds
🟩 1-Mile Coastal Inland Buffer
🟨 Action Area
▭ Lakeside Daisy (*Hymenoxys herbacea*) Counties of Occurrence

N

Basemap courtesy of Esri.

Date: 5/25/2021

Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS

Projection: WGS 1984 Web Mercator

Leafy Prairie-Clover (*Dalea foliosa*)

Federal Listing: Endangered
State Listing within the AA: Endangered in Illinois

Species Description

Leafy Prairie-Clover is a member of the legume family (Fabaceae). One to several stems 20cm to 80cm long arise from a hardened root crown. Alternate leaves are compound, oddly pinnate and are primarily distinguished from other members of the genus on the basis of leaflet number, which ranges from 9 to 31 but typically is between 20 to 27 leaflets. Flowering heads are between 0.4 and 8.9cm long and 0.6 to 1.0cm wide on short peduncles, 0 to 2mm long. Florets are lavender-purple in color with a calyx that has five petals and five strongly exerted anthers with orange pollen (USFWS, 1996).

Species Distribution

The species occurs in thin-soiled (less than 45cm [18in] deep) mesic and wet-mesic dolomite prairie, limestone cedar glades, and limestone barrens. It can persist in successional plant communities following disturbance or woody succession but will decline in advanced stages of woody succession. The natural communities supporting Leafy Prairie-Clover must be maintained by periodic burning (USFWS, 1996). This plant is found in prairie remnants along the Des Plains River in Illinois, in thin soils over limestone substrate. In Alabama and Tennessee, it lives in prairie-like areas on the edges of cedar glades. It favors sites with a wet spring and fall and a dry summer (USFWS, 1997).

Historically, five sites from four counties (Kane, Kankakee, La Salle, and Will) were known in Illinois with unconfirmed records in Boone, Ogle, and Winnebago Counties. The species was thought to be extirpated from Illinois until a large population was discovered west of the Des Plaines River in 1974 in what is now the Lockport Prairie Nature Preserve. Tennessee likely had the most extensive and widespread pre-settlement *Dalea foliosa* populations. The recovery plan lists 33 occurrences in seven counties. There are historic collections from Davidson, Rutherford, and Sumner Counties in middle Tennessee and from Knox County in eastern Tennessee, but the latter record was discounted as a transplant that did not survive. Four county records (Franklin and Jefferson Counties) with two confirmed extant populations (Lawrence and Morgan Counties) were identified in Alabama listed in the recovery plan.

Distribution within Action Area

- 14 known populations in three counties: Cook (1), DuPage (4), and Will (9) (USFWS, 2015)
- Specific locations: Keepataw Forest Preserve, Romeoville Prairie, Midewin National Tall Grass Prairie, Lockport Prairie Nature Preserve, Dellwood Park West – all located in Will County
- Reintroduced at the Waterfall Glen Forest preserve in DuPage County
- Specific location not provided for Cook County

Critical Habitat

No critical habitat has been designated for Leafy Prairie-Clover.

Life History

Dalea foliosa is a short-lived herbaceous perennial that has no capacity for vegetative spread. In March, new ramets (stems) begin to grow from buds on the root crown just below the soil surface. By July, these ramets are 40 to 65cm tall. Nonflowering plants have from 1 to 4 ramets, and flowering plants have from 1 to 20 ramets. A single ramet will develop one or more inflorescence buds in late June. Flowering begins in late July, peaks in mid-August, and can continue until late August. The number of flowers per inflorescence varies from 40 to 495. Bumblebees, small bees, and syrphid flies have been observed visiting flowers. Leafy Prairie-Clover seeds ripen by early October and disperse from the erect dead ramets from late fall to early spring. Potential dispersal vectors include wind, gravity, birds, and small mammals. Dormant seeds are capable of forming a persistent seed bank (USFWS, 1996).

Current Stressors and Threats

- Residential and commercial development (particularly roadway construction)
- Power line maintenance
  The population located in Romeoville, Illinois is located within a maintained utility power transmission line and has the potential to be affected by powerline maintenance.
- Herbicide use
- Severe drought events
- Herbivory
- Succession to woody habitat (USFWS, 1996).

List of References

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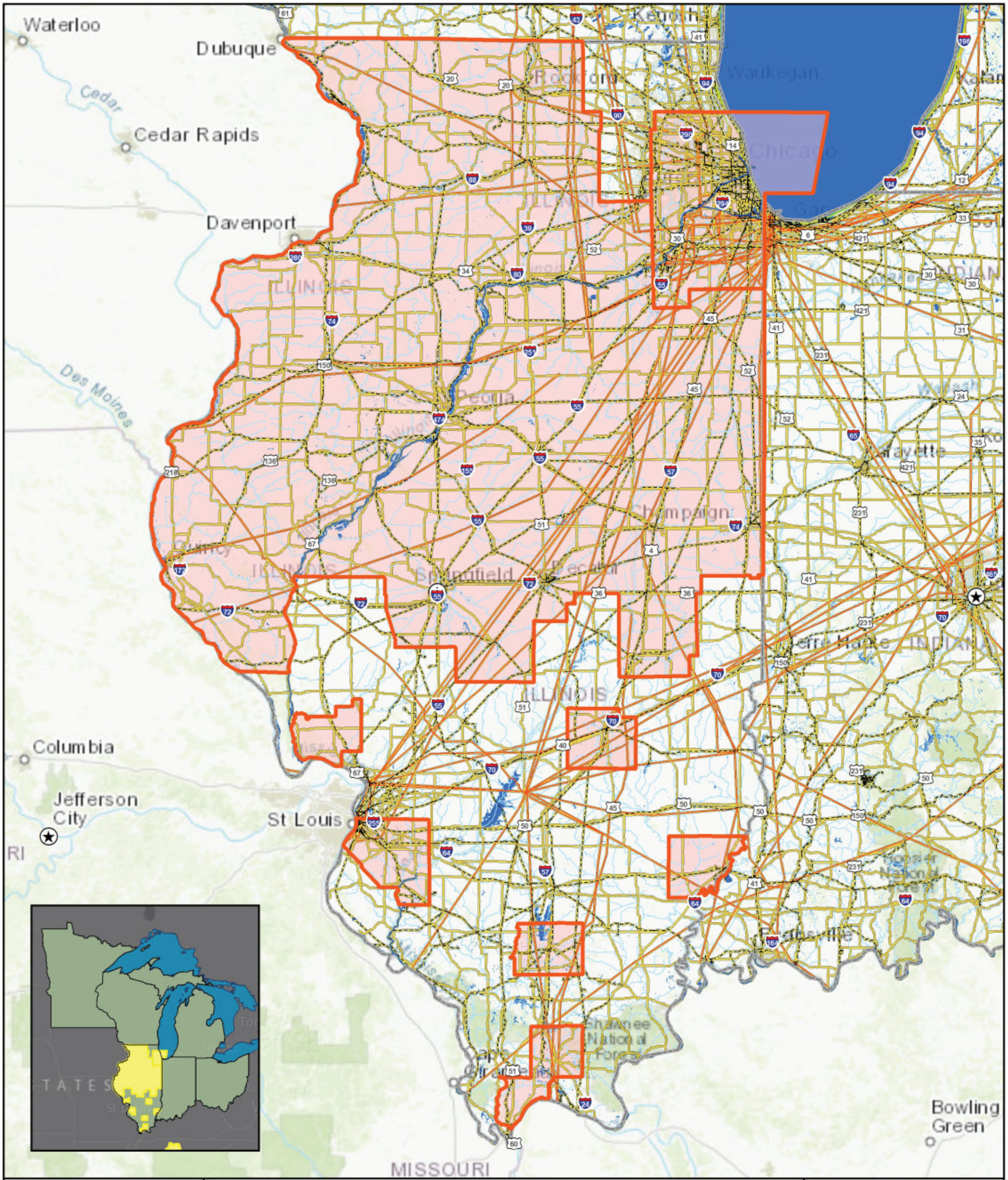

0 10 20 40 60
Miles
0 10 20 40 60 80
Kilometers

LEAFY PRAIRIE-CLOVER (*DALEA FOLIOSA*)
ACTION AREA OVERVIEW MAP

SCALE 1:3,800,000

Petroleum Pipeline	Commercial Navigable Waterway	🟩 1-Mile Coastal Inland Buffer
Major Road	Rivers & Streams	🟨 Action Area
Railroad	🟦 Lakes & Ponds	🟥 Leafy Prairie-clover (*Dalea foliosa*) Counties of Occurrence

N

Basemap courtesy of Esri.
Date: 5/25/2021
Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS
Projection: WGS 1984 Web Mercator

Leedy's Roseroot (*Rhodiola integrifolia* ssp*. leedyi*)

Federal Listing: Threatened
State Listing within the AA: Endangered in Minnesota

Species Description
Leedy’s Roseroot is a perennial member of the stonecrop (orpine) family, which have waxy leaves that enable them tolerate periods of water stress. Leedy's Roseroot has a relatively elongate, leafy stem. The closely-packed leaves arise directly from the main stem and are smooth, with irregularly toothed to toothless edges. Although they are succulent, they can appear quite limp in dry weather. Male and female flowers are borne on separate plants. The small 4- to 5-petaled flowers are arranged in dense heads at the end of the leafy stem. They vary in color from dark red to occasional yellow or oranges (USFWS, 2021).

Species Distribution
The Minnesota populations of *R. integrifolia* ssp. *leedyi* are found on shallow ledges on north-facing dolomite cliffs up to 30m (98ft) in height. Plants are restricted to crevices in maderate cliffs, a very specialized habitat of specific strata where groundwater seeps through the rock and is cooled by air coming from underground air passages in karst topography. This results in a constantly wet, dripping condition, an unusual product of a long geologic history (MNDNR, 2021).

In New York, this species occurs on cliffs along the western shore of Seneca Lake. And, similarly to the Minnesota populations, the one known population in South Dakota grows from rock fissures with seepage on a north-facing cliff (MNDNR, 2021).

Historically four populations from two counties were identified in Minnesota and include: Bear Creek Cliff and Deer Creek Cliff in Fillmore County and Simpson Cliff and Whitewater Wildlife Management Area in Olmsted County. Three populations in two counties were identified in New York and include: Glenora Cliff and Gelnora Falls in Yates County and Watkins Glen in Schuyler County (USFWS, 1998).

Currently Leedy's Roseroot is a cliffside wildflower, found today in only seven locations in three states. Four populations are found in Fillmore and Olmsted Counties, Minnesota. Two are in upstate New York, a large population on the shores of Seneca Lake and a single plant at Watkins Glen. In South Dakota the subspecies occurs on Black Hills National Forest on a cliff at approximately 7,000 feet above sea level (Custer and Pennington Counties) (USFWS, 2021).

Distribution within Action Area

- No new populations identified or reintroduced in Minnesota
- Fillmore County: Cliff Creek and Deer Creek
- Olmsted County: Simpson Cliff and Whitewater Wildlife Management Area

Critical Habitat
No critical habitat has been designated for Leedy’s Roseroot.

Life History
Flowering occurs in early June with bees and syrphus flies as primary pollinators. Seeds are winged and wind dispersed. Occasionally, seeds will germinate in their follicles and produce seedlings on the parent plant (USFWS, 1998).

Current Stressors and Threats
Leedy's Roseroot is a species whose rarity is caused more by its history, the special conditions of its unique cliffside habitat, and the infrequency of that habitat in the landscape than by direct habitat destruction (USFWS, 1993).

- Increased human activities
  Despite the fact that Leedy's Roseroot has probably been rare for thousands of years, increased human activities could degrade its habitat. Unlike species with a wider range of preferred living conditions, it has nowhere else to go if its cliffside habitat is destroyed. Although the steepness of the cliffs protects Leedy's Roseroot from most direct impacts, surface runoff from disturbed lands can dislodge plants or bury them during heavy rains and spring thaws. This impact is enhanced in areas where soil disturbance occurs at the top of the cliffs (USFWS, 1993). At one Minnesota site, erosion of a nearby trail has created a gully several feet deep. New York populations occur downhill from a number of lakeside homes. Tree cutting uphill of the plants, staircases and pipes to the lakeshore, and clearance of vegetation on the cliffs could have a negative impact on the plants (USFWS, 1993).
- Groundwater contamination and hydrologic changes
  In Minnesota ground water contamination or changes in ground water hydrology are the greatest threats to Leedy's Roseroot. Such changes could occur through misapplication of pesticides or synthetic fertilizers to nearby uplands or by use of sinkholes as dump sites. Groundwater flow regimes are poorly understood and it is unclear how close these activities would need to be to adversely affect the plants.

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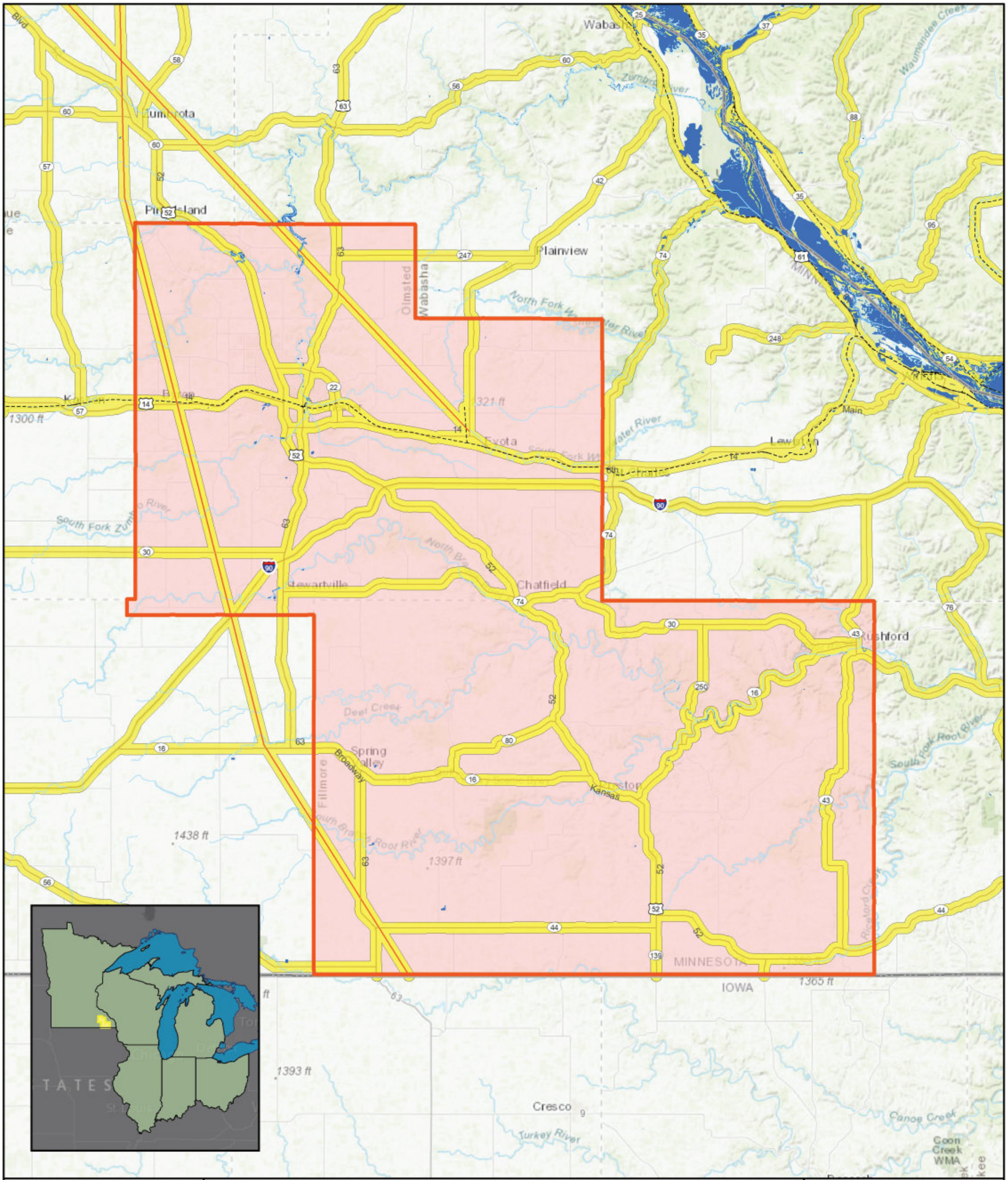

0 2 4 8 12
Miles
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Kilometers

LEEDY'S ROSEROOT (*RHODIOLA INTEGRIFOLIA SSP. LEEDYI*) ACTION AREA OVERVIEW MAP

SCALE 1:750,000

— Petroleum Pipeline	— Commercial Navigable Waterway	🟩 1-Mile Coastal Inland Buffer
— Major Road	— Rivers & Streams	🟨 Action Area
------ Railroad	🟦 Lakes & Ponds	▭ Leedy's Roseroot (*Rhodiola integrifolia ssp. leedyi*) Counties of Occurrence

N

Basemap courtesy of Esri.

Date: 5/25/2021

Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS

Projection: WGS 1984 Web Mercator

Mead's Milkweed (*Asclepias meadii*)

Federal Listing: Threatened
State Listing within the AA: Endangered in Illinois, Indiana, and Wisconsin

Species Description

Mead's Milkweed is readily distinguished from these and other species by a combination of smooth "stalkless" opposite leaves with a herringbone venation and a single nodding umbel consisting of large fragrant greenish-cream flowers. Immature plants may resemble those of other milkweeds or species in the related dogbane (Apocynaceae) family. Juvenile or seedling plants are often difficult to locate and identify due to their small stature and slender linear leaves (USFWS, 2003).

Mead's Milkweed usually begins its seasonal growth in mid to late April. It has a single slender unbranched stalk, 20 to 40cm high, without hairs but with a whitish waxy covering. The hairless leaves are opposite, broadly ovate, 2 to 3in (5 to 7.5cm) long, 3/8 to 2in (1 to 5cm) wide, with a whitish waxy covering. A solitary umbel at the top of the stalk has 6 to 15 greenish ivory/cream-colored flowers, which appear in late May and early June (USFWS, 2003).

Species Distribution

The primary habitat of Mead's Milkweed is mesic to dry mesic, upland tallgrass prairie, characterized by vegetation adapted for drought and fire. Mead's Milkweed populations are generally restricted to full sun in late-successional or virgin grassland; however, plants may also persist vegetatively in partial shade, such as in edges of glades or barrens that are being encroached upon by woody vegetation. Mead's Milkweed has also been found on glades or barrens. Populations in Kansas, Iowa, and Illinois have been classified as dry-mesic to mesic prairie. Populations in Missouri, however, have been classified as sandstone, chert, limestone/dolomite, or shale prairie with the exception of igneous glades in Iron and Reynolds counties. Southern Illinois sites are classified as sandstone barrens (USFWS, 2003).

The historical range includes Illinois, Indiana, Iowa, Kansas, Missouri and Wisconsin (USFWS, 2021). In 2003 Mead's Milkweed currently was known from 171 sites in 34 counties in eastern Kansas, Missouri, south-central Iowa, and southern Illinois. The majority of counties with extant populations were clustered within a 125 square mile area of eastern Kansas and southwest Missouri. Outside this area, populations are widely dispersed across 11 counties of northern Missouri, southeast Missouri, southwest Iowa and southern Illinois (USFWS, 2003).

Currently Mead's Milkweed has 330 known extant populations occurring in Illinois, Indiana, Iowa, Kansas, and Missouri, with the majority occurring in Kansas and Missouri. No extant populations were identified in Wisconsin (USFWS, 2013).

Distribution within Action Area

- Illinois: Shawnee Hills Region; 4 extant populations in Saline County. Three populations were introduced within the Grand Prairie Region, three within the Northeastern Morainal Region, and one within the Western Forest-Prairie Region.
- Indiana and Illinois: Grand Prairie Region; no extant populations identified. One population was introduced in the Northwestern Morainal Region.
- Wisconsin: Driftless Region; no extant populations identified; one historic record exists but population has not been relocated. Eleven populations have been introduced in the Till Plains Region (USFWS, 2013).

Critical Habitat

No critical habitat has been designated for Mead's Milkweed.

Life History

Mead’s Milkweed is a long-lived perennial rhizomatous herb that may persist indefinitely or until destroyed by chance impacts from animals or pathogens. Mead’s Milkweed persists in stable habitat of late-successional prairie. This species has low reproductive rates. Flowering occurs in late May in the south through early to mid-June in the north. Severe drought can cause loss of flowers or wilting and dying back of an entire plant. Pollinators include small bumblebees, and miner bees. Young green fruit pods appear by late June and reach their maximum length of 4 to 8cm by late August or early September. As these pods mature, they darken, and the hairy seeds borne within are mature by mid-October. Seeds are wind-dispersed (USFWS, 2003).

Current Stressors and Threats

- Habitat destruction
  The primary threat to Mead’s Milkweed is habitat destruction and alteration of tallgrass prairie due to intense agricultural use, urban growth, and urban residential, industrial, and commercial development, recreational use of sites, and hay mowing (USFWS, 2003).

List of References

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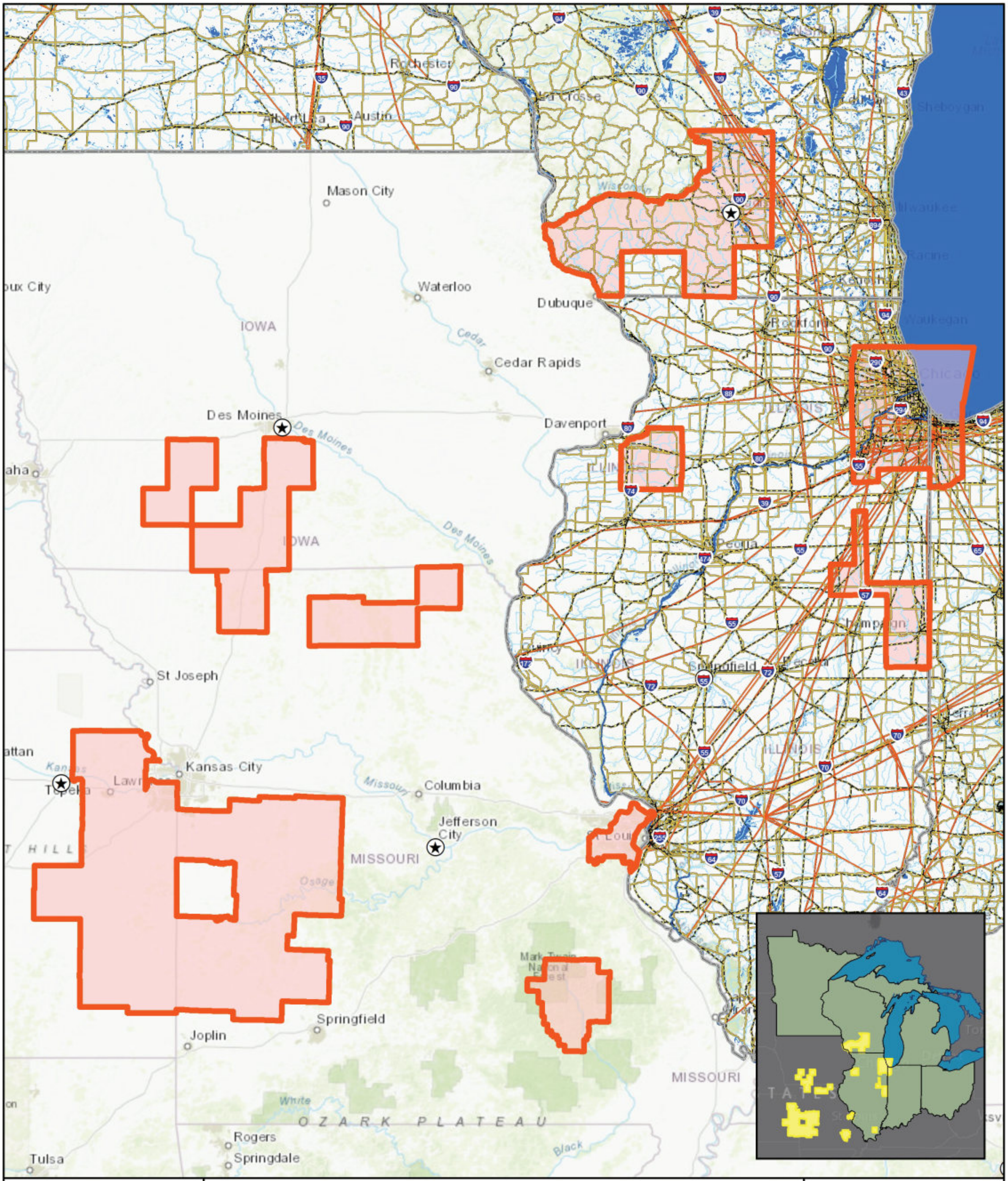

MEAD'S MILKWEED (*ASCLEPIAS MEADII*)
ACTION AREA OVERVIEW MAP

SCALE 1:5,500,000

- Petroleum Pipeline
- Major Road
- Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- Lakes & Ponds
- 1-Mile Coastal Inland Buffer
- Action Area
- Mead's Milkweed (*Asclepias meadii*) Counties of Occurrence

N

Basemap courtesy of Esri. Date: 5/25/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS Projection: WGS 1984 Web Mercator

Michigan Monkey-Flower (*Mimulus michiganensis*)

Federal Listing: Endangered
State Listing within the AA: Endangered in Michigan

Species Description

Michigan Monkey-Flower is a member of the Scrophulariaceae (snapdragon family) and is an endemic variety of a widespread and diverse complex of yellow monkey-flowers. Michigan Monkey-Flower is an aquatic to semi-aquatic perennial plant characterized by its mat-forming, clonal growth habit. The stems, which range to about 40cm (15.7in) or more in length, are lax and reclining at their base, rooting freely at lower leaf nodes to produce numerous additional shoots via stolons. Propagation in this manner often results in the production of clones of up to several hundred stems or more. The broadly ovate to roundish, opposite leaves are inconspicuously to coarsely sharp-toothed and have leafstalks that are usually shorter than the blades. Upward the leaves become somewhat reduced and shorter stalked. Bright yellow, snapdragon-like, tubular flowers are produced from the upper leaf axils, borne on slender pedicels that may be longer than the leaves (USFWS, 1997).

Species Distribution

Michigan Monkey-Flower is restricted to cold, alkaline spring seepages and streams, usually in association with northern white cedar (*Thuja occidentalis*) swamps occurring along current or post-glacial Great Lakes shorelines. It frequently occurs in northern white cedar swamps formed in drainages found at the base of relatively steep morainic slopes and bluffs (USFWS, 1997).

Historically, Michigan Monkey-Flower was known from only 15 extant occurrences and is distributed principally within Michigan's Mackinac Straits region in Charlevoix, Cheboygan, Emmet, and Mackinac Counties, with outlying localities to the south in Benzie and Leelanau Counties (USFWS, 1997). The five-year review in 2011 identified three additional occurrences for a total of 19 (USFWS, 2011), and four new occurrences were discovered subsequent to the 2011 status review (USFWS, 2018).

Distribution within Action Area

- Michigan Counties listed in ECOS (USFWS, 2021): Benzie, Charlevoix, Cheboygan, Emmet, Leelanau, Mackinac
- Benzie: 1 occurrence
- Charlevoix: 4 occurrences
- Cheboygan: 5 occurrences
- Emmett: 4 occurrences
- Leelanau: 3 occurrences
- Mackinac: 5 occurrences
- One occurrence occurs within both Cheboygan and Emmett Counties (USFWS, 2018)
- Reintroductions since 2011 Review: Harbor Springs and Oden Fish Hatchery (Emmett County); Martin Point North and Point La Par South (Charlevoix County)

Critical Habitat

No critical habitat has been designated for Michigan Monkey-Flower.

Life History

Flowering occurs primarily from approximately mid-June to August, extending occasionally into October. It flowers most abundantly when growing in full sunlight, although it appears to persist as mostly sterile colonies when growing under heavy tree canopy cover. The two-lipped flowers range from 16 to 27mm (0.6 to 1.1in) in length and have an irregularly red-spotted lower lip and tube. The three-lobed, heavily-bearded lower lip forms a wide landing platform for insect pollinators. Fruit, which is seldom produced, consists of an oblong, pointed capsule, 8 to 10mm long, containing numerous oval seeds with longitudinal striations (USFWS, 1997).

Current Stressors and Threats

- Habitat destruction/modification
  The greatest threat to Michigan Monkey-Flower is direct destruction and modification of the species' essential habitat. Development, both inland and along Great Lakes shores, has probably resulted in local extinctions such as at Mullet Lake and portions of Burt Lake.
- Hydrological disruptions
- Overcollection (USFWS, 1997)
- Competition from invasive species

List of References

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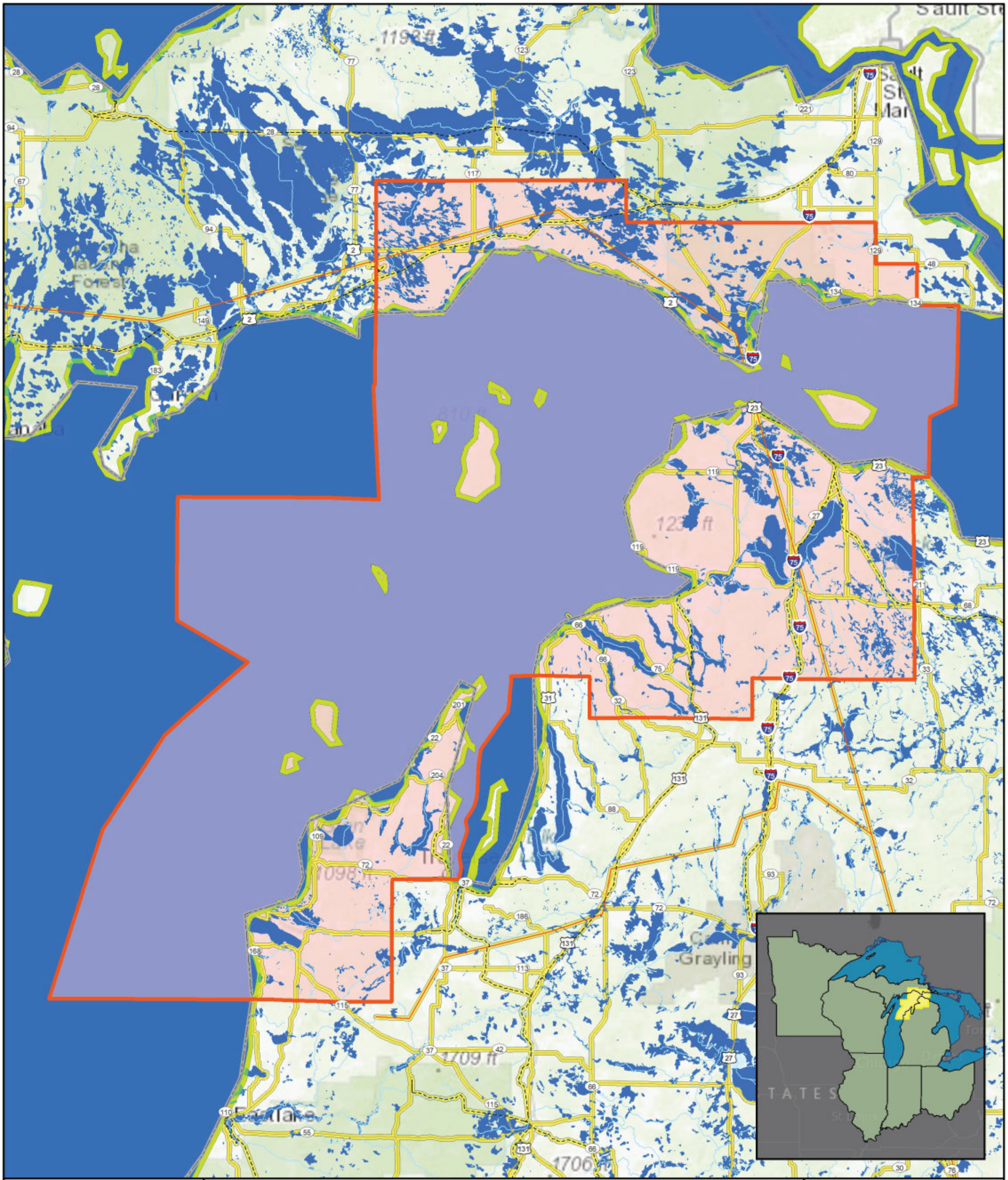

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Miles
0 4.75 9.5 19 28.5 38
Kilometers

MICHIGAN MONKEY FLOWER (*MIMULUS MICHIGANENSIS*)
ACTION AREA OVERVIEW MAP

SCALE 1:1,756,588

- Petroleum Pipeline
- Major Road
- ------ Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- ▬ Lakes & Ponds
- 🟩 1-Mile Coastal Inland Buffer
- 🟨 Action Area
- 🟥 Michigan Monkey Flower (*Mimulus michiganensis*) Counties of Occurrence

N

Basemap courtesy of Esri.

Date: 5/25/2021

Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS

Projection: WGS 1984 Web Mercator

Minnesota Dwarf Trout Lily (*Eythronium propullans*)

Federal Listing: Endangered
State Listing within the AA: Endangered in Minnesota

Species Description

The Minnesota Dwarf Trout Lily is an herbaceous, spring blooming, perennial member of the lily family (Liliaceae). Leaves are slightly mottled and are paired in flowering plants but single in vegetative plants (Recovery Plan). The blooming plant is readily identified by the very small size of its flowers. Flowers of the Dwarf Trout Lily are about the size of a dime or less, pale pink, with a variable number of perianth parts ("petals"). Most members of the lily family have 6 "petals", but Dwarf Trout Lilies may have four, five or six (USFWS, 2021).

Species Distribution

The Minnesota Dwarf Trout Lily occurs mostly on the lower parts of wooded north-facing slopes 15 to 27m high, and on adjacent floodplains. Sites are associated either with streams or abandoned stream channels. This species appears to grow best in habitats with a surface layer of rich, black, well-aerated soil (USFWS, 1987).

The Minnesota Dwarf Trout Lily is a forest wildflower found in Rice and Goodhue Counties, Minnesota. Because it is known only from this small area the Dwarf Trout Lily is considered a Minnesota "endemic" - i.e. a species that grows in Minnesota and nowhere else on earth (USFWS, 2021). Historically, the Minnesota Dwarf Trout Lily occurred in colonies that range in size from one or two scattered plants to more than 500 individuals. Plants mainly occur at elevations between 960 and 1000 feet above sea level (USFWS, 1987).

Distribution within Action Area

- Restricted to portions of the Straight River, Cannon River, Little Cannon River, Zumbro River, and Prairie Creek watersheds in Minnesota.
- In 2011 Minnesota DNR recognized 40 occurrences of the Minnesota Dwarf Trout Lily
- Counties include: Rice, Goodhue, and Steele (USFWS, 2011)

Critical Habitat

No critical habitat has been designated for Minnesota Dwarf Trout Lily.

Life History

The Minnesota Dwarf Trout Lily is a spring ephemeral, flowering from late April to mid-May. Below-ground perennial bulbs are sustained by the annual formation of new bulbs. Vegetative production of a new individual is accomplished by the formation of a new bulb at the tip of a runner that arises from the underground stem of flower plants. This can result in a new plant being produced at distances as great as 3.5cm from the parent plant. Flowers are available for pollination for 6 to 7 hours per day and are principally visited by a small bee (*Andrena carlini*). Other species of bees, flies, and beetles infrequently visit the Minnesota Dwarf Trout Lily. The Minnesota Dwarf Trout Lily does not readily self-pollinate, and typically only produces seeds when cross pollinated with the white trout lily (*E. albidum*). Sexual reproduction is possible but is a likely rare, periodic event (USFWS, 1987).

Current Stressors and Threats

- Habitat destruction/modification
  The primary threat to the Minnesota Dwarf Trout Lily is destruction, modification or curtailment of its habitat or range. High populations of white-tailed deer tend to graze on Minnesota Dwarf Trout Lily reducing the number of individuals at that occurrence. Increased flooding and erosion, especially due to development activities, may have significant impacts on population size.

- Invasive species control
- Woody shrub succession
- Non-native earthworms

List of References

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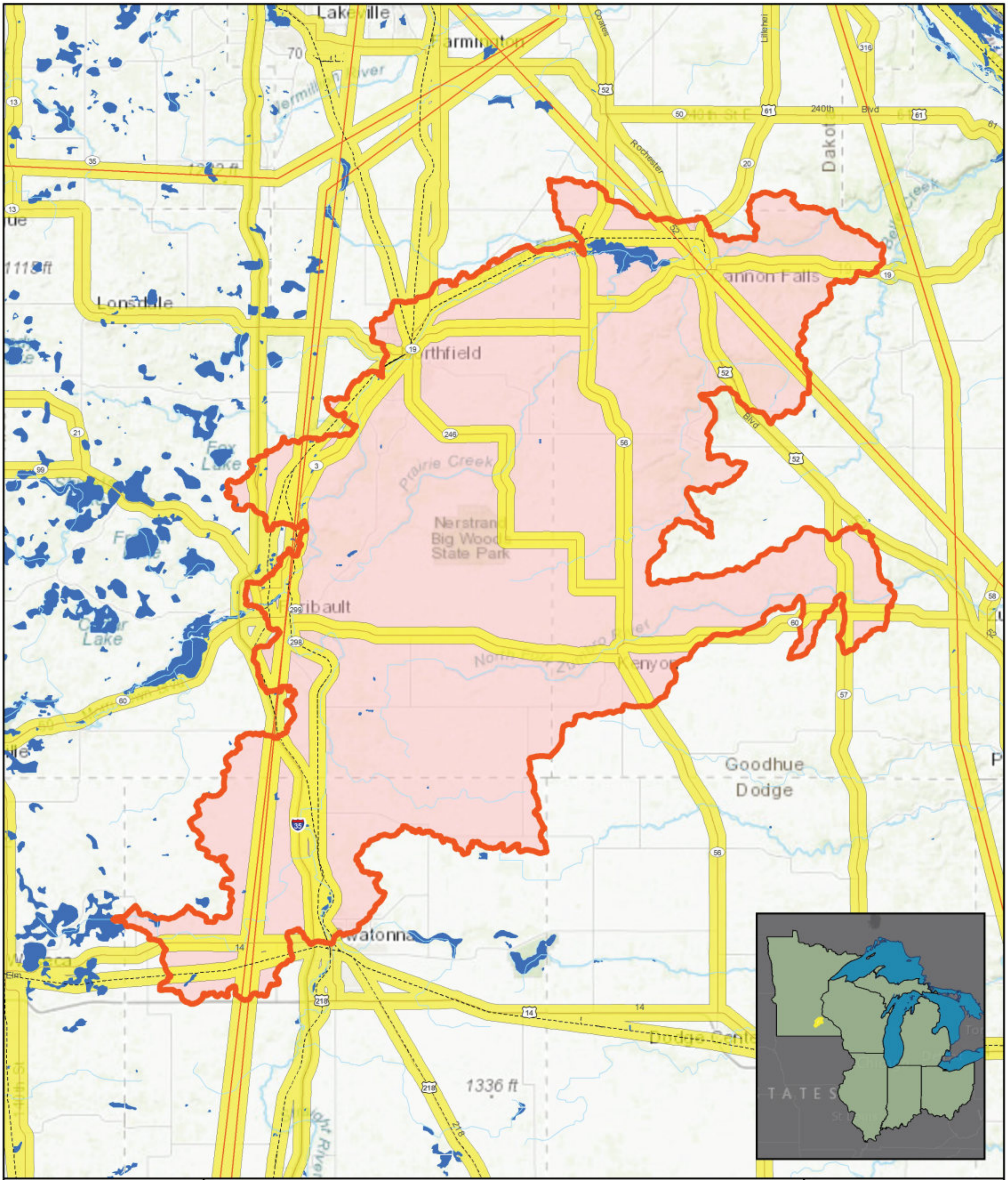

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Miles
0 1.252.5 5 7.5 10
Kilometers

MINNESOTA DWARF TROUT LILY (*ERYTHRONIUM PROPULLANS*) ACTION AREA OVERVIEW MAP

SCALE 1:500,000

- Petroleum Pipeline
- Major Road
- Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- Lakes & Ponds
- 1-Mile Coastal Inland Buffer
- Action Area
- Minnesota Dwarf Trout Lily (*Erythronium propullans*) Counties of Occurrence

N

Basemap courtesy of Esri. Date: 5/25/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS Projection: WGS 1984 Web Mercator

Northern Wild Monkshood (*Aconitum noveboracense*)

Federal Listing: Threatened
State Listing within the AA: Endangered in Ohio; Threatened in Wisconsin

Species Description

Northern Wild Monkshood is a perennial herb arising from short tuberous roots with basal cauline leaves that are palmately cleft or dissected with usually blue to whiteish flowers that are borne in a terminal raceme or panicle (USFWS, 1983). The flowers are about 1in in length, and a single stem may have many flowers. Stems range from about 1 to 4ft in length. The leaves are broad with coarse, toothed lobes (USFWS, 2007).

Species Distribution

Northern Wild Monkshood is typically found on shaded to partially shaded cliffs, algific talus slopes, or on cool, streamside sites. These areas have cool soil conditions, cold air drainage, or cold groundwater flowage. On algific talus slopes, these conditions are caused by the outflow of cool air and water from ice contained in underground fissures. These fissures are connected to sinkholes and are a conduit for the air flows (USFWS, 2007). In New York, Northern Wild Monkshood can also be found in semi-shaded seepage springs at high elevation headwaters in the stream-side crevices downstream (USFWS, 1983).

Historical ranges spanned northeastern Iowa and southwestern Wisconsin to northeastern Ohio and the Catskill Mountains of New York. In 1983 Northern Wild Monkshood was restricted to 20 extant sites in three distinct regions: in and adjacent to the unglaciated (Wisconsin epoch) portion of Iowa (Allamakee, Clayton, Dubuque, Jackson, and Delaware Counties) and Wisconsin (Grant, Richland, Sauk, and Vernon Counties), the northeastern Ohio glaciated area (Summit and Portage Counties) and the glaciated area of the Catskill Mountains of New York (Chenango and Ulster County) (USFWS, 1983).

Distribution within Action Area

ECOS lists the following counties with occurrences (USFWS, 2021):

- Ohio: Hocking, Portage, Summit
- Wisconsin: Grant, Monroe, Richland, Sauk, Vernon

Critical Habitat

No critical habitat has been designated for Northern Wild Monkshood.

Life History

Northern Wild Monkshood is a perennial and reproduces from both seed and small tubers. The flowers bloom between June and September and are pollinated when bumblebees pry open the blossom to collect nectar and pollen (USFWS, 2007). Fruiting occurs August through late September in Wisconsin (WIDNR, 2021) and late October in Ohio (ODNR, 2021).

Current Stressors and Threats

- Dam and reservoir construction (hydrologic alteration)
- Road construction maintenance (de-icing agents, herbicide use)
- Power line construction and maintenance
- Logging and quarrying
- Grazing
- Development of recreational foot trails
- Urban and residential development
- Overcollection for scientific use (USFWS, 1983).

List of References

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Miles
0 15 30 60 90 120
Kilometers

NORTHERN WILD MONKSHOOD (*ACONITUN NOVEBORACENSE*) ACTION AREA OVERVIEW MAP

SCALE 1:6,500,000

— Petroleum Pipeline
— Major Road
------ Railroad
— Commercial Navigable Waterway
— Rivers & Streams
■ Lakes & Ponds
■ 1-Mile Coastal Inland Buffer
■ Action Area
□ Northern Wild Monkshood (*Aconitun noveboracense*) Counties of Occurrence

N

Basemap courtesy of Esri. Date: 5/25/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS Projection: WGS 1984 Web Mercator

Pitcher’s Thistle (*Cirsium pitcheri*)

Federal Listing: Threatened
State Listing within the AA: Endangered in Indiana; Threatened in Illinois, Michigan, and Wisconsin

Species Description

Pitcher’s Thistle is a monocarpic (flowers and sets seed only once), perennial, herbaceous plant, generally flowering after a 5- to 8-year juvenile stage. The stems and leaves of juveniles and adults are woolly-white, and the leaves are deeply pinnatifid with the lobes less than 1cm wide and up to 4cm long. Minute spines are concentrated along the edge of the leaf at its base, with a few spines between the lobes of the distal leaf margins. The flowering stems are up to 1m tall and have several to a dozen widely scattered leaves. Individuals typically have a single branching flowering stem with terminal and axillary flowering heads of a cream or pinkish color. Juveniles and adults have a taproot that may reach 2m in length (USFWS, 2002).

Species Distribution

Pitcher’s Thistle is endemic to the beaches and grassland dunes of Lakes Michigan, Superior, and Huron. It is found most frequently in the near-shore plant communities, although it occurs in all non-forested areas of Great Lakes dune systems. Pitcher’s Thistle colonizes patches of open, windblown areas of the landscape, and gradually declines locally as the density of vegetation and ground litter increases through plant succession. This species is dependent on continually colonizing the mosaic of open habitats within the Great Lakes dunes, and it is patchily distributed with varying population sizes in all open zones of the dunes vegetation (USFWS, 2002).

The majority of known sites of Pitcher’s Thistle occur along the shores of Lake Michigan. The species ranges from the north shore of Lake Superior south to Indiana, and formerly occurred in northern Illinois, where it is has been experimentally reintroduced. Distribution of the species extends along the Lake Michigan shoreline in Wisconsin. In the east it ranges through northern Lake Huron to the Manitoulin Island archipelago and southern Georgian Bay in Ontario. Pitcher’s Thistle extends as far south as Lambton County, Ontario, Canada on Lake Huron, as indicated by pre-1964 collections for two localities (USFWS, 2002).

Distribution within Action Area

Of the 193 extant occurrences (EO) in the U.S., 169 EO (including PO) occur in Michigan (9 are historic) (MNFI, 2021). Among the remaining 24 extant EO outside of Michigan, 10, including 1 reintroduced population, occur in Wisconsin; 13, including 2 reintroduced populations are in Indiana; and 1 reintroduced population occurs in Illinois. Aside from the reintroduced populations and new occurrences in Michigan (4 in the Upper Peninsula and 2 in the northern Lower Peninsula), spatial distribution of Pitcher’s Thistle has not changed since 2002 (USFWS, 2010). The overall species distribution remains similar to the 2010 five-year review (USFWS, 2018).

ECOS lists the following counties with occurrences (USFWS, 2021):

- Illinois: Lake
- Indiana: Lake and Porter
- Michigan: Alcona, Alger, Allegan, Alpena, Antrim, Arenac, Benzie, Berrien, Charlevoix, Cheboygan, Chippewa, Delta, Emmet, Grand Traverse, Huron, Iosco, Leelanau, Mackinac, Manistee, Mason, Muskegon, Oceana, Ottawa, Presque Isle, Schoolcraft, and Vanburen
- Wisconsin: Door, Manitowoc, and Sheboygan

Critical Habitat

No critical habitat has been designated for Pitcher’s Thistle.

Life History

Seed dormancy is broken by cold, moist stratification, with seed germination occurring in May and June. Seedlings produce 1 to 6 leaves in the first season. Juveniles typically consist of one rosette, unless they are grazed, trampled or buried where they may develop multiple rosettes. Juveniles may remain dormant for one or two years as a result of drought. The chances of juvenile mortality decrease as they increase in size. Age of reproduction ranges from 5 to 8 years and appears to be correlated with habitat. Pitcher's Thistle blooms from May to September, with the date of peak anthesis occurring later with increasing latitude (mid-July at Sleeping Bear Dunes). Flowering is determinant and commences from the terminal head and proceeds downward. Smaller axillary flowering head buds located below the flowering inflorescence may bloom late in the season or if distal heads are damaged or removed. The primary pollinators are bees (USFWS, 2002).

Seed dispersal commences in late July at the northern limits of its range but can occur from June to August. Seeds have a long (up to 25mm) loosely attached pappus. Primary seed dispersal is through individual seeds blowing from the inflorescence head or by the whole plant and heads falling to the ground at the end of the flowering season. Maximum observed primary dispersal distances range from 1.83 to 4.00m based on seed locations and on seedling distributions around previous year's adult plants. Secondary dispersal is effected by wind blowing seed and seed heads across the sand, snow or water surface (USFWS, 2002).

Current Stressors and Threats

- Habitat destruction
  Around ten percent of Pitcher's Thistle populations have been lost, modified or curtailed through habitat destruction, overuse and repeated disturbance. Some populations have also been lost or negatively impacted through the alteration of local dune geomorphic processes, which prevents the creation and maintenance of Pitcher's Thistle habitat. In addition, shoreline stabilization projects such as sea walls, rip rap, and planting of beach grass, northern white cedar, and some exotic species also alters dune building processes and may decrease habitat available to Pitcher's Thistle (USFWS, 2010).
- Non-native species
  Additionally, the introduction of non-native species for biological control may pose a substantial risk. Several moth species feed on native thistles and are also the adopted host of common bull thistle. Increased populations of bull thistle in the vicinity of Pitcher's Thistle could lead to feeding damage. The flowerhead weevil was released in Walworth and Waukesha Counties in Wisconsin to control musk thistles. If this weevil spreads to the Pitcher's Thistle range, it may pose a serious threat to seed production and regeneration (USFWS, 2010).

List of References

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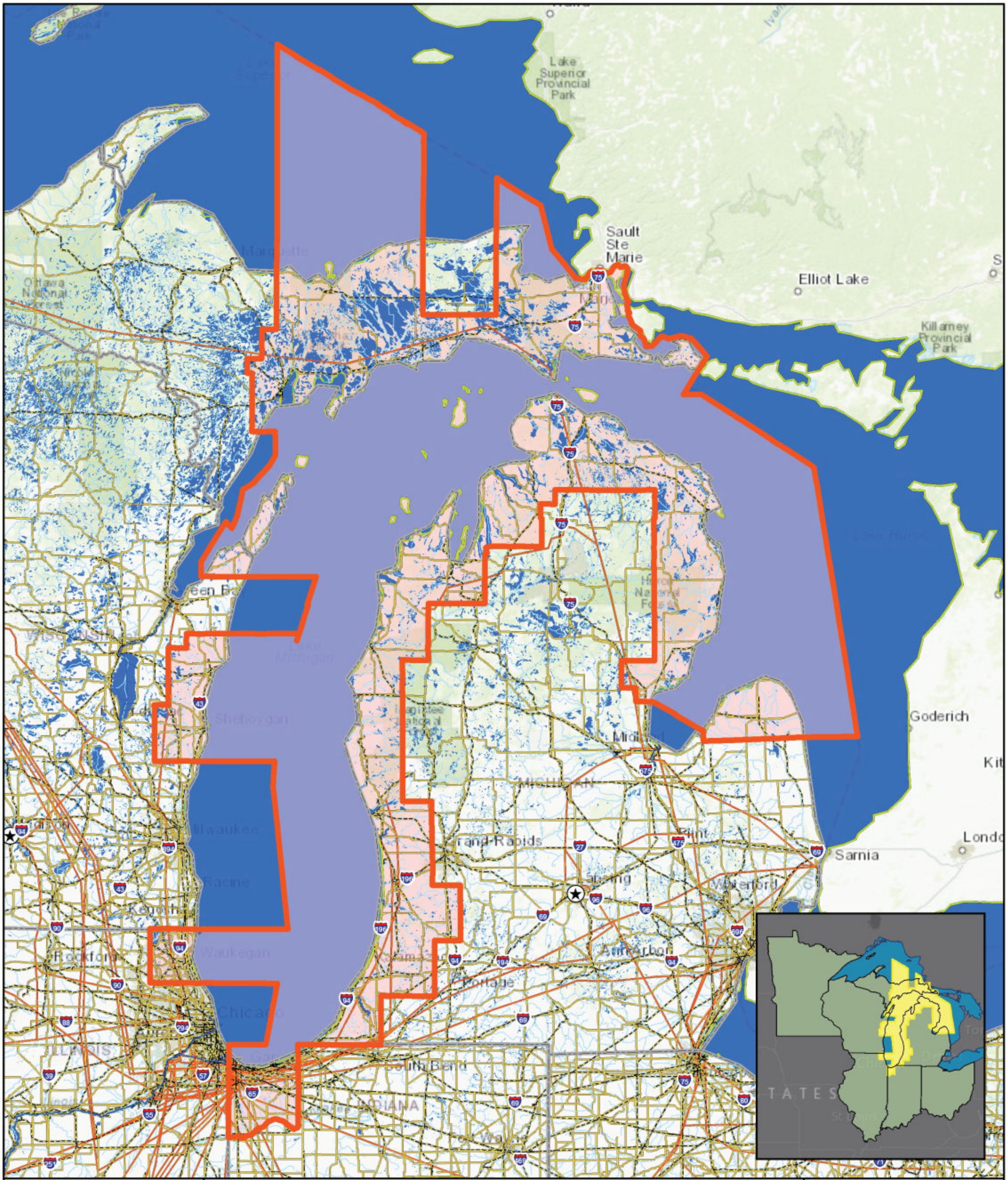

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Miles
0 12.525 50 75 100
Kilometers

PITCHER'S THISTLE (*CIRSIUM PITCHERI*) ACTION AREA OVERVIEW MAP

SCALE 1:5,000,000

- Petroleum Pipeline
- Major Road
- Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- Lakes & Ponds
- 1-Mile Coastal Inland Buffer
- Action Area
- Pitcher's thistle (*Cirsium pitcheri*) Counties of Occurrence

N

Basemap courtesy of Esri.

Date: 5/25/2021

Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS

Projection: WGS 1984 Web Mercator

Prairie Bush-Clover (*Lespedeza leptostachya*)

Federal Listing: Threatened
State Listing within the AA: Endangered in Illinois and Wisconsin; Threatened in Minnesota

Species Description

Also known as slender-leaved bush clover, Prairie Bush-Clover has a clover-like leaf comprised of three leaflets about an inch long and a quarter inch wide. Flowering plants are generally between nine and eighteen inches tall with the flowers loosely arranged on an open spike. The pale pink or cream-colored flowers bloom in mid-July. The entire plant has a grayish-silver sheen. The showy pink flowers of Prairie Bush-Clover are less often seen than the silvery-green pods because of the plant's short blooming season and its ability to produce pods directly from flowers that never open (USFWS, 2021).

Species Distribution

Prairie Bush-Clover is endemic to midwestern prairies. Habitats are usually north-facing slopes of 10-15° and with fine silty loam, fine sandy loam or clay loam. Specifically, the Des Moines River basin and the Little Sioux basin seem to be the “core” area for this species and are the location of nine of the thirteen Iowa populations and nine of the twelve Minnesota populations. Additionally, Prairie Bush-Clover has been identified on margins of bedrock outcrops specifically in Cottonwood and Morton Counties, Minnesota (USFWS, 1988).

Historic records include 27 counties in Illinois, Iowa, Minnesota, and Illinois. The history of subsequent collections and sightings of the species suggests that the Prairie Bush-Clover has always been found more often in Iowa than the other three states (USFWS, 1988).

In 1988 Prairie Bush-Clover was known from 36 sites in 24 counties in northern Illinois, Iowa, southern and western Wisconsin, and southern Minnesota (USFWS, 1988).

Distribution within Action Area

The majority of Minnesota populations of Prairie Bush-Clover occur in prairies that have been or are presently used as pasture (MNDNR, 2021).

ECOS lists the following counties with occurrences (USFWS, 2021):

- Illinois: Cass, Champaign, Cook, DuPage, Fayette, Jo Daviess, Lee, McHenry, Ogle, and Winnebago
- Minnesota: Brown, Cottonwood, Dakota, Dodge, Goodhue, Jackson, Martin, Mower, Nobles, Olmsted, Redwood, Renville, Rice, and Rock
- Wisconsin: Dane, Grant, Green, Pierce, Rock, and Sauk

Critical Habitat

No critical habitat has been designated for Prairie Bush-Clover.

Life History

Prairie Bush-Clover is a perennial species. Plants reach maturity in approximately 5 years or more, and mature plants have been observed to flower repeatedly over four seasons. It is estimated that individual plants fequently live 10 years or more. Established plants typically send up a single stem from each root, though they may occasionally produce 2 or 3 stems. Flowering begins in mid-July and continues into early September. Two flower types are produced chasmogamous (potentially outcrossing) and cleistogamous (obligately self-pollinating). Both flower types can be produced on a single plant, or a plant may bear all cleistogamous flowers. Pollinators are unknown. Each plant produces as many as 560 pods with an average of 235 pods per plant. Seed production begins in late August through early October. Seed production is much lower compared to pod production. It is possible seeds persist in the seed bank for a few years, and seed germination typically begins in May and continues through July (USFWS, 1988).

Current Stressors and Threats

- Habitat loss and degradation (MNDNR, 2021)
- Agriculture (row crop conversion, livestock grazing, herbicides)
- Rural residential development
- Insect and mammal herbivory
- Woody succession (USFWS, 1988)

List of References

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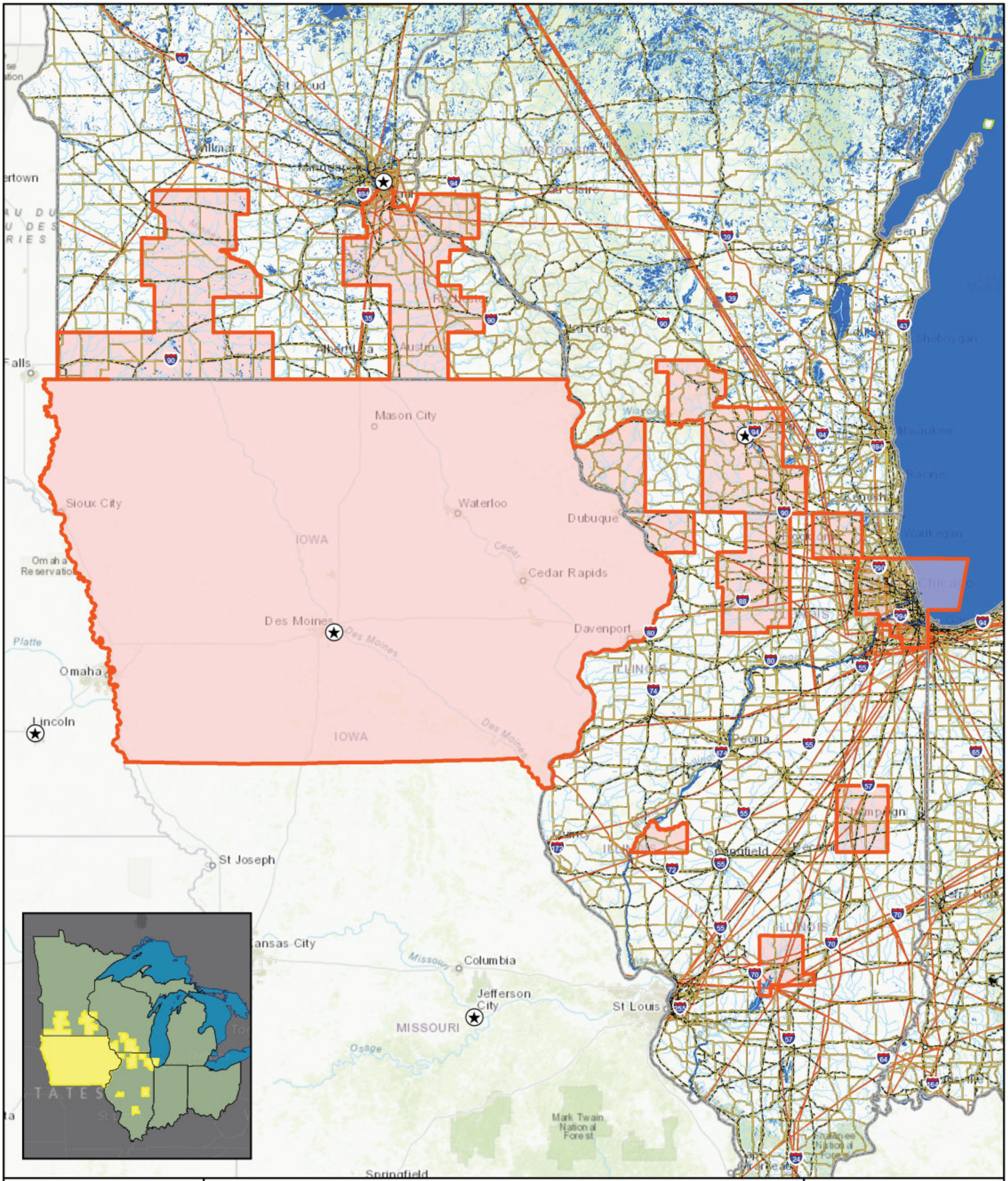

PRAIRIE BUSH-CLOVER (*LESPEDEZA LEPTOSTACHYA*) ACTION AREA OVERVIEW MAP

SCALE 1:6,000,000

Petroleum Pipeline
Major Road
Railroad
Commercial Navigable Waterway
Rivers & Streams
Lakes & Ponds
1-Mile Coastal Inland Buffer
Action Area
Prairie Bush-clover (*Lespedeza leptostachya*) Counties of Occurrence

N

Basemap courtesy of Esri.
Date: 5/25/2021
Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS
Projection: WGS 1984 Web Mercator

Short’s Bladderpod (*Physaria globosa*)

Federal Listing: Endangered
State Listing within the AA: Endangered in Indiana

Species Description

Short’s Bladderpod is an upright biennial or perennial (lives for 2 years or longer) with several stems, some branched at the base, reaching heights up to 50cm (20in), and which are leafy to the base of the inflorescence (a group or cluster of flowers arranged on a stem that is composed of a main branch or a complicated arrangement of branches). The basal leaves, borne on short petioles (stalks) are 2.5 to 5cm (1 to 2in) in length and 0.5 to 1.5cm (0.2 to 0.6in) wide, obovate (egg-shaped and flat, with the narrow end attached to the stalk) or oblanceolate (with the widest portion of the leaf blade beyond the middle) in shape, with a smooth or slightly wavy margin, and gray-green in color due to a layer of dense hairs. Leaves are gradually reduced in size and petiole length higher up the stem. Numerous flowers are borne on a raceme (elongate, spike-shaped inflorescence to which individual flowers are attached by slender pedicels, or stalks, which in Short’s Bladderpod are longer than the flowers). The yellow flowers are composed of four spoon-shaped petals, 0.4 to 0.7cm (0.16 to 0.28in) long, with a nectary at the base of each petal. The fruit is globose in shape and lightly beset with stellate (star-shaped) hairs, but becoming smooth with time, and typically contains one to four seeds, less often five (USFWS, 2017a).

Species Distribution

Short’s Bladderpod typically grows on steep, rocky, wooded slopes and talus areas. It also occurs along tops, bases, and ledges of bluffs and infrequently on sites with little topographic relief. The species usually is found in these habitats on south- to west-facing slopes near rivers or streams, and most populations are closely associated with calcareous outcrops. The most vigorous and stable occurrences are found in sites with a relatively open overstory canopy. The remaining populations of Short’s Bladderpod are in many cases small, isolated, and have limited potential for recolonization should they be extirpated (USFWS, 2017b).

Historically, Short’s Bladderpod is known from 55 occurrences that had been verified and tracked in NHP databases (USFWS, 2017a). As of 2016 there were 10 extant occurrences in Kentucky, 20 in Tennessee, and 1 in Posey County, Indiana, for a total of 31 extant occurrences range-wide (USFWS, 2017a, 2017c).

Distribution within Action Area

Posey County in southwestern Indiana is the only reported occurrence of Short’s Bladderpod (USFWS, 2021). Less than 1,000 individuals are known at this location along Bonebank Road (USFWS, 2017a).

Critical Habitat

There is final critical habitat for Short’s Bladderpod (79 FR 50989).

The Endangered Species Act and its implementing regulations require identification of the physical or biological features essential to the conservation of Short’s Bladderpod in areas occupied at the time of listing, focusing on the features’ primary constituent elements (PCEs). PCEs are those specific elements of the physical or biological features that provide for a species’ life-history processes and are essential to the conservation of the species. Based on our current knowledge of the physical or biological features and habitat characteristics required to sustain the species’ life-history processes, the PCEs for Short’s Bladderpod are:

(1) Bedrock formations and outcrops of calcareous limestone, sometimes with interbedded shale or siltstone, in close proximity to the mainstem 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 Short's Bladderpod.

The Service designates critical habitat based on availability of the PCEs for a given species, delineating those areas determined to be essential for the species' conservation. The Service designated approximately 373 hectares (ha) (925.5 acres (ac)) of critical habitat for Short's Bladderpod, distributed among 20 units in Posey County, Indiana; Clark, Franklin, and Woodford Counties, Kentucky; and Cheatham, Davidson, Dickson, Jackson, Montgomery, Smith, and Trousdale Counties, Tennessee (79 FR 50989). There are 20 critical habitat areas that constitute our best assessment of areas that meet the definition of critical habitat for Short's Bladderpod, which included all locations that the species was known to occupy at the time it was listed endangered (USFWS, 2017a).

Life History

Short's Bladderpod is a biennial or perennial that typically flowers and produces seed during the months of March through June. Observed pollinators include mining bees (*Andrena* sp.), two species of dipterans (*Nemotelus bruesii*, *Toxomerus geminatus*) and four species of hymenopterans (bees; *Lasioglossum illinoense*, *L. versatus*, *Halictus ligatus*, *Augochlorella striata*). Timing of seed germination is not currently known, but it is possible that seeds could germinate in the fall and form rosettes over winter, germinate in spring when conditions become favorable, or exhibit either phenology depending upon the dormancy status of individual seeds and variation in seasonal climatic conditions (USFWS, 2017a).

Current Stressors and Threats

- Habitat loss/degradation
  The main causes for habitat degradation or loss include future construction and ongoing maintenance of transportation rights-of-way; prolonged inundation and soil erosion due to flooding and water level manipulation, overstory shading due to forest succession, and competition from invasive plant species (USFWS, 2017b).
- Dynamics of small populations

List of References

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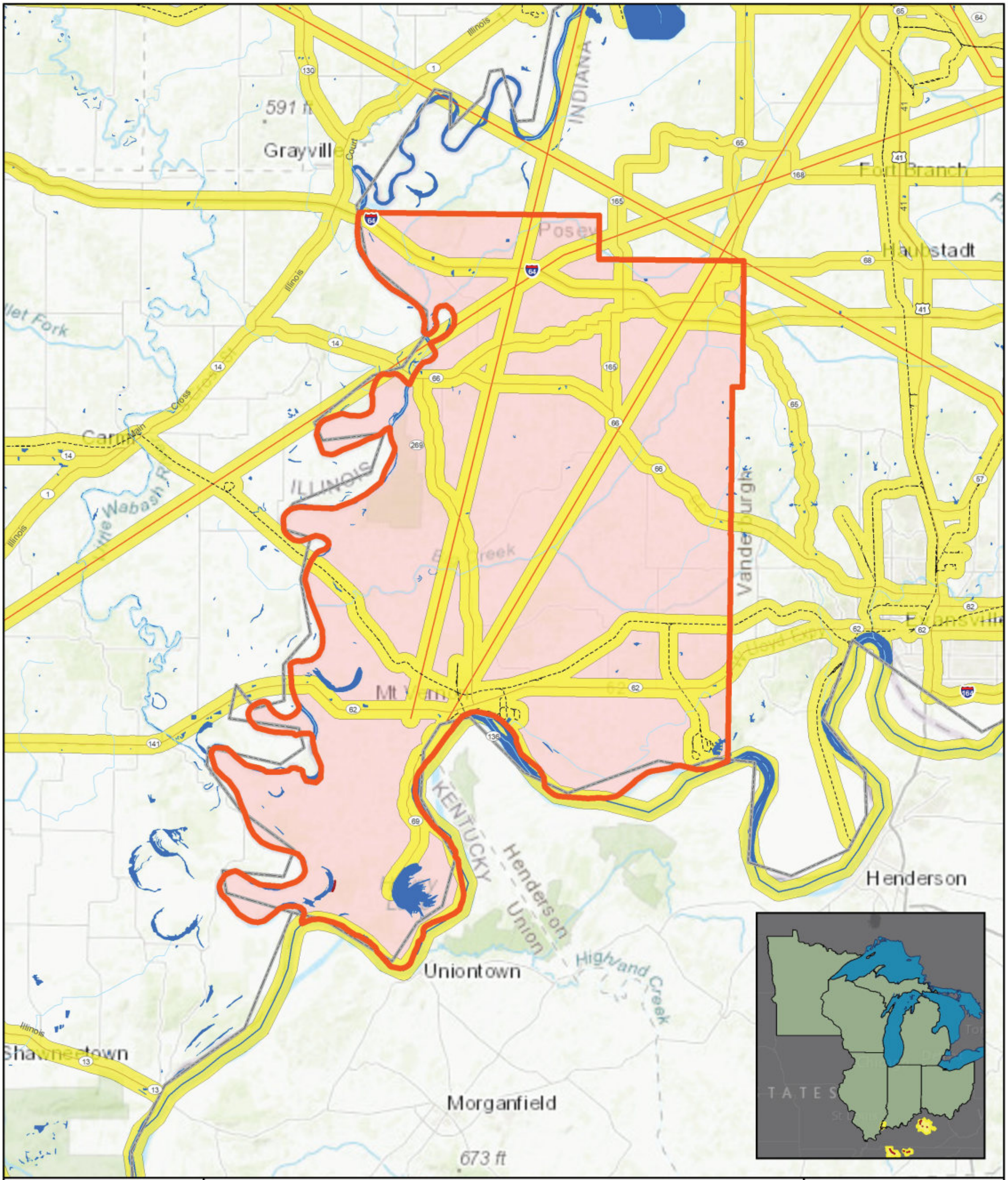

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Miles

0 1.25 2.5 5 7.5 10
Kilometers

SHORT'S BLADDERPOD (*PHYSARIA GLOBOSA*) ACTION AREA OVERVIEW MAP

SCALE 1:450,000

—	Petroleum Pipeline
—	Major Road
- - - - -	Railroad
—	Commercial Navigable Waterway
—	Rivers & Streams
🟦	Lakes & Ponds
🟩	1-Mile Coastal Inland Buffer
🟨	Action Area
▨	Short's Bladderpod (*Physaria globosa*) Critical Habitat
☐	Short's Bladderpod (*Physaria globosa*) Counties of Occurrence

N

Basemap courtesy of Esri.

Date: 5/25/2021

Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS

Projection: WGS 1984 Web Mercator

Short’s Goldenrod (*Solidago shortii*)

Federal Listing: Endangered
State Listing within the AA: Endangered in Indiana

Species Description

Short’s Goldenrod is a perennial herb with one to several erect or ascending stems 0.5 to 1.3m tall, arising from a creeping rhizome. Stems are terete in cross section, slightly ribbed, and minutely scabrid-puberulent at least above the middle. Leaves are alternate, crowded, 5 to 10cm long and 0.6 to 1.5cm wide. Individual leaves are firm, oblong-lanceolate to narrowly elliptic, remotely serrulate and glabrous on both sides. The leaves are largest near the middle of the stem and become progressively smaller towards the inflorescence. Lower leaves are reduced and usually absent during flowering time. The inflorescence is terminal and ranges from racemose to paniculate with divergent, secund branches. Heads are 10 to 14 flowered on puberulent stalks usually 5mm or less in length. The involucre is 4 to 6mm long and 3mm wide with imbricate, coriacious and glabrous phyllaries. Ray florets number 4 to 8 and are 2.5 to 3.0mm long. The corollas are elliptic-linear with bright yellow ligules about 2mm long. The disc florets are also bright yellow with a short tube, funnelform throat and five linear spreading lobes about equaling the throat length. The white pappus is capillary and about 2mm long. Achenes are cuneate-cylindric, about 2mm long, and pale brown with appressed, silky pubescence (USFWS, 1988).

Species Distribution

Short's Goldenrod is a species of full sun or partial shade and occurs in a variety of dry, mostly open habitats. These include limestone cedar glades, open eroded areas, edges of dry, open oak-hickory woods, cedar thickets, pastures, old fields, power line rights-of-way, and rock ledges along highway rights-of-way. Cedar glades, open eroded areas and woodland edges appear to be the natural habitats for Short's Goldenrod and support the largest and healthiest populations. Short’s Goldenrod is considered to be a cedar glade endemic or near--endemic. This species also occurs in large glady clearings or in open woodlands composed of various oaks and hickories. The glade habitat within Blue Licks Nature Preserve in Blue Licks Battlefield State Park occupies two areas. One area is approximately 1,300m^2 and is characterized by a sparse covering of grasses and forbs with scattered individuals or "islands" of woody species. The substrate consists mainly of shallow clay soils with much limestone cobble and shale intermixed. The other glade-like area of the nature preserve occupies approximately 1,200m^2 and is located along both sides of an old buffalo trace. Vegetation and substrate are very similar to the adjacent cedar glade except more weed species occur (USFWS, 1988).

The known historic distribution of Short’s Goldenrod consisted of only two widely separated population areas in Kentucky. The population in the vicinity of Blue Licks was previously described under present distribution. The Blue Licks population was first discovered in 1939 and has remained extant in that area till the present (USFWS, 1988).

The second area of historic distribution was at the Falls of the Ohio, Jefferson County, Kentucky. This population of Short’s Goldenrod was first discovered in 1840 and last reported in the 1860's. The "Falis" is a large outcrop of Devonian limestone in the Ohio River lying between Louisville, Kentucky, and New Albany, Indiana. In the past, prior to construction of locks and dams, the Falls consisted of a series of rapids and chutes with scattered, large rock outcrops and several rocky islands. The extent of the historic population at the Falls is not known since the original collection data is very general and only mentions, "Rock Island," "Rocky Islands," or "Falls of the Ohio" as locations. The Falls have been greatly altered due to the construction of locks and dams and most of the islands have been destroyed or inundated (USFWS, 1988).

Distribution within Action Area

An Indiana occurrence was discovered in 2001 along the Blue River in Harrison County and appears to be stable. Approximately 139 clumps of Short's Goldenrod were counted in 2001 when the occurrence was first discovered. Additional counts in 2005 revealed 191 clumps (USFWS, 2007). Harrison County in southern Indiana is the only reported occurrence of Short's Goldenrod (USFWS, 2021).

Critical Habitat

No critical habitat has been designated for Short's Goldenrod.

Life History

Little is known about the reproductive status of Short's Goldenrod. Short's Goldenrod produces flowers from mid-August to early November. Specific pollinators are not known, but sweat bees (likely Halictidae) and the common black blister beetle (*Epicauta pennsylvanica*) have been observed in large numbers, likely feeding on the flowers. Achenes (fruits) mature several weeks after the flowers wither. Short's Goldenrod seeds are wind dispersed, but there is no evidence to suggest that this species expands its range by this method. It is possible that historically, bison may have been a dispersal vector, and that the historic distribution may have been correlated with movement patterns and disturbance caused by bison (USFWS, 1988).

Current Stressors and Threats

- Anthropogenic impacts
  Occurrences of Short's Goldenrod located within Blue Licks Battlefield State Resort Park, Kentucky, are protected from general habitat disturbance due to their location on park property and their location within an area that has been dedicated by KSNPC as a state nature preserve (Blue Licks State Park Nature Preserve). These occurrences could be adversely affected, however, through accidental trampling by park workers/visitors and inadvertent destruction resulting from park activities. Occurrences on private property are more severely threatened by direct habitat disturbance. These occurrences could be adversely affected by construction activities (land-clearing, grading, bulldozing); agricultural practices (improvement of pastures through grading and planting of fescue, trampling by livestock); fire (at wrong time of year); highway maintenance (right-of-way disturbance, spraying of herbicides); and power line maintenance (spraying of herbicides; USFWS, 2017). The Indiana occurrence is threatened by competition from exotics and the potential raising of the Ohio River's pool level. At present, trampling by visitors does not seem to be a serious threat; recreational use of the area does occur, but the plants do not seem to have been affected. The raising of the Ohio River's pool level (and subsequently the Blue River) is unlikely but could change the hydrologic dynamics of the site and cause a vegetative shift surrounding the Short's Goldenrod occurrence (USFWS, 2017).
- Secondary succession
  Natural (secondary) succession can eliminate potential habitat for Short's Goldenrod through changes in vegetational composition. As old-field habitats and closed canopy woodlands develop, potential habitat is lost (USFWS, 2017).

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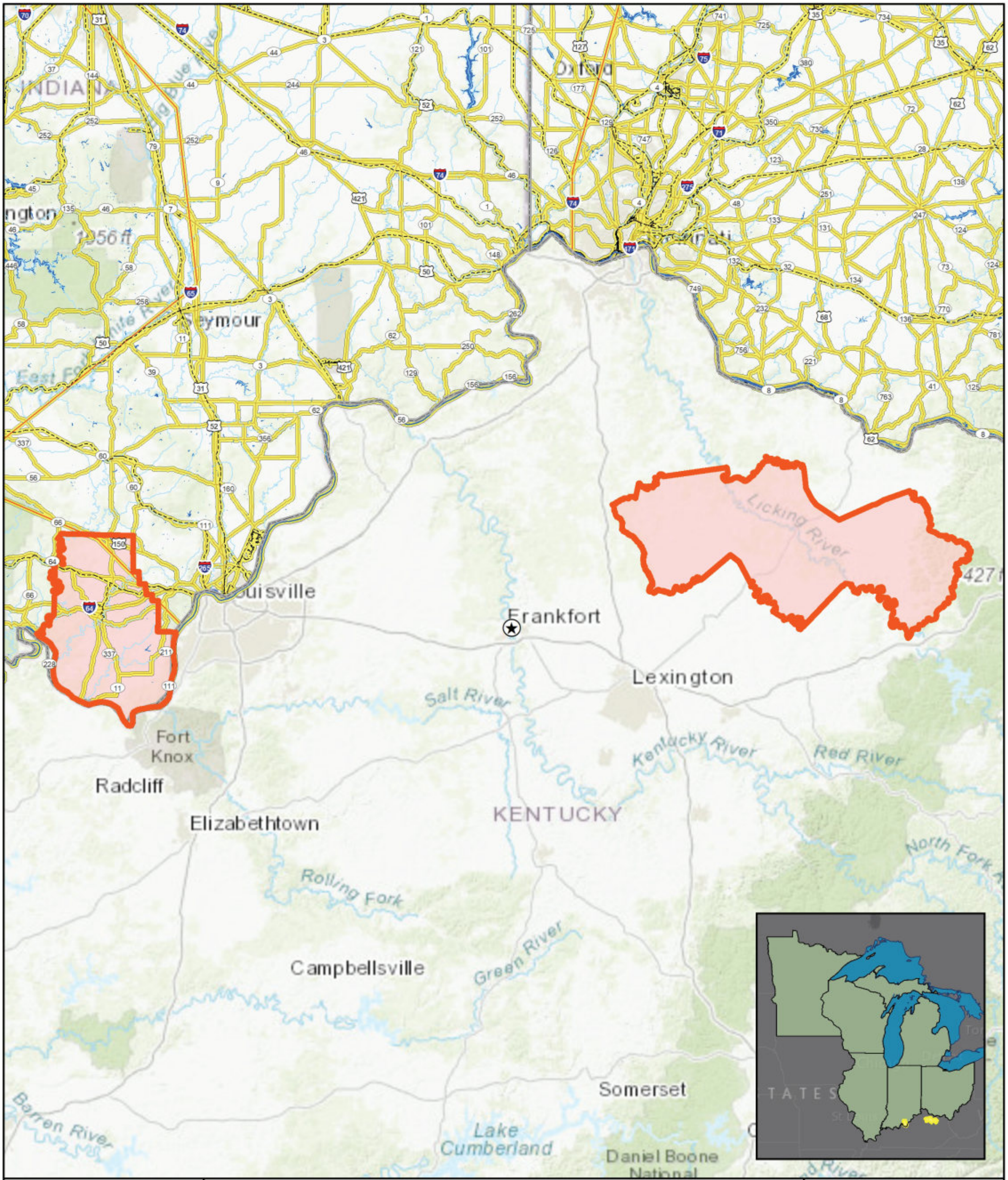

0 5 10 20 30
Miles
0 5 10 20 30 40
Kilometers

SHORT'S GOLDENROD (*SOLIDAGO SHORTII*) ACTION AREA OVERVIEW MAP

SCALE 1:1,800,000

- — Petroleum Pipeline
- — Major Road
- - - - - - Railroad
- — Commercial Navigable Waterway
- — Rivers & Streams
- ■ Lakes & Ponds
- 🟩 1-Mile Coastal Inland Buffer
- 🟨 Action Area
- ▭ Short's Goldenrod (*Solidago shortii*) Counties of Occurrence

N

Basemap courtesy of Esri. Date: 5/25/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS Projection: WGS 1984 Web Mercator

Small Whorled Pogonia (*Isotria medeoloides*)

Federal Listing: Threatened
State Listing within the AA: Endangered in Illinois and Ohio; Threatened (but presumed extirpated) in Michigan

Species Description

Isotria is a genus with only two species: *I. medeoloides* and *I. verticillata*, the Large Whorled Pogonia. Both species are herbaceous perennials with slender, hairy, fibrous roots that radiate from a crown or rootstock. In the genus *Isotria*, over-wintering buds for the next year' s shoot form on the rootstock at ground level in robust plants and beneath the soil surface on most smaller plants. The five or six leaves of *Isotria* plants (or four leaves in some vegetative plants) display themselves in a circular arrangement (false whorl) at the apex of a robust, smooth, hollow stem. Small Whorled Pogonia has a number of key characteristics that differentiate it from Large Whorled Pogonia. Particularly important are the color of the stem and flower, the relative lengths of the sepals and petals, and the length of the stem (peduncle) of the fruit capsule in relation to the length of the capsule itself. An individual Small Whorled Pogonia is usually single-stemmed, although occasionally a plant produces two or more stems in a cluster. The stem ranges from 6 to 35cm tall in a flowering plant and is similar in color, with the same degree of glaucousness, as white seedless grapes; the elliptic to elliptic—obovate leaves are also a pale milky-green or grayish-green. The flower is yellowish-green with a greenish-white lip. The sepals vary from linear-oblanceolate to narrowly spatula-like in shape, and spread outward when in full flower. The lateral petals are oblanceolate to oblong-elliptic and point forward above the lip. The sepals are approximately 1.5 to 2.5cm long and either equal in length to the lateral petals or up to 1.5 times as long (USFWS, 1992).

Species Distribution

The Small Whorled Pogonia occurs on upland sites in mixed-deciduous or mixed- deciduous/coniferous forests that are generally in second- or third-growth successional stages. Characteristics common to most Small Whorled Pogonia sites include sparse to moderate ground cover in the species' microhabitat, a relatively open understory canopy, and proximity to features that create long persisting breaks in the forest canopy. Soils at most sites are highly acidic and nutrient poor, with moderately high soil moisture values. Light availability could be a limiting factor for this species. (USFWS, 1992).

Small Whorled Pogonia was listed as endangered on October 12, 1982. At the time of listing, records for the species were known from 48 counties in 16 states and Canada. However, only 17 sites (in ten states and Ontario, Canada) were known to be extant, and these sites contained a total of fewer than 500 plants. Subsequent searches have resulted in the discovery of several new sites: the 1991 census totaled approximately 2,600 stems at 86 sites in 15 states and Canada. (USFWS, 1992).

States in which Small Whorled Pogonia is known or believed to occur include Connecticut (5 counties), Delaware (2 counties), Georgia (7 counties), Illinois (1 county), Maine (5 counties), Maryland (1 county), Massachusetts (5 counties), Michigan (1 county), Missouri (1 county), New Hampshire (7 counties), New Jersey (6 counties), New York (2 counties), North Carolina (11 counties), Ohio (2 counties), Pennsylvania (6 counties), Rhode Island (1 county), South Carolina (2 counties), Tennessee (13 counties), Virginia (39 counties), and West Virginia (4 counties; USFWS, 2021).

Distribution within Action Area

ECOS lists the following counties (USFWS, 2021):

- Illinois: Randolph
- Michigan: Berrien
- Ohio: Hocking and Scioto

The single Illinois site (one colony) was discovered in 1973. In 1991, only one plant was observed. This site is located on land owned by the Nature Conservancy and is protected (USFWS, 1992). The population was last recorded in 1996; however, it was not identified in 2007 (USFWS, 2008).

The population identified in Berrien County, Michigan was last observed in 1981 and is believed to be extirpated from the state (MNFI, 2021).

The Ohio populations have been permanently protected through land acquisitions and conservation easements (USFWS, 2008).

Critical Habitat

No critical habitat has been designated for Small Whorled Pogonia.

Life History

Populations of Small Whorled Pogonia consist of plants that may be in any of four different states: vegetative, with an abortive flower bud, flowering, or dormant. On the average, a flowering plant is taller and has a wider whorl diameter than one with an abortive bud; likewise, the latter is bigger than a vegetative plant. In the northern part of its range, plants with flowering buds emerge from the leaf litter in May and flower in June. Farther south (e.g., in Virginia), such plants typically emerge in April, with flowering beginning in very late April to mid-May. An individual plant may stay in flower from four days to nearly two weeks. Small Whorled Pogonia is scentless, apparently lacks nectar, and is primarily self-pollinating. The effects of inbreeding, if any, on the long-term viability of this species are not known. Insect pollination may take place on occasion; however, this has not been documented. The Small Whorled Pogonia only occasionally reproduces vegetatively, as indicated by rare occurrences of two or more stems originating from a single root stock. As soon as pollination occurs, the ovary begins to plumpen. The fruit capsule does not fully ripen until fall and may not dehisce until late fall. Many plants form a visible over-wintering vegetative bud at the base of the stem in August or September. Small Whorled Pogonia can also enter dormancy; however, dormancy length is largely unknown and suspected to be anywhere between 1 year to 4 years (USFWS, 1992).

Current Stressors and Threats

- Habitat loss/conversion
  The primary threat to Small Whorled Pogonia is conversion of forested habitat into roads and/or residential development, and individual sites may be degraded or eliminated as a result of development within or adjacent to its habitat.
- Herbivory
  Herbivory, specifically deer and rabbit, continues to be documented for numerous populations throughout this species range. Ohio’s population is fenced for herbivory protection from deer.
- Illegal plant collection
  Although no current observations of illicit collecting have been reported recently, illegal plant collection may still threaten population of Small Whorled Pogonia (USFWS, 2008).

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0 20 40 80 120
Miles

0 20 40 80 120 160
Kilometers

SMALL WHORLED POGONIA (*ISOTRIA MEDEOLOIDES*)
ACTION AREA OVERVIEW MAP

SCALE 1:7,000,000

- Petroleum Pipeline
- Major Road
- Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- Lakes & Ponds
- 1-Mile Coastal Inland Buffer
- Action Area
- Small Whorled Pogonia (*Isotria medeoloides*) Counties of Occurrence

N

Basemap courtesy of Esri. Date: 5/25/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS Projection: WGS 1984 Web Mercator

Tennessee Pondweed (*Potamogeton tennesseensis*)

Federal Listing: Under Review between 2021 and 2025 for potential protection under ESA
State Listing within the AA: Potentially Threatened in Ohio

Species Description

Tennessee Pondweed is a perennial herbaceous aquatic plant. It has rhizomes with cauline stems terete, without spots, 10 to 35cm. Leaves both submersed and floating or floating absent and are more or less spirally arranged. Submersed leaves sessile with stipules persistent and inconspicuous that are light brown to dark green, ligulate, 0.5 to 1.5cm. Floating leaves are borne on petioles that are continuous in color to apex and are 2.5 to 6cm long. Leaf blades are greenish brown adaxially, lance-oblong, 2 to 4cm long and 5 to 13mm at the base with 9 to 23 veins. Inflorescences are greenish in color, unbranched, emersed and 10-22 mm wide. Fruits are sessile, greenish brown, quadrate-orbicular, slightly compressed, abaxially keeled, laterally ridged and 2 to 3mm long with an erect beak present (0.5mm long; Flora of North America, 2021).

Species Distribution

A regional endemic, Tennessee Pondweed is dependent of aquatic habitats within a relatively narrow Appalachian range (NatureServe, 2021). Tennessee Pondweed is known to occur in Kentucky (no data), Ohio (15 occurrences), Pennsylvania (3 occurrences), Tennessee (8 occurrences), Virginia (3 counties) and West Virginia (7 counties; NatureServe, 2021).

Distribution within Action Area

No specific data found for Ohio. Vinton and Jackson Counties are identified to have occurrences (USDA, 2021).

Critical Habitat

No critical habitat was identified for Tennessee Pondweed.

Life History

No specific data regarding life history was identified.

Current Stressors and Threats

- Altered water quality/quantity
  Aquatic habitat highly threatened by agricultural run-off and other pollutants or alterations (including dams and water diversions).
- Mining and oil/gas activities
- Land use conversion
- Habitat fragmentation (NatureServe, 2021)

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0 10 20 40 60
Miles
0 10 20 40 60 80
Kilometers

TENNESSEE PONDWEED (*POTAMOGETON TENNESSEENSIS*) ACTION AREA OVERVIEW MAP

SCALE 1:3,000,000

- Petroleum Pipeline
- Major Road
- Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- 🟦 Lakes & Ponds
- 🟩 1-Mile Coastal Inland Buffer
- 🟨 Action Area
- ☐ Tennessee Pondweed (*Potamogeton tennesseensis*) Counties of Occurrence

N

Basemap courtesy of Esri.

Date: 5/25/2021

Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS

Projection: WGS 1984 Web Mercator

Virginia Sneezeweed (*Helenium virginicum*)

Federal Listing: Threatened
State Listing within the AA: Threatened in Indiana

Species Description

Virginia Sneezeweed (*Helenium virginicum,* Blake) was first described in 1936 by S.F. Blake based on a collection made by E.T. Wherry from a site discovered by Lloyd Carr in Augusta County, Virginia. Virginia Sneezeweed is a 1 dm high herb with a stem simple below the inflorescence, branched above, and winged (0.3 to 2.5mm wide) throughout by the decurrent leaf bases. Basal leaves, gland-dotted, toothed or untoothed, widest in the upper half and tapering at both ends, are clustered in a rosette. The relatively few, mostly untoothed stem leaves, the middle and upper ones being narrowly linear or lance-linear, are progressively reduced up the stem. Rosette leaves, the lower stem, and some lower stem leaves are coarsely hairy. The inflorescence, loosely cymose (an inflorescence in which the terminal flower or terminal flower of a branch blooms first), consists of 2 to 20 heads, each 2.5 to 3cm wide. The central flower disk is nearly ball-shaped. Ray flowers are golden yellow, wedge -shaped and three-toothed, and disk corollas are yellow, turning purplish at the base with age. The fruit is an achene with hairs on its nerves. The pappus, consisting of 6 to 7 awn-tipped white scales that crown the achene, is 1.5mm long. The achene readily loses its corolla, resulting in a silvery appearance due to the long pappus scales (USFWS, 2000).

Species Distribution

Virginia Sneezeweed is limited to the seasonal wetlands commonly referred to as sinkhole ponds. In Virginia, these natural wetlands are located along a 90-km (56-mi) band in the alluvial fan deposits at the foot of the west side of the Blue Ridge Mountains. The pond basins have formed by the local solution of underlying carbonate formations (dolomite and limestone) but are overlain by acidic alluvial material that has eroded from the Blue Ridge Mountains to the east and south. The wetlands are subject to fluctuating water levels that may vary from year to year, but in general the pond sites are inundated in winter and spring and drier during the summer months. However, drought and high rainfall can modify this pattern, and extended periods of inundation of up to 20 months have been documented at one site. Ponds supporting Virginia Sneezeweed vary in size, basin depth and shape, and length of hydroperiod. While many of the wetlands appear pond-like, consisting of more or less circular water-filled depressions with concentric vegetation zones, others within shallow basins are more meadow-like in physiognomy with little well-defined vegetation zonation. The level of disturbance present at the sinkhole ponds includes relatively undisturbed ponds surrounded by forest, more meadow-like habitats around farm ponds actively used by cattle, a backyard seasonal wetland maintained in a open state by the landowner, a seasonally wet mowed lawn, and a seasonal wetland degraded by severe cattle trampling and ongoing attempt to fill the site (USFWS, 2000).

First found in Augusta County, Virginia in 1935, the range of Virginia Sneezeweed was expanded to Rockingham County in 1967. Up until the late 1970’s fewer than ten occurrences were known, but six more occurrences were documented in the 1970’s. Surveys in 1987, 1990, 1991, and 1995 resulted in the discovery of 15 additional occurrences. As of 2000, 30 populations have been documented with 23 in Augusta County and 7 in Rockingham County.

States in which Virginia Sneezeweed is known or believed to occur include Indiana (1 county), Missouri (8 counties), and Virginia (4 counties; USFWS, 2021). The 5 Year Review lists 19 occurrences in Virginia, 56 occurrences in Missouri, and one occurrence in Indiana.

Distribution within Action Area

Hamilton County in Indiana is the only county with known occurrences of Virginia Sneezeweed (USFWS, 2021).

Virgnia Sneezeweed was discovered in Hamilton County, Indiana on August 14, 2018. On November 29, 2018 a DNA analysis conducted by Dr. John Knox confirmed that the species was Virginia Sneezeweed. Upon the initial observation of this occurrence, Fishers Parks and Recreation personnel estimated the number of plants to be less than 100 and this population was placed under permanent protection (USFWS, 2020).

Critical Habitat

No critical habitat has been identified for Virginia Sneezeweed

Life History

A fibrous rooted perennial herb, Virginia Sneezeweed blooms from early July through October with a peak in late July to early August. Seed dispersal occurs in late fall, and dormancy is broken gradually with most germination delayed until the next growing season after water has drawn down. Virginia Sneezeweed appears as a basal rosette in the first year and then in its second year usually bolts, producing a single flowering stem. A single flowering stem can include 1 to 15 flowering heads. The production of new basal leaves continues year-round, and leaves that have been growing under water are more slender than those that have grown above water. Nothing is known about the pollinators of Virginia Sneezeweed; however, casual observations of insect visitors suggest that it is not a single pollinator (USFWS, 2000).

Current Stressors and Threats

- Hydrologic alteration
  Primary habitat-related threats identified for Virginia Sneezeweed include changes to hydrology, such as drought or flooding as a result of changing climate, ditching or pond deepening on private lands, or groundwater withdrawal associated with development.
- ATV or other vehicle use
- Competition and encroachment by other plant species including invasives (USFWS, 2020).

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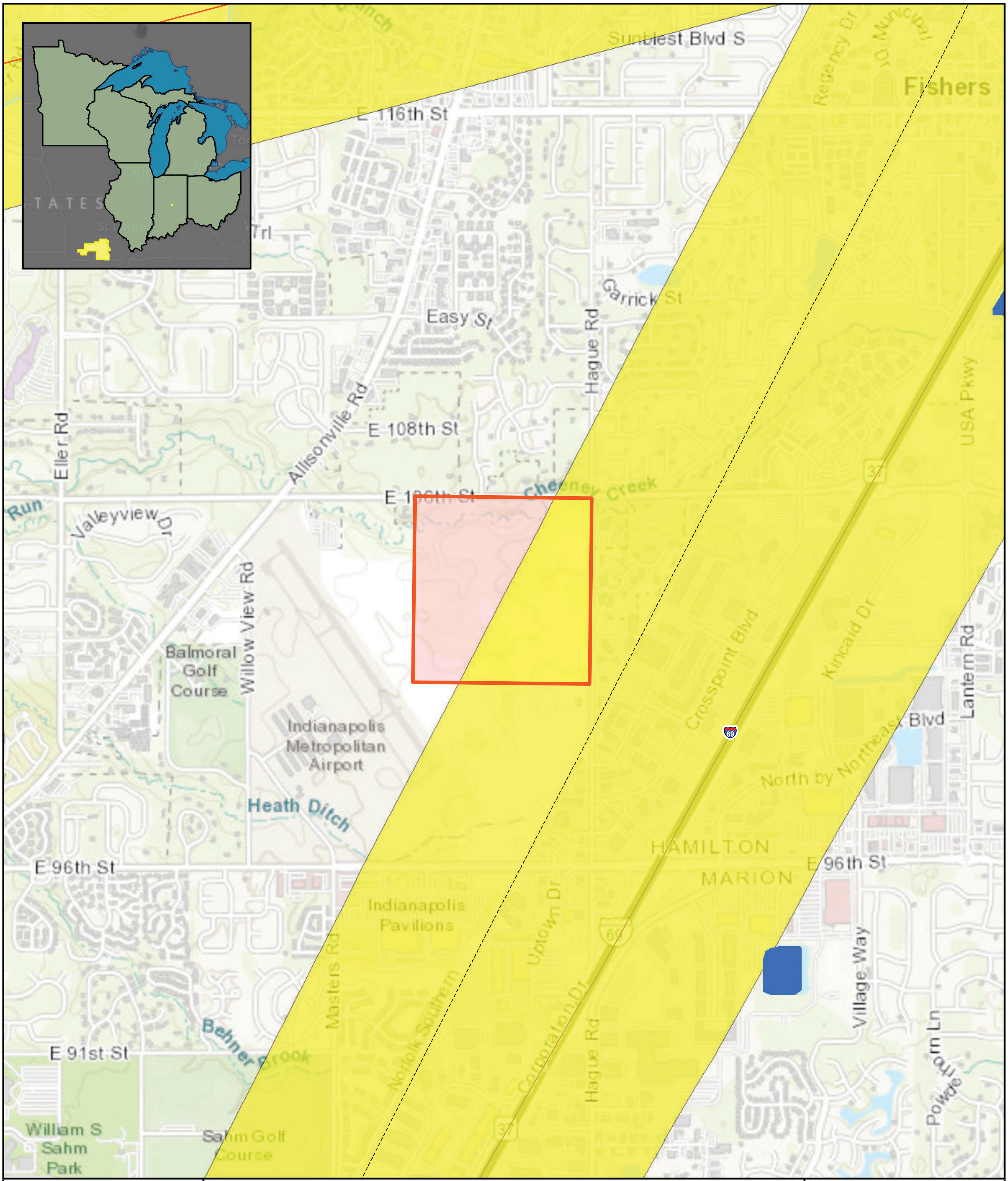

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Meters

VIRGINIA SNEEZEWEED (*HELENIUM VIRGINICUM*)
ACTION AREA OVERVIEW MAP

SCALE 1:30,000

─ Petroleum Pipeline	─ Commercial Navigable Waterway	🟩 1-Mile Coastal Inland Buffer
─ Major Road	─ Rivers & Streams	🟨 Action Area
- - - Railroad	🟦 Lakes & Ponds	▭ Virginia Sneezeweed (*Helenium virginicum*) Counties of Occurrence

N

Basemap courtesy of Esri. Date: 6/14/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS, EIA Projection: WGS 1984 Web Mercator

Virginia Spiraea (*Spiraea virginiana*)

Federal Listing: Threatened
State Listing within the AA: Endangered in Ohio

Species Description

Virginia Spiraea is a perennial shrub that has a modular growth form. The species is clonal, with a root system and vegetative characteristics that allow it to thrive under appropriate disturbance regimes. Virginia Spiraea is a large shrub 1 to 3m tall with profuse branching. Leaves are entire to completely serrate, ovate to lanceolate in shape and are 3 to 15cm long and 2 to 5cm wide. Flowers are yellow/greenish to pale white and are approximately 5 to 22cm wide. (USFWS, 1992).

Species Distribution

Virginia Spiraea is found along the banks of high gradient sections of second and third order streams, or on meander scrolls and point bars, natural levees, and other braided features of lower reaches (often near the stream mouth). They are also found in disturbed rights-of-way (USFWS, 1992).

All localities are within the southern Blue Ridge or the Appalachian (Cumberland) plateau physiographic provinces on the headwaters, or just over the divide, of streams that flow to the Ohio drainage basin. This distribution is probably relictual from a more widespread distribution during late glacial time (USFWS, 1992). Virginia Spiraea has historic records in Pennsylvania; however, this species no longer occurs in that state (USFWS, 2021a).

States in which Virginia sneezeweed is known or believed to occur include Georgia (2 counties), Kentucky (6 counties); North Carolina (8 counties), Ohio (1 county), Tennessee (11 counties), Virginia (6 counties), and West Virginia (14 counties; USFWS, 2021b).

Distribution within Action Area

Scioto County in Ohio is the only county with known occurrences of Virginia Spiraea (USFWS, 2021b). Virginia Spiraea was first discovered in Ohio in 1991 on Scioto Brush Creek and it is presently known from a small stretch of this creek. Ohio populations are small with 10 or less clones (ODNR, 2021; USFWS, 2021c).

Critical Habitat

No critical habitat has been identified for Virginia Spiraea.

Life History

Sexual reproduction is very rare and suggests poor genetic variability. Reproduction is primarily from vegetative propagules. Range-wide, fewer than 30 different genotypes are currently known (ODNR, 2021). Flowering occurs late May through late July. Flowering in the first year is rare or sparse until an individual is established. The species' flowers are visited by a host of insects, most commonly beetles. Identified insects, which are common and widespread, include flower long-horn beetles, a flower beetle, and a soldier beetle. Most flowers abort without producing follicles, particularly if the water supply is inadequate, but follicles are sporadically produced in most populations. Seeds, however, seem to be rarely produced. The seeds are very small (> 2mm long x ca. 0.5mm wide) and could be dispersed by wind or water. The follicles begin to dehisce in late August-September and continue through late winter. The follicles are at the end of a long, flexible stem that would "shake out" the small seed as a result of wind or high water. The coryrnbs often become waterlogged, collect debris, and become heavy. As one would expect, quality of seed varies greatly among corymbs and plants. Often, only one portion of a corymb will produce seed. (USFWS, 1992).

Current Stressors and Threats

- Human activity
  The only documented cause of extirpation of Virginia Spiraea has been human activity, and it appears to be extirpated in six out of thirty-three watersheds.
- Impoundments
  Impoundments are a double threat to this species: clones are not only destroyed by rising water, but the impoundment may also serve as a “death trap” for propagules washed downstream.
- Various insect pests (including aphids, ants, and the copper underwing moth caterpillar)
- Introduction of invasive vegetation such as Japanese knotweed (*Reynoutria japonica*), Chinese privet (*Ligustrum sinense*), Japanese Spiraea (*Spiraea japonica*), and rambler rose (Multiflora rose; USFWS, 1992).

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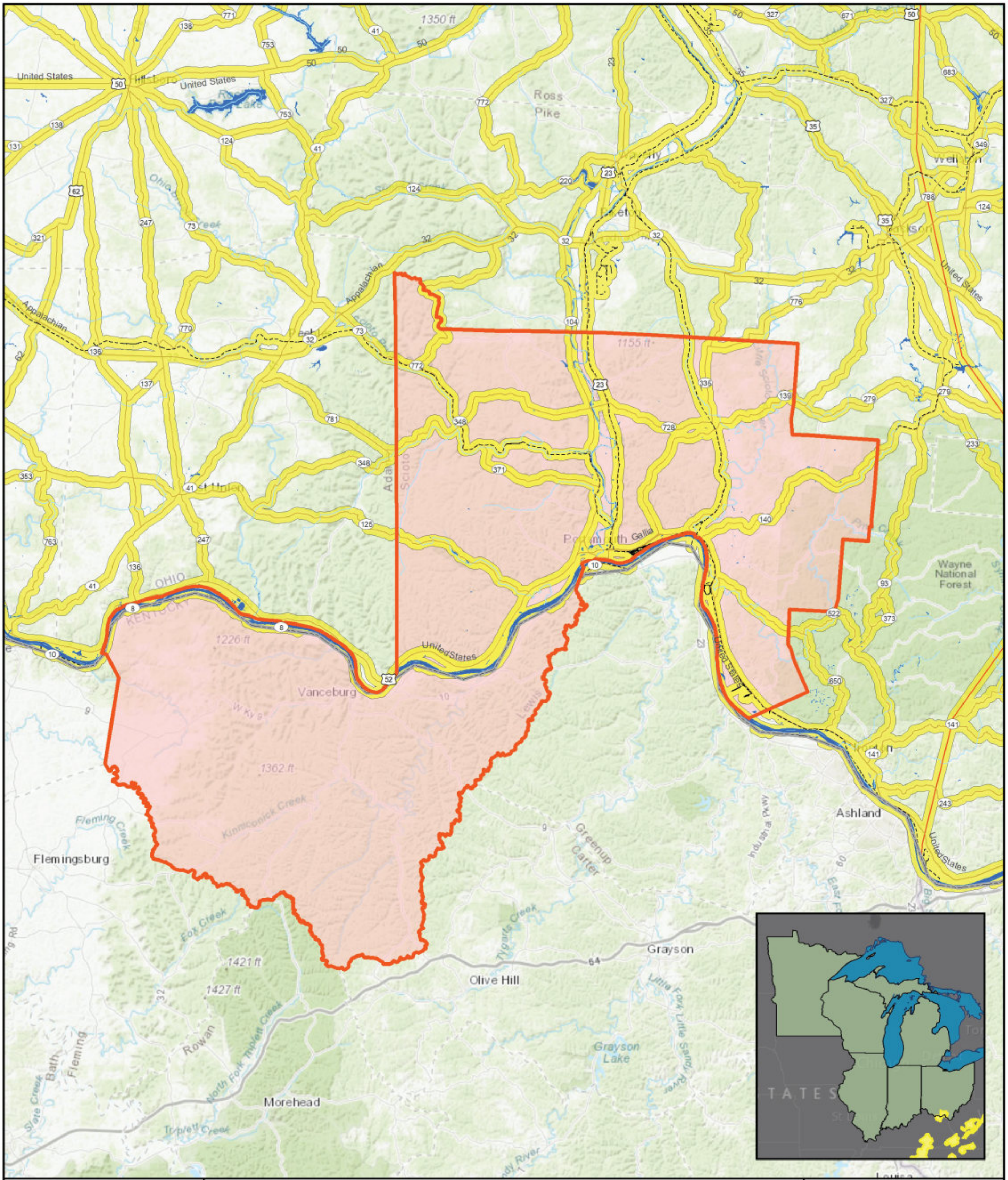

0 2 4 8 12
Miles

0 2 4 8 12 16
Kilometers

VIRGINIA SPIRAEA (*SPIREA VIRGINIANA*) ACTION AREA OVERVIEW MAP

SCALE 1:750,000

- Petroleum Pipeline
- Major Road
- Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- Lakes & Ponds
- 🟩 1-Mile Coastal Inland Buffer
- 🟨 Action Area
- ☐ Virginia Spiraea (*Spirea virginiana*) Counties of Occurrence

N

Basemap courtesy of Esri.
Date: 5/25/2021
Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS
Projection: WGS 1984 Web Mercator

Western Prairie Fringed Orchid (*Platanthera praeclara*)

Federal Listing: Threatened
State Listing within the AA: Endangered in Minnesota

Species Description

Western Prairie Fringed Orchid is a smooth, erect, perennial herb that grows to 1.2m (4ft) tall. Plants have two to five fairly thick, elongate, hairless leaves each. The open, spikelike flowering stalk bears up to 24 showy, 2.5cm (1in) wide, white flowers. The lower petal of each flower is deeply 3-lobed and fringed, hence the common name. The seedpods, which contain many tiny seeds, are about 2.5cm (1in) long and tapered on both ends (USFWS, 1996).

Eastern Prairie Fringed Orchid and Western Prairie Fringed Orchid, a species pair similar in gross morphology, can be distinguished by flower color, fragrance, and size; column structure; petal shape; and sepal width. The lateral lobes of the lip of Western Prairie Fringed Orchid are often, but not always, narrower than those of Eastern Prairie Fringed Orchid. The basic distinguishing characteristics of Western Prairie Fringed Orchid are its slightly larger flowers and less elongated inflorescence (USFWS, 1996).

Species Distribution

Preferred habitat is unplowed, calcareous prairies and sedge meadows; plants have also been observed in successional communities such as borrow pits, old fields, and roadside ditches (USFWS, 1996). In Minnesota this species is found almost exclusively in remnant native plant communities. In northern Minnesota, these are typically northern wet prairie, northern mesic prairie, and occasionally prairie wet meadows. In southern Minnesota, most populations are found in southern mesic prairies, and occasionally southern wet prairies. The majority of the sites occur in full sunlight on moist calcareous till or sandy soils. None of the sites have had a significant history of cattle grazing, though a few have a history of intermittent mowing for hay (MNDNR, 2021).

Historically, Western Prairie Fringed Orchid was distributed throughout much of the western Central Lowlands and eastern Great Plains physiographic provinces of the central United States and Interior Plains in extreme south-central Canada. Historical observations or collections (last observed prior to 1970 and/or confirmed destroyed) are known from 81 counties in 8 states. Comparison of the historical and extant ranges shows the species apparently has been lost from South Dakota and Oklahoma, with significant reductions in counties of occurrence in Iowa, southeastern Kansas, Missouri, and eastern Nebraska (USFWS, 1996).

States in which Virginia sneezeweed is known or believed to occur include Colorado (32 counties), Iowa (99 counties); Kansas (4 counties), Minnesota (12 counties), Missouri (11 counties), Nebraska (66 counties), North Dakota (2 counties), South Dakota (16 counties), and Wyoming (11 counties; USFWS, 2021).

Distribution within Action Area

In 1996, Western Prairie Fringed Orchid reportedly occurred in 8 counties in Minnesota (USFWS, 1996). Currently, the following counties are listed to support known or possible populations of Western Prairie Fringed Orchid: Clay, Dodge, Douglas, Faribault, Fillmore, Freeborn, Goodhue, Hennepin, Houston, Kandiyohi, Kittson, Martin, Mower, Nicollet, Nobles, Norman, Pennington, Pipestone, Polk, Red Lake, and Rock (MNDNR, 2021).

Critical Habitat

No critical habitat has been identified for the Western Prairie Fringed Orchid.

Life History

Plants bloom from mid-June in the southern portion of the range to late July in the northern portion. Individual flowers last up to 10 days, and inflorescence produce flowers for up to 3 weeks. Pollination is required for seed production in Western Prairie Fringed Orchid. The white flowers lack nectar guides, bear long nectariferous spurs, and are fragrant at night, a suite of features typical of sphingophyllous (sphinx moth-pollinated) plants (USFWS, 1996).

Seeds mature on the plant and are released in early fall, the capsules opening at the onset of dormancy. A single capsule may produce thousands of seeds. Therefore, under ideal circumstances for germination and survivorship, the reproductive potential of a small population could be very large. Seeds are wind-dispersed and may also be adapted for dissemination through the soil profile by water. Orchid seeds are extremely small, and each bears a minute, morphologically undifferentiated embryo that often consists of only a few cells. Orchid seeds contain very limited food reserves and exhibit limited development. Continued growth of the seedling in natural conditions requires association with a compatible soil-inhabiting mycorrhizal fungus. After infection with this symbiont fungus, orchids may persist in an underground saprophytic stage until or beyond the second year before the first green foliage leaves appear. Seedling establishment may also be linked to the availability of suitable microhabitats, edaphic factors controlling soil mycorrhizae, and interspecific competition (USFWS, 1996).

Current Stressors and Threats

- Agriculture
  Agricultural threats to the Western Prairie Fringed Orchid include conversion of habitat to cropland, overgrazing, and intensive mowing that may reduce primary productivity and seed dispersal or facilitate invasion of exotic cool season grasses.
- Drainage of water sources
- Lack of prairie management/woody succession
- Herbicides and pesticides
- Collection of plants from small populations (USFWS, 2009)

List of References

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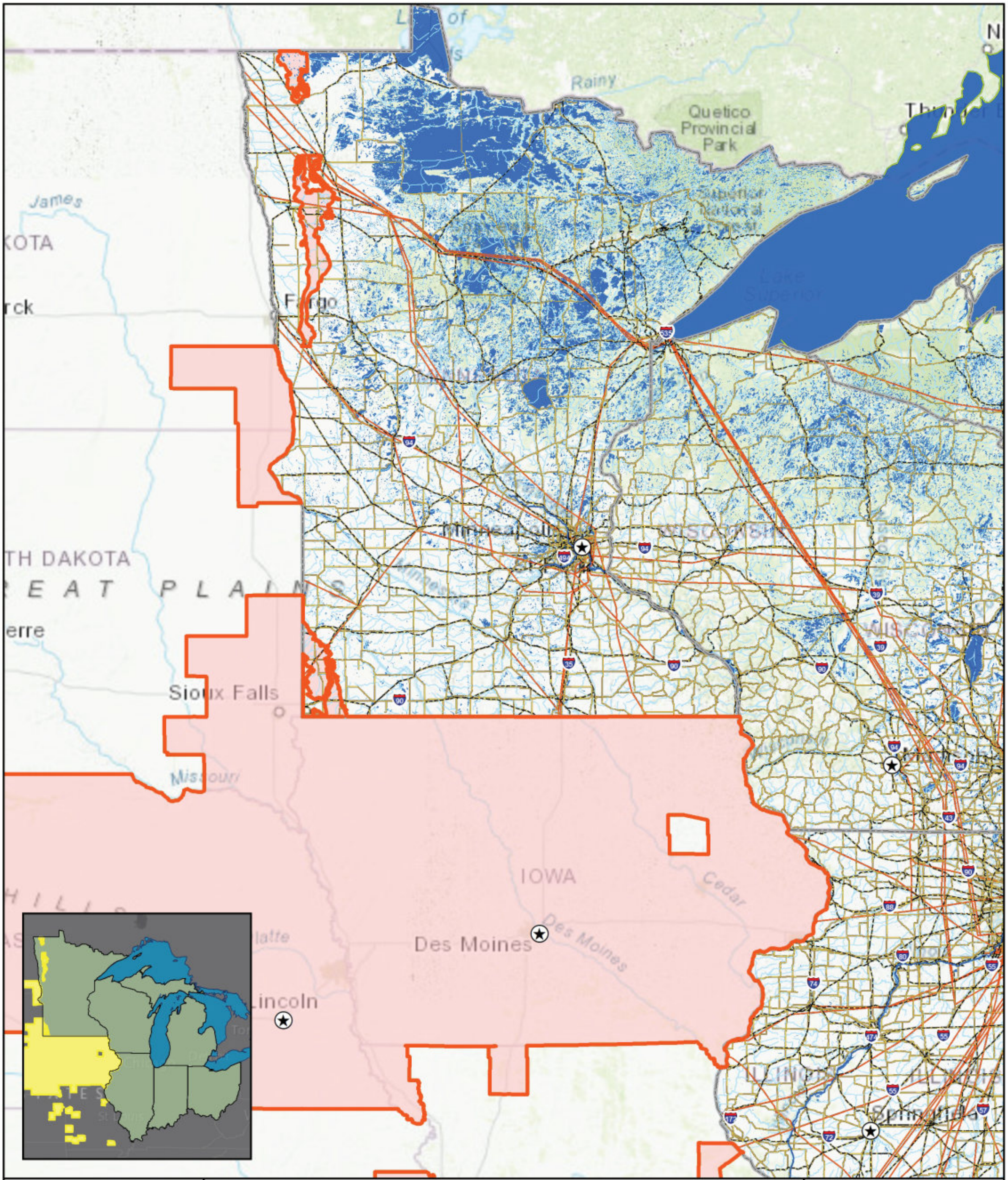

WESTERN PRAIRIE FRINGED ORCHID (*PLATANTHERA PRAECLARA*) ACTION AREA OVERVIEW MAP

SCALE 1:7,000,000

Petroleum Pipeline	Commercial Navigable Waterway	1-Mile Coastal Inland Buffer
Major Road	Rivers & Streams	Action Area
Railroad	Lakes & Ponds	Western Prairie Fringed Orchid (*Platanthera praeclara*) Counties of Occurrence

N

Basemap courtesy of Esri. Date: 5/25/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS Projection: WGS 1984 Web Mercator

SNAILS

Iowa Pleistocene Snail (*Discus macclintocki*)

Federal Listing: Endangered
State Listing within the AA: Endangered in Illinois

Species Description

The Iowa Pleistocene Snail is a small terrestrial snail with an adult width of 6 to 8mm. The shell is moderately high-spired, almost dome shaped, and tightly coiled; adults typically have six whorls. Ribs are relatively fine and confined to the upper half of each whorl. The shell color is either brown or greenish-white. The species has a moderate-sized umbilicus and lacks a parietal callus (USFWS, 1984).

Species Distribution

The Iowa Pleistocene Snail occurs exclusively on algific talus slopes. These slopes are developed over the entrances to small fissures and caves. Air flows through fractured bedrock, over frozen groundwater, and out-vents on steep slopes to create a cool, moist microclimate (USFWS, 1984; USFWS, 2009). Ground temperature rarely exceeds 10°C (50°F) or falls below -10°C (14°F), and average humidity often exceeds 60 percent (USFWS, 1984). This habitat is only known to occur in the Driftless Area that overlaps the states of Illinois, Iowa, Minnesota, and Wisconsin (USFWS, 2009). It is known from fossil records that the Iowa Pleistocene Snail was distributed throughout the Midwest during the Pleistocene era (400,000 years ago; USFWS, 2009). Its historic range included parts of southern Iowa and adjacent Nebraska, northern Missouri, west and central Illinois, Indiana, and Ohio (USFWS, 1984). As the glaciers receded, the snail survived in small pockets of suitable habitat on algific talus slopes. The Iowa Pleistocene Snail is currently only known to occur in the Driftless Area in portions of Clayton, Clinton, Delaware, Dubuque, Fayette, and Jackson Counties, Iowa and Jo Daviess County, Illinois (USFWS, 2009). The original recovery plan identified 19 known Iowa Pleistocene Snail locations within this range. With additional studies conducted since the recovery plan was issued, the number of known locations has increased to 38 sites on 31 geographically isolated algific talus slopes (USFWS, 2013).

Distribution within Action Area

- Only known to occur on one algific talus slope in Jo Daviess County, Illinois.
- ECOS indicates the species is known or believed to occur in Grant County, Wisconsin; however, no populations of Iowa Pleistocene Snail are currently known to occur in Wisconsin (USFWS, 2013).

Critical Habitat

No critical habitat has been designated for the Iowa Pleistocene Snail.

Life History

The Iowa Pleistocene Snail occurs only in small areas on algific talus slopes, described above. Abundance on occupied slopes may range from 50 up to 205,000 individuals per colony or slope, and high spatial and/or temporal variation in population size has been noted in some locations (USFWS, 2013). Individuals are typically active during the warmer months and hibernate through the winter (USFWS, 1984). The Iowa Pleistocene Snail feeds primarily on decaying birch and maple leaves in the forest floor litter but may also feed on dogwood and willow leaves (USFWS, 1984; USFWS, 2013). The species matures during its third year and lays clutches of up to six eggs multiple times per year under logs or bark or just beneath the soil surface. Individuals are hermaphroditic and may be able to self-fertilize (USFWS, 2013). Average lifespan is less than seven years. Predators include the short-tailed shrew (*Blarina brevicauda*) and predatory beetles (USFWS, 2013).

Current Stressors and Threats

Primary threats to the Iowa Pleistocene Snail include human disturbance, natural calamities, and climate change (USFWS, 1984; USFWS, 2009).

- Human disturbance
  Anthropogenic activities such as slope clearing, pasturing of domestic animals, and road building, destroy major food sources, lessens litter accumulation, increases soil erosion, and leaves the slopes more exposed to seasonal temperature extremes (USFWS, 1984). Most grazing threats have been alleviated by working with landowners to fence their sites (USFWS, 2009). However, increased development (primarily rural house building) in northern Iowa could threaten some sites as there tend to be scenic ridges above the algific slopes (USFWS, 2009). Sinkhole filling is also a concern when they occur in crop fields or pastures. Some sinkholes are not intentionally filled, but are impacted by runoff from crop fields, causing soil and probably agricultural chemicals to enter (USFWS, 2009). Human traffic is also a major cause of damage to many algific slopes. Recreational hiking, hunting, scientific investigations, and educational programs have the potential to overutilize algific slopes, resulting in trampling from foot traffic and dislodging of the fragile bryophyte cover over the thin soil and rock surfaces (USFWS, 1984; USFWS, 2013).
- Natural calamities
  Natural calamities may also damage algific slopes, thereby affecting the Iowa Pleistocene Snail. Small-scale geographic processes, such as rockfalls and stream undercutting, have damaged algific slopes by burying critical portions or physically removing small areas. Trampling by deer and other traffic may cause minor damage, and tree falls in critical areas can cause severe but highly localized damage. Weather-related factors, such as unusually severe summers or winters, tornadoes, lightning strikes, and forest fires, may affect Iowa Pleistocene Snail populations or their habitat (USFWS, 1984).
- Climate change
  Climate change may also affect Iowa Pleistocene Snail populations. While predicted climate changes may not necessarily change the cold microclimate conditions on the algific talus slopes that support this species, it is possible that warming may render the algific talus slopes in the southern portion of the species' range less suitable. Because populations are fragmented, dispersion or colonization into new suitable habitat (e.g., further north) may not occur without intervention (USFWS, 2013).

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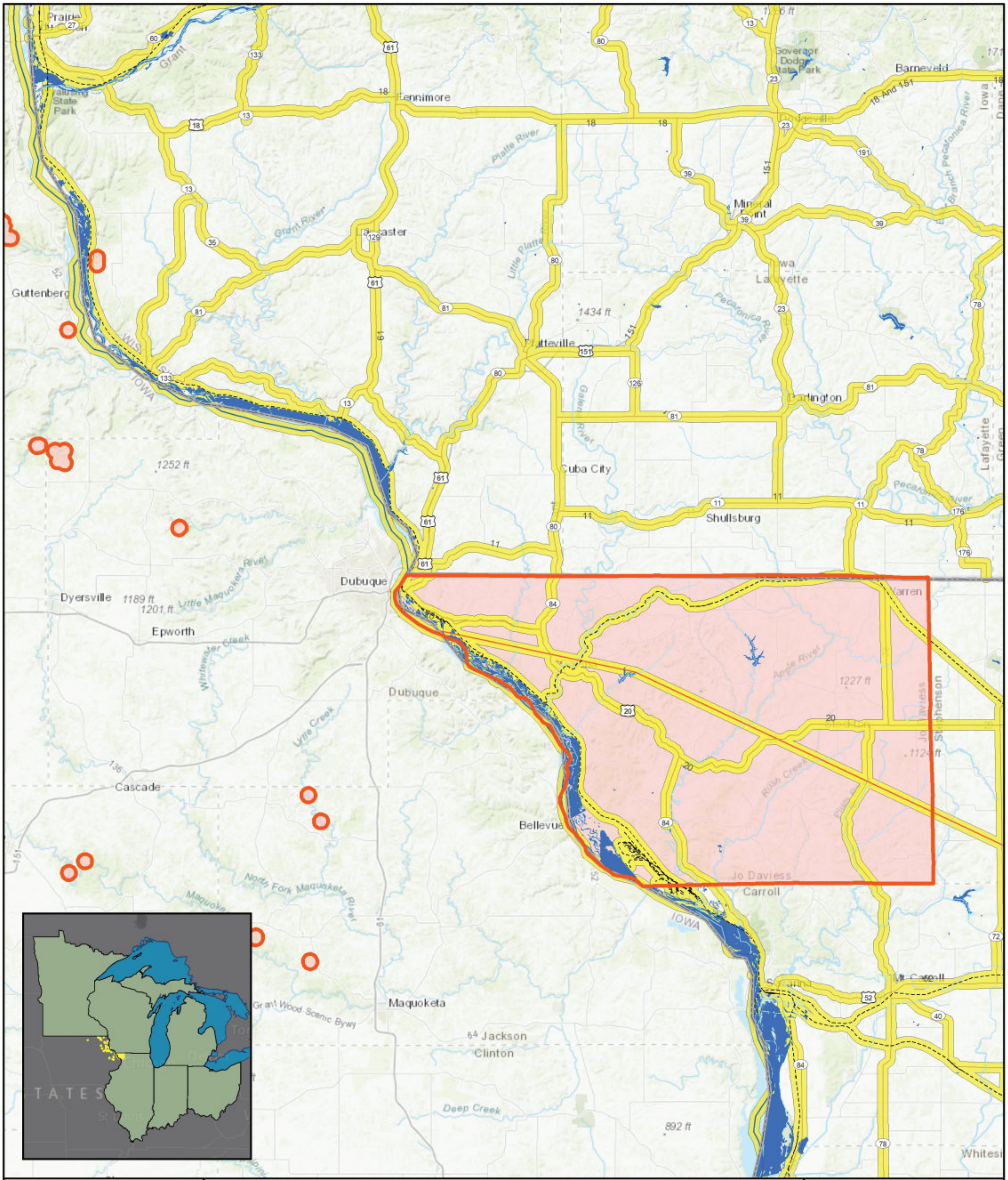

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Miles
0 2.5 5 10 15 20
Kilometers

IOWA PLEISTOCENE SNAIL (*DISCUS MACCLINTOCKI*) ACTION AREA OVERVIEW MAP

SCALE 1:800,000

- Petroleum Pipeline
- Major Road
- Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- Lakes & Ponds
- 🟩 1-Mile Coastal Inland Buffer
- 🟨 Action Area
- 🟥 Iowa Pleistocene Snail (*Discus macclintocki*) Counties of Occurrence

N

Basemap courtesy of Esri. Date: 5/25/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS Projection: WGS 1984 Web Mercator

FRESHWATER MUSSELS

Clubshell (*Pleurobema clava*)

Federal Listing: Endangered
State Listing within the AA: Endangered in Illinois, Indiana, Michigan, and Ohio

Species Description

The Clubshell is a small mussel, averaging 1 to 1.5in in length, though it may reach lengths up to about 3in. The shell is triangular, elongate, and relatively thick. The umbos are low and projected far forward. Beak sculpture, if visible, consists of a few weak ridges on the umbo. The periostracum is yellow to light brown, with broken green rays present near the umbo. On older individuals, the periostracum may be dark brown or black and the green rays may be obscured. Pseudocardinal teeth are small but well developed, and lateral teeth are long and slightly arched. The beak cavity is shallow to moderately deep and the nacre is white, becoming iridescent posteriorly (Cummings & Mayer, 1992; USFWS, 1994).

Species Distribution

The Clubshell is frequently described as a small-stream species, although historic records suggest it occurred in larger rivers as well. The Clubshell is generally found in clean, coarse sand and gravel runs, often just downstream of a riffle, and individuals typically burrow completely beneath the substrate (USFWS, 1994). The Clubshell is primarily an upper Ohio River system species. The species was historically widespread and was reported from Ohio River tributary streams in Kentucky, Illinois, Indiana, and Ohio, as well as from more isolated systems in Michigan, Pennsylvania, and West Virginia (USFWS, 1994). Historic record of Clubshell exist for nearly 100 streams in the Lake Erie (Michigan), Maumee River (Indiana, Michigan, Ohio), Wabash River (Illinois, Indiana), Blue River (Indiana), Tennessee River (Alabama, Tennessee), Cumberland River (Tennessee), Green River (Kentucky), Salt River (Kentucky), Kentucky River (Kentucky), Licking River (Kentucky), Great Miami River (Ohio), Little Miami River (Ohio), Ohio Brush Creek (Ohio), Scioto River (Ohio), Hocking River (Ohio), Muskingum River (Ohio), Kanawha River (West Virginia), Middle Island Creek (West Virginia), Little Kanawha River (West Virginia), Hughes River (West Virginia), Monongahela River (Pennsylvania, West Virginia), Allegheny River (Pennsylvania), and Ohio River (Pennsylvania, Ohio) drainages, including the Ohio River mainstem (USFWS, 1994). However, at the time of listing, Clubshell was thought to be extant in only 12 streams (USFWS, 2019). Recent reviews of the species distribution suggest that its distribution remains similar; Clubshell appears to be restricted to 13 populations in the Ohio River and Lake Erie basins, and portions of 21 streams support, or might still support, the species (USFWS, 2019).

Distribution within Action Area

- Reintroduced in Champaign and Vermilion Counties, Illinois (Middle Fork Vermilion River and Salt Fork Vermilion River)
- Known from 9 Counties in Indiana: Kosciusko, Marshall, Fulton, Pulaski, Starke, White, Tippecanoe, and Carroll Counties (Tippecanoe River); DeKalb County (Fish Creek)
- Occurs in Hillsdale County, Michigan (West Branch of the St. Josephs River)
- In Ohio, Clubshell is known or believed to occur in Williams and Defiance Counties (West Branch of the St. Josephs River, Fish Creek); Hancock, Hardin, Union, Madison, Franklin, Greene, Pickaway, Ross, Pike, and Scioto Counties (Big Darby Creek, Little Darby Creek), Coshocton County (Walhonding River); Trumbull and Ashtabula Counties (Lake Erie drainage).

Critical Habitat

No critical habitat has been designated for the Clubshell.

Life History

The Clubshell is tachytictic (short-term brooder), with gravid individuals found in May through July (USFWS, 1994). Once released, glochidia must attach to the gills or fins of a suitable host, typically a fish, to complete the transformation from the larval stage to a juvenile mussel. Although some mussel species have particular displays or behaviors to attract host fish, female Clubshells do not have any known mechanisms to lure fish (USFWS, 1994). Several studies have been conducted to identify suitable host fish for Clubshell. Clubshell glochidia have successfully transformed on a variety of cyprinid fish species (minnows and shiners) in the lab. Several centrarchid and percid fish species have also been tested, but yielded no transformation (Freshwater Mussel Host Database, 2017).

Current Stressors and Threats

The Clubshell Recovery Plan (USFWS, 1994) identified 4 major stressors/threats contributing to the decline of Clubshell throughout its range: siltation, impoundment, in-stream sand and gravel mining, and pollutants. Since the initial listing of the species, these and other factors remain ongoing threats to Clubshell, primarily in the form of habitat loss and degradation.

- Water quality degradation
  Water quality degradation from point and non-point sources, particularly in small tributaries that have limited capability to dilute and assimilate pollutants, is an ongoing threat to Clubshell and other native mussels. Since listing, development has resulted in an increased number of sewage treatment plants in drainages that support the Clubshell as well as an increase in the amount of sewage discharged from existing plants. Mounting evidence indicates that freshwater mussels are more sensitive to several components of treated sewage effluent (e.g., ammonia, chlorine, and copper) than are the typical organisms used to establish criteria protective of aquatic life. Small streams are particularly vulnerable to sewage effluent, which can constitute a significant portion of the total stream flow (USFWS, 2019).
- Impoundments
  Clubshell is also affected by hydrologic and water quality alterations from the operation of impoundments. The presence of impoundments may have ameliorated the effects of downstream siltation, but these structures also control river discharges (and the many environmental parameters influenced by discharge), which may profoundly affect the ability of these populations to occupy or successfully reproduce in downstream habitats (USFWS, 2019). In addition, dams represent distributional barriers to fish hosts, as fish may not be able to move upstream past the dams, potentially limiting mussel distribution as well (USFWS, 1994).
- In-stream activities
  In-stream activities, including sand and gravel dredging, gravel bar removal, bridge construction, and pipeline construction, also threaten Clubshell populations. In-stream activities may harm mussels by direct physical disturbance, such as removing material via dredging or construction of permanent structures in the river, and by indirect changes to streamflow patterns resulting from altering the streambed configuration (USFWS, 2019). Land-based development near streams of occurrence, including residential development and agriculture, often results in loss of riparian habitat, increased storm water runoff due to increased impervious surfaces, increased sedimentation due to loss of streamside vegetation, and subsequent degradation of streambanks. Because Clubshells often live below the gravel surface, this species may be exceptionally sensitive to the increased siltation generated by these activities (USFWS, 2019).
- Resource extraction activities
  Coal, oil, and natural gas resources are present in a number of the watersheds that are known to support Clubshell. Exploration and extraction of these energy resources can result in increased siltation, a changed hydrograph, and altered water quality even at a distance from the mine or well field. Clubshell populations in smaller streams are more vulnerable to the effects of these resource extraction activities, which can account for a much larger percentage of a small watershed. However, Clubshell habitat in larger streams can also be threatened by the cumulative effects of a large number of mines and well fields (USFWS, 2019).
- Invasive species
  Invasive zebra mussels (*Dreissena polymorpha*) have continued to spread throughout the Great Lakes, Ohio, and Mississippi River basins since their accidental introduction in the 1980s. Zebra mussels may affect native freshwater mussels both directly, by physically attaching to the shells of native mussels, and indirectly, through competition or changes in water quality. Direct attachment of zebra mussels

may inhibit locomotion, feeding, respiration, or excretion by preventing native mussels from opening or closing. As filter feeders, zebra mussels may strip the water of food and nutrients, and excretion by zebra mussels may increase ambient ammonia concentrations. Zebra mussels have been documented in headwater lakes and reservoirs of a number of streams supporting Clubshell populations, and nearly all remaining reproducing Clubshell populations are downstream of lakes or reservoirs that support, or could support, zebra mussels (USFWS, 2019).

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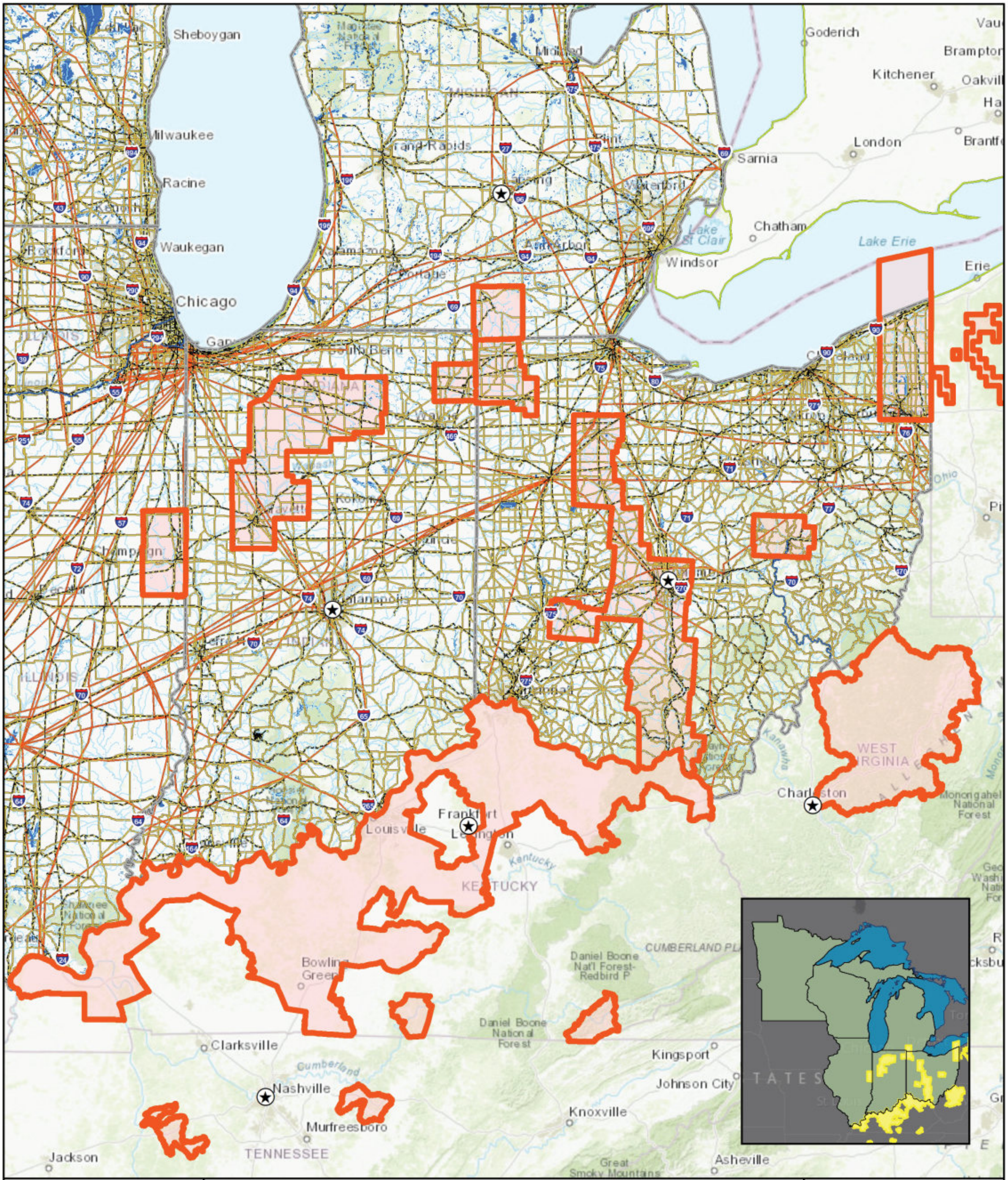

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Miles
0 20 40 80 120 160
Kilometers

CLUBSHELL (*PLEUROBEMA CLAVA*)
ACTION AREA OVERVIEW MAP

SCALE 1:5,500,000

- Petroleum Pipeline
- Major Road
- Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- Lakes & Ponds
- 1-Mile Coastal Inland Buffer
- Action
- Clubshell (*Pleurobema clava*) Counties of Occurence

N

Basemap courtesy of Esri.

Date: 5/25/2021

Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS

Projection: WGS 1984 Web Mercator

Fanshell (*Cyprogenia stegaria*)

Federal Listing: Endangered
State Listing within the AA: Endangered in Illinois, Indiana, and Ohio

Species Description

The Fanshell is a medium-sized mussel, reaching approximately 3in in length. The shell has a circular outline and is solid and moderately inflated. Growth lines on the shell appear as distinct elevated ridges. Numerous pustules are present on the shell surface, usually concentrated in the center of the shell but sometimes covering the entire shell surface. The periostracum is typically yellow or light green with dark green mottled rays. The pseudocardinal teeth are relatively large and serrated, and the lateral teeth are heavy, short, and straight to slightly curved. The beak cavity is shallow to moderately deep. The nacre is usually silvery white and iridescent posteriorly (USFWS, 1991; Cummings & Mayer, 1992).

Species Distribution

The Fanshell typically inhabits medium to large rivers with gravel substrate (Cummings & Mayer, 1992; USFWS, 1991). It 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 (USFWS, 1991). However, the Recovery Plan indicated that reproducing populations were only believed to occur in three rivers: the Clinch River (Tennessee and Virginia), the Green River (Kentucky), and the Licking River (Kentucky). Remnant populations were thought to persist in the Muskingum River (Ohio), Walhonding River (Ohio), Wabash River (Illinois and Indiana), East Fork White River (Indiana), Tippecanoe River (Indiana), Kanawha River (West Virginia), Tygarts Creek (Kentucky), Barren River (Kentucky), Cumberland River (Tennessee), and Tennessee River (Tennessee) (USFWS, 1991). Recent review of Fanshell distributional data suggests that the species' distribution has not changed substantially since the recovery plan was completed. Fanshell populations in some locations, including the Tennessee River, Ohio River (Greenup Pool), Kanawha River, and Muskingum River have been augmented with translocated adult Fanshell mussels over the past 10 years (USFWS, 2019).

Distribution within Action Area

- Illinois: White County (Wabash River)
- Indiana: Carroll, Daviess, Dubois, Gibson, Lawrence, Martin, Pike, Posey, Wabash, and White Counties (Wabash River, White River, East Fork White River)
- Ohio: Coshocton, Morgan, Muskingum, and Washington Counties (Muskingum River, Walhonding River, Killbuck Creek)

Critical Habitat

No critical habitat has been designated for the Fanshell.

Life History

Life history of the Fanshell is similar to that of other unionid mussel species. Females brood glochidia (larvae) in their gills, and, once released, glochidia must attach to the gills or fins of a suitable host, typically a fish, to complete the transformation from the larval stage to a juvenile mussel. Gravid females have been observed from late October to late May in Tennessee (USFWS, 2019). Glochidia are released in spiral conglutinates; the worm-like shape mimics fish food items and presumably aids in attracting host fish (USFWS, 1991). Ten host fish, including various darter species, sculpin, and logperch, have been identified as suitable hosts for Fanshell glochidia (USFWS, 2019).

Current Stressors and Threats

Like other native freshwater mussels, threats to Fanshell mussels include habitat alteration due to impoundments, navigation projects, pollution, and sand and gravel dredging (USFWS, 1991).

- Water quality degradation

Ongoing threats to the Fanshell include water quality degradation from point and non-point sources, particularly in tributaries that have limited capability to dilute and assimilate sewage, agricultural runoff, and other pollutants.

- Impoundments
  In addition, the species is affected by hydrologic and water quality alterations resulting from the operation of impoundments. The presence of impoundments may have ameliorated the effects of downstream siltation on Fanshells, but these structures also control river discharges and the many environmental parameters influenced by discharge, which may profoundly affect the ability of these populations to occupy or successfully reduce in downstream habitats (USFWS, 2019).
- In-stream activities
  A variety of instream activities (e.g. sand and gravel dredging, road construction, etc.) continue to threaten Fanshell populations. Protecting these populations from the direct physical disturbance of such activities depends on accurately identifying the location of the populations. The indirect effects of altering the streambed configuration may cause changes in previously suitable habitat (USFWS, 2019).
- Resource extraction activities
  Coal, oil, and natural gas resources are present in some of the watersheds known to support Fanshell mussels. Exploration and extraction of these resources can result in increased siltation, an altered hydrograph, and degraded water quality. Although these resource extraction activities generally occur away from the river, extensive road and pipeline networks are required to access sites. These road networks frequently cross or occur near tributaries, contributing sediment to the receiving waterway. In addition, the construction and operation of wells may result in the discharge of brine (USFWS, 2019).
- Development
  Land-based development including residential and agricultural activities near streams often results in loss of riparian habitat, increased stormwater runoff due to increased impervious surfaces, increased sedimentation due to loss of streamside vegetation, and subsequent degradation of streambanks (USFWS, 2019).
- Invasive species
  Zebra mussels may affect native freshwater mussels both directly, by physically attaching to the shells of native mussels, and indirectly, through competition or changes in water quality. Direct attachment of zebra mussels may inhibit locomotion, feeding, respiration, or excretion by preventing native mussels from opening or closing. As filter feeders, zebra mussels may strip the water of food and nutrients, and excretion by zebra mussels may increase ambient ammonia concentrations. Zebra mussel populations in the Ohio River could be negatively influencing Fanshell populations, and could also influence recovery actions to benefit Fanshell by limiting locations in which to establish new populations and/or impacting newly established populations (USFWS, 2019).

List of References

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0 12.5 25 50 75
Miles
0 12.525 50 75 100
Kilometers

FANSHELL (*CYPROGENIA STEGARIA*) ACTION AREA OVERVIEW MAP

SCALE 1:5,000,000

- Petroleum Pipeline
- Major Road
- Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- Lakes & Ponds
- 1-Mile Coastal Inland Buffer
- Action Area
- Fanshell (*Cyprogenia stegaria*) Counties of Occurrence

N

Basemap courtesy of Esri.

Date: 5/25/2021

Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS

Projection: WGS 1984 Web Mercator

Fat Pocketbook (*Potamilus capax*)

Federal Listing: Endangered
State Listing within the AA: Endangered in Illinois and Indiana

Species Description

The shell of Fat Pocketbook is relatively large, thin (in young individuals) to moderately thick (in adults), and highly inflated. The anterior and posterior ends of the shell are rounded. The beaks are very inflated, elevated above the hinge line, and curved inward. Beak sculpture consists of a few faint ridges, generally only visible in young shells. Young individuals may also have a small posterior wing on the shell. The shell surface is smooth, and the periostracum is yellow, tan, or olive, rayless, and usually very shiny. The pseudocardinal teeth are thin and compressed, and the lateral teeth are thin and curved. The hinge line is distinctly S-shaped. The beak cavity is very deep. The nacre is bluish white, sometimes tinged with pink or salmon (USFWS, 1989; Cummings & Mayer, 1992).

Species Distribution

The Fat Pocketbook typically occurs in large rivers and occupies slow-flowing areas with mud, sand, or fine gravel substrate (Cummings & Mayer, 1992; USFWS, 1997). The Fat Pocketbook was historically widely distributed in the Mississippi River drainage from the confluence of the Minnesota and St. Croix Rivers downstream to the White River system. The species was documented in Minnesota, Wisconsin, Iowa, Illinois, Indiana, Missouri, Kentucky, and Arkansas. Most historical records for this species are from the upper Mississippi River (above St. Louis), the Wabash River in Indiana, and the St. Francis River in Arkansas. When listed, only the St. Francis River and White River populations of Fat Pocketbook were believed to be extant and viable (USFWS, 2019). More recently, the range of Fat Pocketbook in the St. Francis and Ohio River drainages has increased over the historically documented extent. While the species appears to remain extirpated from the upper Mississippi River, it has expanded its range into the lower Mississippi River. Since 1985, Fat Pocketbook has been reported from 33 streams in the St. Francis River, Ohio River, and Mississippi River basins, including the Ohio and lower Mississippi River mainstems, and recruitment has been documented in several streams (USFWS, 2019).

Distribution within Action Area

- Illinois: Alexander, Crawford, Gallatin, Hardin, Johnson, Lawrence, Massac, Pope, Pulaski, Wabash, White Counties (Ohio River, Wabash River, Little Wabash River)
- Indiana: Daviess, Gibson, Knox, Pike, Posey Counties (Ohio River, Wabash River, White River, East Fork White River)

Critical Habitat

No critical habitat has been designated for the Fat Pocketbook.

Life History

Life history of the Fat Pocketbook is similar to that of other unionid mussel species. Females brood glochidia (larvae) in their gills, and, once released, glochidia must attach to the gills or fins of a suitable host, typically a fish, to complete the transformation from the larval stage to a juvenile mussel. Like other mussels in the lampsiline subfamily, Fat Pocketbook is likely bradytictic (a long-term brooder), and gravid females have been observed from June to October (USFWS, 1989). Of nearly 30 fish species tested, Freshwater Drum (*Aplodinotus grunniens*) remains the only known suitable host for Fat Pocketbook glochidia (USFWS, 2019).

Current Stressors and Threats

Primary threats or stressors identified for the Fat Pocketbook in the original Recovery Plan included habitat modification due to navigation and flood control activities (e.g. impoundment, channelization, channel maintenance, dredging), as well as siltation and pollution. More recent reviews have also identified hydropower/hydrokinetic development, channel dredging, and illegal discharges and spills as additional threats to the species.

- Impoundments
  Among the extant Fat Pocketbook populations, the Ohio River is the only one currently directly affected by impoundments; however, since listing, this species has expanded its range or been discovered in reaches of the lower river affected by navigation impoundments. The Fat Pocketbook continues to survive and recruit in dam tailwaters as well as in riverine sections and the upper pools of impounded reaches through an approximately 160-mile reach of the lower Ohio River. In addition, Fat Pocketbook continues to survive and reproduce both upstream and downstream of the recently constructed Olmsted Dam (completed in 2018; USFWS, 2019).
- Hydropower development
  Construction of a hydropower generation facility at Smithland Lock and Dam was considered a threat to the Fat Pocketbook. Mussels occurring near the project area could be directly harmed by construction activities or indirectly affected by altered flows, dissolved oxygen levels, and availability of fish hosts (USFWS, 2012). Monitoring during and after construction demonstrated a decline in overall freshwater mussel abundance, possibly due to changes in substrate as a result of the project. However, persistence and recruitment of Fat Pocketbook during and after construction of the hydropower project has been demonstrated (USFWS, 2019).
- Channelization and dredging
  Channel dredging may have many direct and indirect effects on freshwater mussels, including direct mortality, accelerated channel erosion, decreased habitat diversity, increased bedload, and/or increased habitat instability. Maintenance dredging is periodically required for navigation and barge fleeting areas in the Mississippi and Ohio Rivers, and for flood control and drainage efficiency in tributaries and ditches of the St. Francis River drainage. Much of the dredging in the Mississippi and Ohio River basins occurs in depositional areas where Fat Pocketbook is unlikely to occur, and several studies in the St. Francis River basin suggest that Fat Pocketbook populations not only survive channel clean out operations, but rapidly reoccupy post-work channel habitats (USFWS, 2019).
- Pollution
  Fat Pocketbook mussels may be locally vulnerable to spills or illegal discharges. However, such episodes are rare, and impacts are relatively localized. Non-point source pollution (stormwater or agricultural runoff) may have negative effects on mussel populations and has been identified as a concern in the Wabash and St. Francis River drainages. However, the increase in Fat Pocketbook abundance and range over the past two decades within areas that are highly impacted by non-point agricultural runoff and sediments suggests non-point source pollutants are not currently a major impediment to Fat Pocketbook survival (USFWS, 2019).

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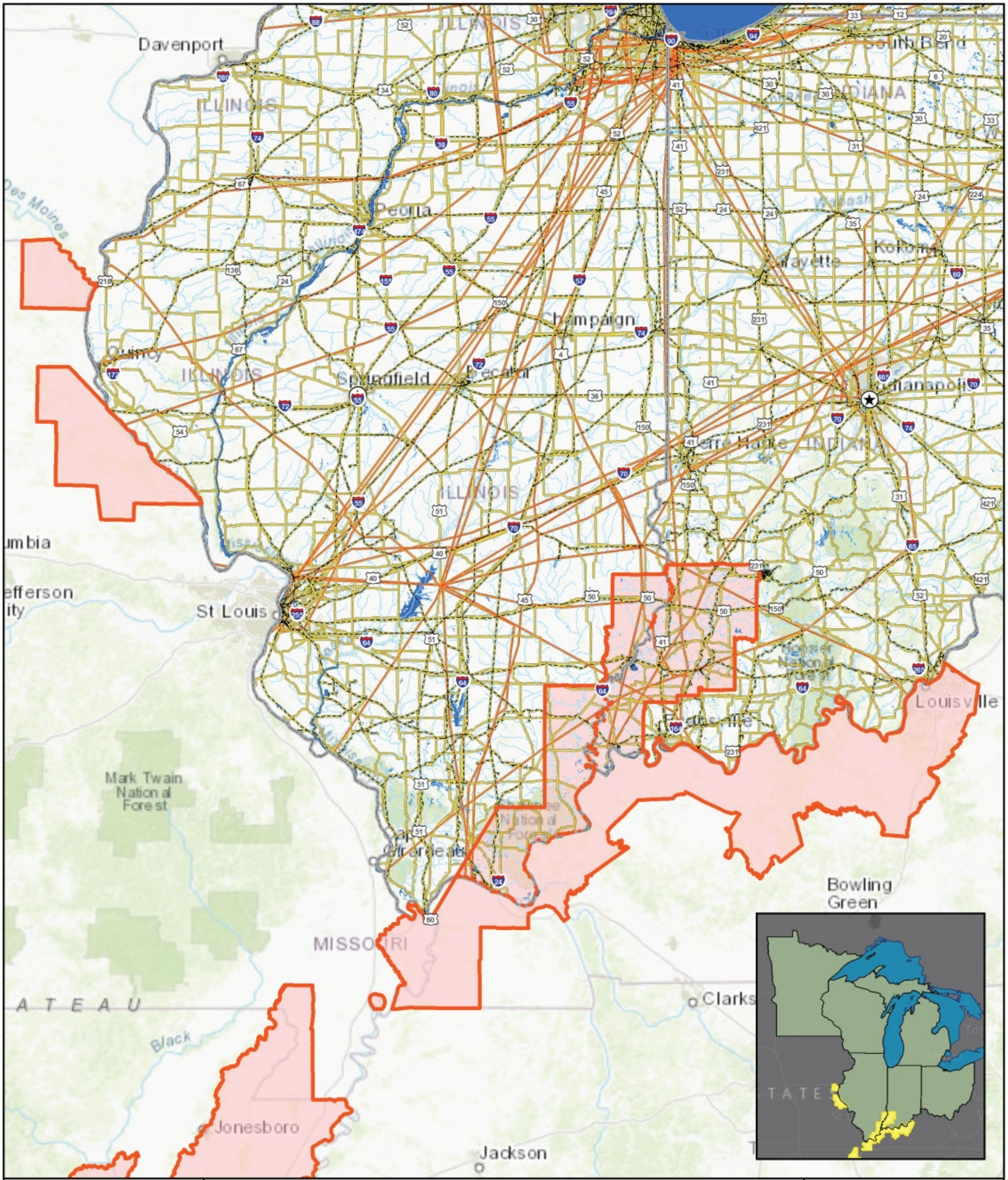

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Miles
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Kilometers

FAT POCKETBOOK (*POTAMILUS CAPAX*)
ACTION AREA OVERVIEW MAP

SCALE 1:4,000,000

— Petroleum Pipeline	— Commercial Navigable Waterway	🟩 1-Mile Coastal Inland Buffer
— Major Road	— Rivers & Streams	🟨 Action Area
------ Railroad	🟦 Lakes & Ponds	🟥 Fat Pocketbook (*Potamilus capax*) Counties of Occurrence

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Basemap courtesy of Esri. Date: 5/25/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS Projection: WGS 1984 Web Mercator

Higgins Eye Pearlymussel (*Lampsilis higginsii*)

Federal Listing: Endangered
State Listing within the AA: Endangered in Illinois, Minnesota, and Wisconsin

Species Description

The Higgins Eye Pearlymussel is a medium-sized mussel, reaching lengths up to 4in (10.2cm). The shell is rounded or oval, solid, and moderately inflated. The species is sexually dimorphic; the posterior end of the shell is bluntly pointed in males and truncated in females. The beaks are turned forward and elevated above the hinge line, and beak sculpture, if visible, consists of a few double-looped ridges. The shell is smooth and yellowish-green to brown, sometimes with green rays. The pseudocardinal teeth are thick and triangular, with two in the left valve and one in the right, and the lateral teeth are thick and straight to moderately curved. The beak cavity is deep. The nacre is white, may be tinged with pink near the beak cavity, and iridescent posteriorly (Cummings & Mayer, 1992; USFWS, 2004).

Species Distribution

Higgins Eye Pearlymussel has generally been characterized as a large river species. It has been found in a variety of substrate types, but typically does not occur where substrate is comprised of hard clay, flocculent silt, organic material, bedrock or concrete, or unstable shifting sand (USFWS, 2004). Historically, the range of Higgins Eye Pearlymussel included the Mississippi River mainstem from just north of St. Louis, Missouri to just South of St. Paul, Minnesota, and tributaries in Illinois (Illinois, Sangamon, and Rock Rivers), Iowa (Iowa, Cedar, and Wapsipinicon Rivers), Wisconsin (Wisconsin and St. Croix Rivers), and Minnesota (Minnesota River; USFWS, 2004). However, its current range is limited to approximately 50% of the historic range; species observations since 1980 have been limited to the Mississippi River upstream of Lock and Dam 19, the St. Croix River, the Wisconsin River, and the lower Rock River (USFWS, 2012). USFWS and partner agencies have undertaken efforts to reintroduce Higgins Eye Pearlymussel into portions of its historic range, including several Mississippi River navigation pools, the lower Rock River, and the Iowa, Cedar, and Wapsipinicon Rivers (USFWS, 2004).

Distribution within Action Area

- Illinois: Adams, Carroll, Hancock, Henderson, Henry, Jo Daviess, Mercer, Pike, Rock Island, Whiteside Counties (Mississippi River, Rock River)
- Minnesota: Chisago, Dakota, Goodhue, Hennepin, Houston, Ramsey, Wabasha, Washington, Winona Counties (Mississippi River, St. Croix River)
- Wisconsin: Buffalo, Columbia, Crawford, Dane, Grant, Iowa, La Crosse, Pepin, Pierce, Polk, Richland, Sauk, St. Croix, Vernon Counties (Mississippi River, St. Croix River, Wisconsin River)

Critical Habitat

No critical habitat has been designated for the Higgins Eye Pearlymussel. However, USFWS has designated several Essential Habitat Areas – primary habitat locations capable of supporting reproducing populations of Higgins Eye Pearlymussel – throughout its range. There are currently 13 Essential Habitat Areas and an additional 6 potential Essential Habitat Areas identified in the Mississippi, St. Croix, and Wisconsin Rivers (USFWS, 2008).

Life History

The Higgins Eye Pearlymussel is bradytictic (long-term brooder). Individuals spawn in the summer and larvae, known as glochidia, are held in the marsupia over the winter before being released the following spring/summer. Once released, glochidia must attach to the gills or fins of a suitable host, typically a fish, to complete the transformation from the larval stage to a juvenile mussel. The edge of the female mussel's mantle is developed into a flap that resembles a small fish, presumably luring host fish to the mussel. Fish species identified as suitable hosts for Higgins Eye Pearlymussel include sauger (*Sander canadensis*), walleye (*Sander vitreus*), freshwater drum (*Aplodinotus grunniens*), largemouth bass (*Micropterus* *salmoides*), smallmouth bass (*Micropterus dolomieu*), yellow perch (*Perca flavescens*), and black crappie (*Pomoxis nigromaculatus*; USFWS, 2004).

Current Stressors and Threats

The Higgins Eye Pearlymussel Recovery Plan (First Revision; USFWS, 2004) identified zebra mussels and other invasive species, habitat alteration, water quality, and commercial harvest as present threats to the species. The 2020 5-year review also identified toxic chemical spills as a potential threat.

- Zebra mussels
  Zebra mussels were introduced to North America via ballast water in commercial shipping vessels in the 1980s and have since spread throughout the Great Lakes, Mississippi River, and Ohio River basins. Zebra mussels may affect native freshwater mussels both directly, by physically attaching to the shells of native mussels, and indirectly, through competition or changes in water quality. Direct attachment of zebra mussels may inhibit locomotion, feeding, respiration, or excretion by preventing native mussels from opening or closing. As filter feeders, zebra mussels may strip the water of food and nutrients, and excretion by zebra mussels may increase ambient ammonia concentrations. Various studies have documented profound effects of zebra mussels on areas occupied by Higgins Eye Pearlymussel (USFWS, 2004).
- Impoundments and dredging
  Habitat alteration poses another threat to Higgins Eye Pearlymussel. Modifications to the Upper Mississippi River for navigation, including construction of wing dams, dredging, and the current lock and dam system, replaced the once free-flowing system with a stepped gradient river and may have altered substrate composition, sedimentation, and current velocity. Although most of these changes have already occurred, future changes in channel operation and maintenance could affect the species.
- In-stream development
  Smaller-scale habitat alteration from in-stream development projects, such as barge loading facilities or highway bridges, continues to be a threat.
- Water quality degradation
  Changes in water quality due to point and non-point contaminants and pollutants, and chronic and episodic events, may also threaten Higgins Eye Pearlymussel and other native mussel species. Several toxic chemical spills have been reported throughout the range of Higgins Eye Pearlymussel, particularly in the Mississippi River, and have killed mussels and fish in affected areas. Such spills likely continue to threaten Higgins Eye Pearlymussel and other native mussels (USFWS, 2020).

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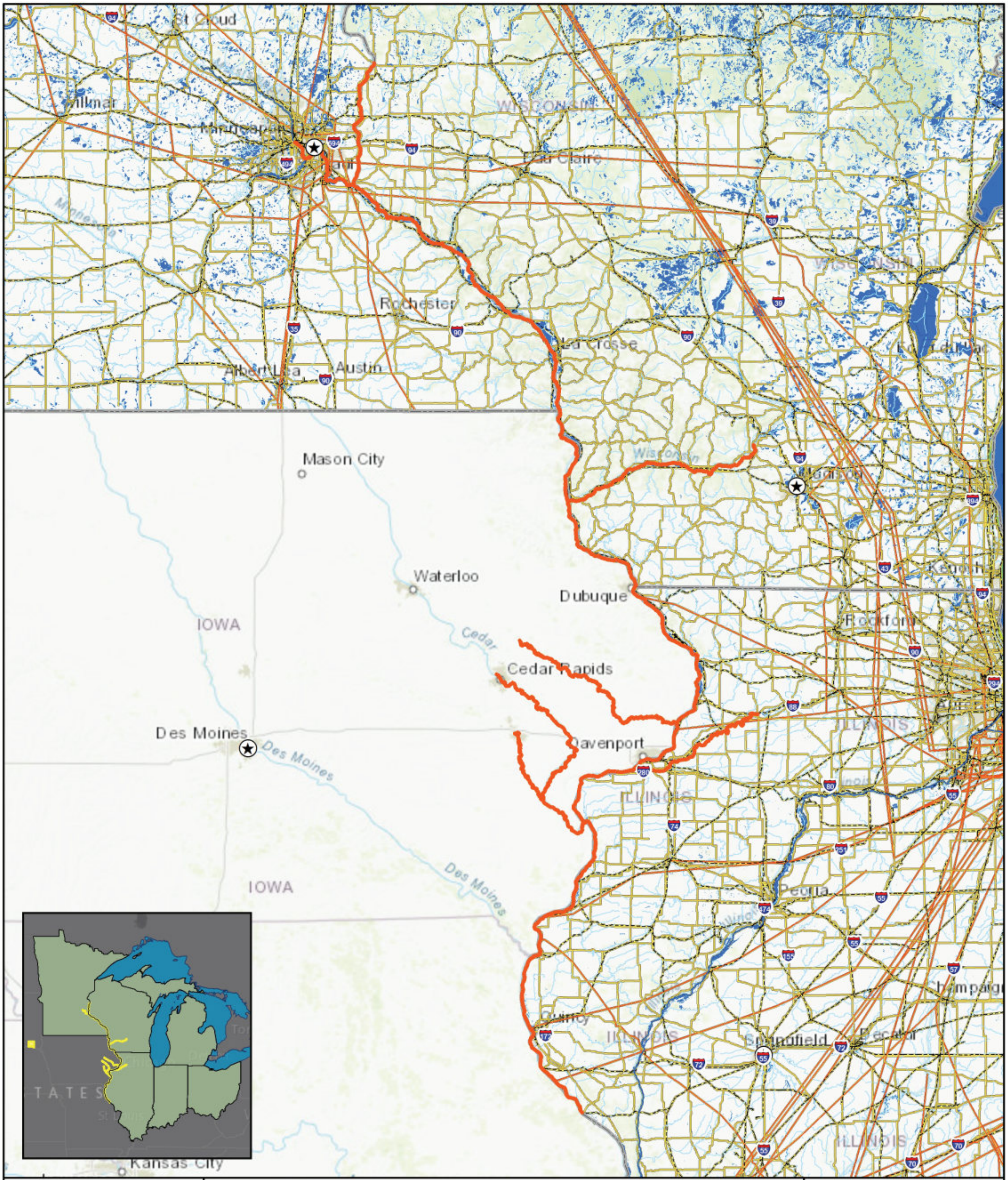

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HIGGINS' EYE PEARLYMUSSEL (*LAMPSILIS HIGGINSII*) ACTION AREA OVERVIEW MAP

SCALE 1:4,500,000

- Petroleum Pipeline
- Major Road
- ------ Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- ▬ Lakes & Ponds
- 🟩 1-Mile Coastal Inland Buffer
- 🟨 Action Area
- ▭ Higgins' Eye Pearlymussel (*Lampsilis higginsii*) Counties of Occurrence

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Basemap courtesy of Esri. Date: 5/25/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS Projection: WGS 1984 Web Mercator

Longsolid (*Fusconaia subrotunda*)

Federal Listing: Proposed Threatened. The Longsolid was petitioned for Federal listing under the Endangered Species Act in 2010. The U.S. Fish & Wildlife Service proposed listing the species as Threatened in 2020 (85 FR 61384).
State Listing within the AA: Endangered in Ohio

Species Description

The Longsolid is a medium-sized, thick-shelled mussel. The shell is oval or elliptical, becoming more elongate with age, and moderately inflated, though there is variability in the inflation depending on population and location (Cummings & Mayer, 1992; USFWS, 2018). The beaks are low and directed forward. The shell is smooth, and the periostracum is light brown, becoming darker brown or black in adults. Fine broken green rays are present on the umbo (Cummings & Mayer, 1992; USFWS, 2018). The pseudocardinal teeth are large and well developed, and the lateral teeth are large and straight. The beak cavity is wide, compressed, and very deep. The nacre is white, iridescent posteriorly (Cummings & Mayer, 1992; USFWS, 2018).

Species Distribution

The Longsolid occurs in small to large rivers in substrates ranging from sand and gravel to coarse gravel and cobble. The species has been associated with slower, deeper microhabitats, suggesting it has a greater tolerance for pool and run habitats (USFWS, 2018). The Longsolid was historically known from 162 populations in the Great Lakes, Ohio, Cumberland, and Tennessee River basins in Alabama, Georgia, Illinois, Indiana, Kentucky, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia (USFWS, 2018). However, many populations have since been extirpated, and the Longsolid is currently only known from 60 populations in Alabama, Kentucky, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia. The species is considered extirpated from Georgia, Illinois, and Indiana and from the entire Great Lakes basin (USFWS, 2018).

Distribution within Action Area

- Illinois: Alexander, Massac, Pope, and Pulaski Counties (Ohio River)
- Indiana: Crawford, Dearborn, Ohio, Perry, Posey, Spencer, Switzerland, Vanderburgh, and Warrick Counties (Ohio River)
- Ohio: Gallia, Lawrence, Monroe, and Washington Counties (Ohio River); Coshocton, Holmes, Morgan, Muskingum, and Noble Counties (Walhonding River, Muskingum River); Stark and Tuscarawas Counties (Tuscarawas River); Trumbull County (Shenango River)

Critical Habitat

No critical habitat has been designated for the Longsolid.

Life History

Life history of the Longsolid is similar to that of other unionid mussel species. Females brood glochidia (larvae) in their gills, and, once released, glochidia must attach to the gills or fins of a suitable host, typically a fish, to complete the transformation from the larval stage to a juvenile mussel. The Longsolid is a short-term brooder and is typically gravid from May to July (USFWS, 2018). Longsolid glochidia are released in packets called conglutinates, which drift in the water column and are targeted by sight-feeding fish, facilitating attachment of glochidia to the fish host (USFWS, 2018). Host fish species for Longsolid are unknown, but based on other species of *Fusconaia*, likely hosts are minnows of the family Cyprinidae and genera *Campostoma*, *Cyprinella*, *Notropis*, and *Luxilus*, as well as potentially sculpins of family Cottidae, genus *Cottus* (USFWS, 2018).

Current Stressors and Threats

Like other rare native mussels, habitat degradation or loss, genetic isolation and displacement, and invasive species are potential threats to the Longsolid.

- Development and urbanization
  Development and/or urbanization may affect mussels by altering water quality, water quantity, and habitat, and roads in particular are generally associated with negative effects on the biotic integrity of aquatic ecosystems (USFWS, 2018).
- Dredging, channelization, and impoundments
  Dredging and channelization to maintain waterways for commercial navigation have also profoundly altered riverine habitats nationwide. Extensive construction of dams and impoundments throughout the range of Longsolid may affect mussels both upstream of the dam (change from flowing to impounded waters, increased depths, increased buildup of sediments, decreased dissolved oxygen, and the drastic alteration in resident fish populations) and downstream of the dam (fluctuations in flow regimes, minimal releases and scouring flows, seasonal depletion of dissolved oxygen, reduced or increased water temperatures, and changes in fish assemblages; USFWS, 2018).
- Contaminants
  Contaminants contained in point and non-point discharges can degrade water and substrate quality and adversely impact mussel populations. Although chemical spills and other point sources of contaminants may directly result in mussel mortality, widespread decreases in density and diversity may result in part from the subtle, pervasive effects of chronic, low-level contamination (USFWS, 2018). In addition, chemical control methods used in agriculture, including herbicides, fungicides, insecticides, and their surfactants and adjuvants, are highly toxic to juvenile and adult freshwater mussels (USFWS, 2018).
- Resource extraction activities
  Resource extraction activities may also threaten Longsolid populations. Across the Longsolid's range, the most significant resource extraction impacts are from coal mining and oil and gas exploration. Activities associated with coal mining and oil and gas drilling can contribute chemical pollutants to streams, and natural gas extraction has been associated with increased sedimentation due to increases in impervious surface and tree removal for drill pads and pipelines (USFWS, 2018). Instream sand and alluvial gravel mining has been implicated in the loss of mussel populations. Negative impacts associated with gravel mining include stream channel modifications such as altered habitat, disrupted flow patterns, and sediment transport, and water quality modifications, including increased turbidity, temperature, and sedimentation (USFWS, 2018).
- Invasive species
  Several invasive species are established throughout the range of Longsolid and may threaten the species. Mussels are adversely affected by zebra mussels (*Dreissena polymorpha*) through direct colonization, reduction of available habitat, changes in the biotic environment, or a reduction in food sources. The Asian Clam (*Corbicula fluminea*) alters benthic substrates, may filter mussel sperm or glochidia, competes with native species for limited resources, and causes ammonia spikes in surrounding water when they die off en masse (USFWS, 2018). The Black Carp (*Mylopharyngodon piceus*), a molluscivorous fish, may negatively impact native aquatic communities by direct predation, thus reducing populations of native mussels and snails, many of which are considered endangered or threatened. The presence of non-native species is a substantial threat to the Longsolid throughout its range, but the concentration of non-native species in the lower Ohio and Tennessee Rivers is most problematic (USFWS, 2018).
- Inherent factors
  The Longsolid exhibits several inherent traits that influence population viability, including relatively small population size and low fecundity at many locations compared to other mussels. Small population size puts the species at greater risk of extirpation from stochastic events (e.g., drought) or anthropomorphic changes and management activities that affect habitat. In addition, small, isolated Longsolid

populations may have reduced genetic diversity, be less genetically fit, and more susceptible to disease during extreme environmental conditions (USFWS, 2018).

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Miles
0 15 30 60 90 120
Kilometers

LONGSOLID (*FUSCONAIA SUBROTUNDA*)
ACTION AREA OVERVIEW MAP

SCALE 1:5,500,000

—— Petroleum Pipeline	—— Commercial Navigable Waterway	🟩 1-Mile Coastal Inland Buffer
—— Major Road	—— Rivers & Streams	🟨 Action Area
------ Railroad	🟦 Lakes & Ponds	▭ Longsolid (*Fusconaia subrotunda*) Counties of Occurrence

N

Basemap courtesy of Esri.

Date: 5/25/2021

Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS

Projection: WGS 1984 Web Mercator

Northern Riffleshell (*Epioblasma torulosa rangiana*)

Federal Listing: Endangered
State Listing within the AA: Endangered in Illinois, Indiana, Michigan, and Ohio

Species Description

The Northern Riffleshell is a small mussel with an elongate, moderately thick shell. Individuals are sexually dimorphic. Male shells are bluntly pointed posteriorly, with a distinct sulcus and indented posterior-ventral margin. The area anterior to the sulcus is raised and may have weak undulations or tubercules. Female shells are rounded and greatly expanded posteriorly. The periostracum may extend past the shell margins in the expanded area and is frequently thin and easily broken (Cummings & Mayer, 1992; USFWS, 1994). In both sexes, the umbos are low and slightly turned forward. Beak sculpture consists of a series of double loops, usually eroded away except in the youngest specimens. The periostracum is yellow, light brown, or green, with fine green rays. The pseudocardinal teeth are short and chunky, and the lateral teeth are short and slightly arched (USFWS, 1994). The beak cavity is shallow. The nacre is white, iridescent posteriorly (Cummings & Mayer, 1992; USFWS, 1994).

Species Distribution

The Northern Riffleshell occurs in medium to large rivers, occupying packed sand and gravel substrate in riffles and runs (Cummings & Mayer, 1992; USFWS, 1994). The Northern Riffleshell is primarily an upper Ohio River system species, though it has also been documented in Great Lakes drainages. Historic records are known from approximately 50 streams in the Lake Erie (Michigan, Ohio, Ontario), Sydenham River (Ontario), River Raisin (Michigan), Huron River (Michigan), Detroit River (Michigan, Ontario), River Rouge (Michigan), Clinton River (Michigan), Black River (Michigan), Sandusky River (Ohio), Maumee River (Indiana, Michigan, Ohio), Wabash River (Illinois, Indiana), Ohio River (Kentucky, Ohio, West Virginia), Tennessee River (Alabama, Tennessee), Green River (Kentucky), Salt River (Kentucky), Kentucky River (Kentucky), Scioto River (Ohio), Kanawha River (West Virginia), Muskingum River (Ohio), and Allegheny River (Pennsylvania) drainages, including the Ohio River mainstem (USFWS, 1994). However, at the time of listing, Northern Riffleshell was only believed to be extant in short reaches of six streams: the Green River (Kentucky), Detroit River (Michigan), Big Darby Creek (Ohio), and French Creek, LeBoeuf Creek, and the Allegheny River (Pennsylvania; USFWS, 2019).

Recent data suggests that Northern Riffleshells are limited to four successfully recruiting populations in the Ohio and Great Lakes basins (Sydenham River, Allegheny River, French Creek, and Ausable River). However, populations in several other streams have undergone severe declines, including some of the streams with known extant populations at the time of listing. Northern Riffleshells have been moved from the Allegheny River to several streams in the species' historic range to augment existing populations or reintroduce the species to increase redundancy and species recovery. Receiving streams for relocated/reintroduced individuals include the Licking River (Kentucky), Big Darby Creek (Ohio), Tippecanoe River (Indiana), Vermilion River (Illinois), Allegheny River (New York), Kanawha River (West Virginia), Ohio River (West Virginia), and Beaver River (Pennsylvania; USFWS, 2019).

Distribution within Action Area

- Illinois: Vermilion County (reintroduced into the Vermilion River)
- Indiana: DeKalb and Pulaski Counties (reintroduced into the Tippecanoe River)
- Michigan: Monroe, Sanilac, and Wayne Counties (Great Lakes drainage)
- Ohio: Champaign, Franklin, Madison, Pickaway, Pike, Ross, Scioto, and Union Counties (Big Darby Creek, Scioto River); Defiance and Williams Counties (Maumee River)

Critical Habitat

No critical habitat has been designated for the Northern Riffleshell.

Life History

Life history of the Northern Riffleshell is similar to that of other unionid mussel species. Females brood glochidia (larvae) in their gills, and, once released, glochidia must attach to the gills or fins of a suitable host, typically a fish, to complete the transformation from the larval stage to a juvenile mussel. Northern Riffleshells are long-term brooders (bradytictic); glochidia overwinter in the female's gills and are released the following summer. Gravid females move to the substrate surface and gape widely, displaying a white mantle "pad" to attract host fish. When a host fish approaches, the female mussel captures the host fish between the valves of the shell, trapping the fish while the mussel expels glochidia onto the fish's gills and other tissues (USFWS, 2009). Suitable host fish for Northern Riffleshells include several darter and sculpin species; additional species of *Etheostoma* and *Percina* may also serve as suitable hosts (USFWS, 2009).

Current Stressors and Threats

The Northern Riffleshell Recovery Plan (USFWS, 1994) identified four major stressors/threats contributing to the decline of Northern Riffleshell throughout its range: siltation, impoundment, in-stream sand and gravel mining, and pollutants. Since the initial listing of the species, these and other factors remain ongoing threats to Northern Riffleshell, primarily in the form of habitat loss and degradation.

- Water quality degradation
  Water quality degradation from point and non-point sources, particularly in tributaries that have limited capability to dilute and assimilate sewage, agricultural runoff, and other pollutants, remains an ongoing threat.
- Impoundments
  This species is affected by hydrologic and water quality alterations resulting from the operation of impoundments. The presence of impoundments may have ameliorated the effects of downstream siltation on Northern Riffleshell, but these structures also control river discharges (and the many environmental parameters influenced by discharge), which may profoundly affect the ability of these populations to occupy or successfully reproduce in downstream habitats (USFWS, 2019).
- In-stream activities
  A variety of instream activities continue to threaten Northern Riffleshell populations, including sand and gravel dredging, gravel bar removal, bridge construction, and pipeline construction. These activities can directly affect the species through crushing, burying in silt/sediment, etc. In addition, the indirect effects of altering the streambed configuration following instream disturbance can result in long-lasting alteration of streamflow patterns that may cause headcutting and channel reconfiguration, thereby eliminating previously suitable habitat some distance from the disturbance (USFWS, 2019).
- Resource extraction activities
  Coal, oil, and natural gas resources are present in some of the watersheds known to support the Northern Riffleshell, including the Allegheny and Elk Rivers. Exploration and extraction of these resources can result in increased siltation, a changed hydrograph, and altered water quality, even at a distance from the mine or well field. Northern Riffleshell habitat in larger streams can be further affected by the cumulative effects of multiple mines and well fields (USFWS, 2019).
- Development
  Land-based development near streams of occurrence, including residential development and agriculture, often results in loss of riparian habitat, increased storm water runoff due to increased impervious surfaces, increased sedimentation due to loss of streamside vegetation, and subsequent degradation of streambanks. *Epioblasma*, including Northern Riffleshell, appear to be exceptionally sensitive to the increased siltation and associated turbidity caused by changing land use. Development has also increased the number of sewage treatment plants in drainages that support the Northern Riffleshell and increased the amount of sewage discharged from existing plants. Freshwater mussels are more sensitive to several components of treated sewage effluent (*e.g.,* ammonia, chlorine and copper) than are the typical organisms used to establish water quality criteria protective of aquatic life (USFWS, 2019).

- Disease and predation
  Little is known about diseases in freshwater mussels. However, mussel die-offs have been documented in Northern Riffleshell streams, and some researchers believe that disease may be a factor contributing to the die-offs. Due to the relatively small size of Northern Riffleshell, several animals prey on this mussel, including muskrats, raccoons, otters, molluscivous fish, and some invertebrates. Such predation could locally reduce populations of Northern Riffleshell. This effect may be negligible in larger populations such as those in the Allegheny River, but it could represent a significant threat to small, isolated Northern Riffleshell populations located elsewhere.
- Invasive species
  Invasive zebra mussels (*Dreissena polymorpha*) may directly or indirectly affect Northern Riffleshells and other native mussels by directly attaching to the native mussels' shells or by competing for food and other resources, and two invasive fish species, Round Goby (*Neogobius melanostomus*) and Black Carp (*Mylopharyngodon piceus*), have been documented in Northern Riffleshell's range and are known to be molluscivorous.
- Climate change
  Changes in precipitation and temperature due to climate change may have negative effects on native mussels, though it is unclear what the long-term effects may be (USFWS, 2019).

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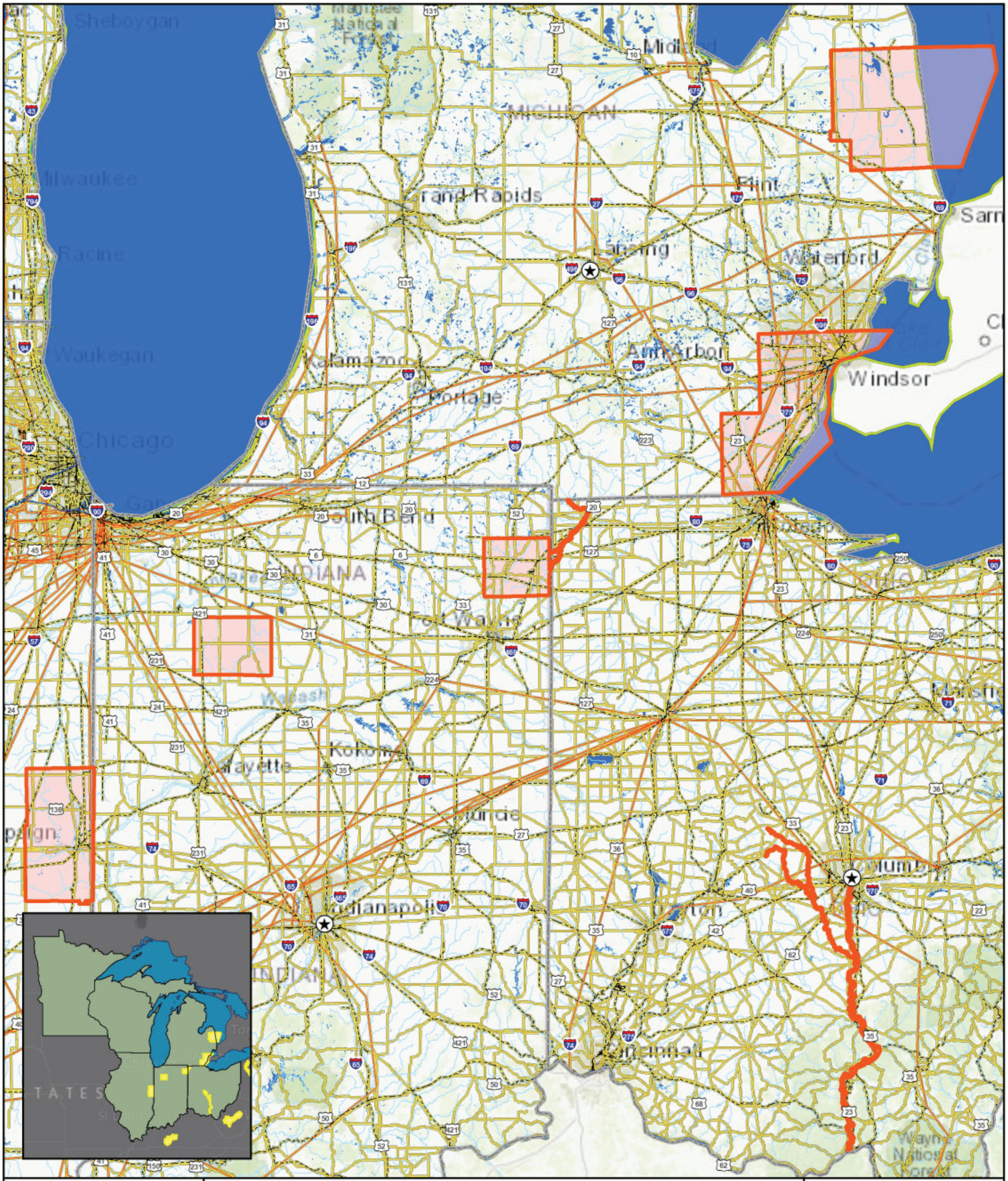

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Kilometers

NORTHERN RIFFLESHELL (*EPIOBLASMA TORULOSA RANGIANA*) ACTION AREA OVERVIEW MAP

SCALE 1:3,500,000

- Petroleum Pipeline
- Major Road
- Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- Lakes & Ponds
- 1-Mile Coastal Inland Buffer
- Action Area
- Northern Riffleshell (*Epioblasma torulosa rangiana*) Counties of Occurrence

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Basemap courtesy of Esri. Date: 5/25/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS Projection: WGS 1984 Web Mercator

Orangefoot Pimpleback (*Plethobasus cooperianus*)

Federal Listing: Endangered
State Listing within the AA: Endangered in Illinois

Species Description

The shell of Orange Pimpleback is thick, heavy, moderately inflated, and nearly circular in outline. The umbos are directed forward and only slightly elevated above the hinge line. The posterior two-thirds to three-fourths of the shell is covered with numerous pustules or tubercles. The periostracum is light brown in younger individuals, becoming chestnut or dark brown in older individuals. Faint greenish rays may be present on young specimens (USFWS, 1984; Cummings & Mayer, 1992). The pseudocardinal teeth are well developed, and the lateral teeth are short and straight or slightly curved. The beak cavity is very deep and compressed. The nacre is white and is often tinged with pink or salmon near the beak cavity (USFWS, 1984; Cummings & Mayer, 1992). Notably, the foot of live mussels is orange (Cummings & Mayer, 1992).

Species Distribution

The Orangefoot Pimpleback occurs in medium to large rivers in sand and gravel substrate. The species has reportedly been collected in both deep water and shallower riffle and shoal areas (USFWS, 1984). The Orangefoot Pimpleback historically occurred in Ohioan or Interior Basin streams, with known records from the Ohio River, Kanawha River, Wabash River, Rough River, Tennessee River, Duck River, French Broad River, Holston River, Clinch River, and Cumberland River (USFWS, 1984). However, at the time of listing, the species was only known to occur in the Tennessee, Cumberland, and lower Ohio Rivers. Since listing, the species' range has apparently decreased even more, with only two known extant populations: one in the Tennessee River downstream of Pickwick Landing Dam, and one in the lower Tennessee River below Kentucky Lake Lock & Dam and the lower Ohio River downstream of the mouth of the Tennessee River; the lower Tennessee River is considered to be part of the lower Ohio River population due to the proximity and connection of the two rivers. It is not known whether the Orangefoot Pimpleback persists in the Cumberland River (USFWS, 2018).

Distribution within Action Area

- Only occurs in Massac and Pulaski Counties, Illinois (Ohio River)

Critical Habitat

No critical habitat has been designated for the Orangefoot Pimpleback.

Life History

Life history of the Orangefoot Pimpleback is thought to be similar to that of other unionid mussel species. Females brood glochidia (larvae) in their gills, and, once released, glochidia must attach to the gills or fins of a suitable host, typically a fish, to complete the transformation from the larval stage to a juvenile mussel. The host fish for the Orangefoot Pimpleback is still unknown (USFWS, 2018).

Current Stressors and Threats

Impoundment, sedimentation, and pollution were identified as threats to the Orangefoot Pimpleback in the original recovery plan (USFWS, 1984).

- Water quality degradation

  Ongoing threats include water quality degradation from point and non-point sources, particularly in tributaries that have limited capability to dilute and assimilate sewage, agricultural runoff, and other pollutants. Regulated point sources may adversely affect the Orangefoot Pimpleback mussel. Freshwater mussels appear to exhibit more sensitivity to some pollutants than organisms typically used in toxicity testing. As a result, some of the water quality criteria established by the U.S. Environmental Protection Agency to protect aquatic life may not be protective of mussels; for example, the current EPA numeric criteria for ammonia may not protect mussels. Consequently, sewage treatment plants that comply with their ammonia effluent limits may still be discharging water that is toxic to mussels. Few substances have been tested for their toxicity to mussels and no tests have been conducted on Orangefoot Pimpleback mussels. “Safe” concentrations of regulated pollutants for this species are not yet known (USFWS, 2018).

- Impoundments
  In addition, the species is affected by hydrologic and water quality alterations resulting from the operation of impoundments. The presence of impoundments may have ameliorated the effects of downstream siltation on Orangefoot Pimpleback mussels in some situations, but these structures also control river discharges and the many environmental parameters influenced by discharge, which may limit the ability of these populations to occupy potential habitat or reproduce successfully (USFWS, 2018).
- Instream activities
  A variety of instream activities (e.g., sand and gravel dredging, navigation, fleeting, etc.) continue to threaten Orangefoot Pimpleback populations. Protecting these populations from the direct physical disturbance of such activities depends on accurately identifying the location of the populations. These instream activities may also alter the streambed configuration resulting in adverse changes to previously suitable habitat (USFWS, 2018). Other potential threats include land-based development including residential and agriculture activities near streams, which often results in loss of riparian habitat, increased stormwater runoff due to increased impervious surfaces, increased sedimentation due to loss of streamside vegetation, and subsequent degradation of stream banks (USFWS, 2018).
- Invasive species
  Invasive zebra mussels (*Dreissena polymorpha*) have continued to spread in North American waterways since their accidental introduction in the 1980s. Zebra mussel densities in the Tennessee River system downstream of Wilson and Pickwick Landing dams increased significantly in recent years, and the species currently persists in numbers as high as 12,000 individuals per square meter, posing an increased threat to Orangefoot Pimpleback persistence in this reach. Zebra mussels could also influence recovery actions to benefit this species by limiting the number of suitable locations where new populations could be established and/or impacting newly established populations (USFWS, 2018).
- Low recruitment
  Low recruitment of the Orangefoot Pimpleback is likely contributing to declining populations. Since the Orangefoot Pimpleback is a relatively long-lived species, the rate of decline may not be evident given the uncertainty of finding this species in the wild. Reasons for low recruitment are not known; however, it may involve single or multiple factors, such as difficulty of females being fertilized by sperm, lack of fish host(s), degraded water quality, and other factors. Small isolated populations also represent a threat to the species from lack of gene flow resulting in decreased diversity and greater susceptibility to extirpation from stochastic or catastrophic events (USFWS, 2018).

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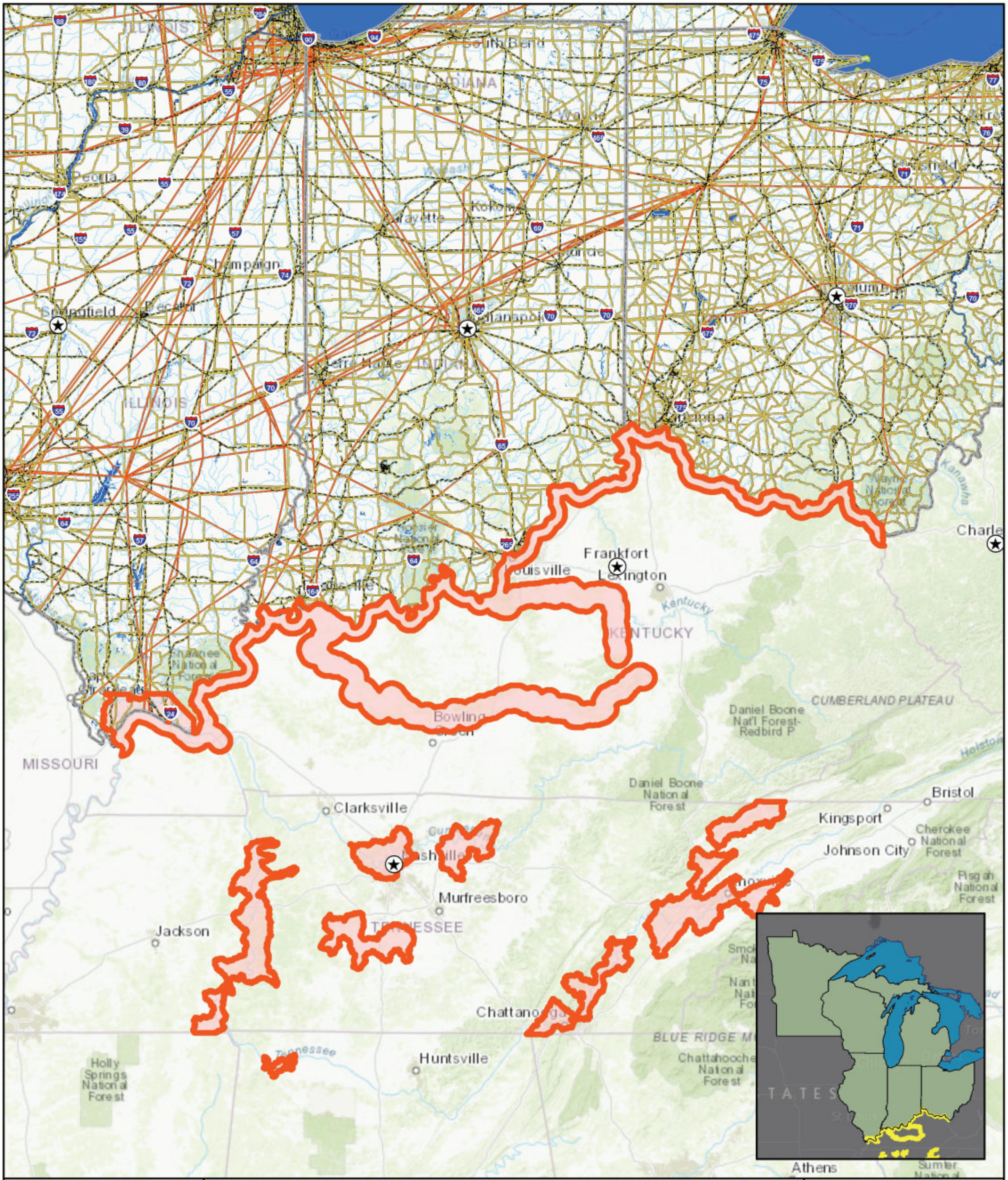

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ORANGEFOOT PIMPLEBACK (*PLETHOBASUS COOPERIANUS*) ACTION AREA OVERVIEW MAP

SCALE 1:5,000,000

Petroleum Pipeline	Commercial Navigable Waterway	🟩 1-Mile Coastal Inland Buffer
Major Road	Rivers & Streams	🟨 Action
Railroad	▬ Lakes & Ponds	▭ Orangefoot Pimpleback (*Plethobasus cooperianus*) Counties of Occurrence.

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Basemap courtesy of Esri. Date: 5/25/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS Projection: WGS 1984 Web Mercator

Pink Mucket (*Lampsilis abrupta [=Lampsilis orbiculata]*)

Federal Listing: Endangered
State Listing within the AA: Endangered in Illinois and Ohio

Species Description

The shell of Pink Mucket is moderately large, round to elliptical, heavy, and inflated. The species is sexually dimorphic; the posterior end of the shell is bluntly pointed in males and truncated in females. The beaks are turned forward and elevated above the hinge line and beak sculpture consists of a series of double-looped ridges, often only visible in young shells. The periostracum is yellow to greenish brown and may have faint green rays. The pseudocardinal teeth are thick and triangular and the lateral teeth are short, heavy, and slightly curved. The beak cavity is deep. The nacre may be white, pink, or salmon, becoming iridescent posteriorly (USFWS, 1985; Cummings & Mayer, 1992).

Species Distribution

The Pink Mucket occurs in medium to large rivers in habitat ranging from silt to boulders, rubble, gravel, and sand with moderate to swift current. It is an Ohioan or Interior Basin species, occurring in the lower Mississippi and Ohio Rivers and their larger tributaries (USFWS, 1985; Cummings & Mayer, 1992). Pink Mucket was historically widespread throughout this range. The recovery plan listed records from 25 streams, but recent sampling efforts and a more thorough search of historical data indicate the species was known from nearly 50 streams (USFWS, 2018). At the time of listing, Pink Mucket was considered extant in 16 streams (USFWS, 1985). Recent data indicates that extant populations of Pink Mucket occur in 29 streams in the upper Mississippi River, Missouri River, Ohio River, Cumberland River, Tennessee River, lower Mississippi River, White River, and Red River drainages in Alabama, Arkansas, Illinois, Kentucky, Louisiana, Missouri, Ohio, Tennessee, and West Virginia (USFWS, 2018).

Distribution within Action Area

- Illinois: Massac County (Ohio River)
- Ohio: Adams, Athens, Brown, Clermont, Gallia, Hamilton, Lawrence, Meigs, Morgan, Scioto, and Washington Counties (Ohio River, Muskingum River)

Critical Habitat

No critical habitat has been designated for the Pink Mucket.

Life History

Life history of the Pink Mucket is similar to that of other unionid mussel species. Females brood glochidia (larvae) in their gills, and, once released, glochidia must attach to the gills or fins of a suitable host, typically a fish, to complete the transformation from the larval stage to a juvenile mussel. The Pink Mucket is a long-term brooder (bradytictic). Females become gravid in August and brood glochidia over the winter before releasing the glochidia the following summer. The edge of the mantle is modified to resemble a small fish, presumably luring potential host fish to the female mussel (USFWS, 1985). Suitable host fish identified in laboratory studies include Largemouth Bass (*Micropterus salmoides*), Smallmouth Bass (*Micropterus dolomieu*), Spotted Bass (*Micropterus puctulatus*), Walleye (*Sander vitreus*), White Crappie (*Pomoxis annularis*), and Sauger (*Sander canadensis*; USFWS, 2018).

Current Stressors and Threats

Impoundment, sedimentation, and pollution were identified as threats to the Pink Mucket in the original recovery plan (USFWS, 1985).

- Impoundments

  Impoundments may result in reduced flows, altered temperature regimes, and anoxic conditions, potentially eliminating previously suitable mussel habitat (USFWS, 1985). In addition, hypolimnetic dam releases may lead to altered temperature regimes, extreme water level fluctuations, reduced turbidity, seasonal oxygen deficits, and high concentrations of certain heavy metals (USFWS, 1985). Recent research suggests that such tailwater conditions may affect mussel communities for many miles downstream of dam sites (USFWS, 2018). Changes in dam operations, such as implementation of minimum flows, have in some cases improved conditions in tailwaters. However, some older dams in the Pink Mucket's range have been identified as being at high risk for failure; a failure of one of these major dams could result in catastrophic habitat alterations (USFWS, 2018).

- Sedimentation
  Increased sedimentation from land use and development activities, such as mining, dredging, farming, logging, and road construction, may also affect Pink Mucket and other native mussels. High levels of suspended solids may clog mussels' gills and reduce or inhibit filter feeding, causing nutritional stress and mortality (USFWS, 1985). In addition, land use practices may contribute to stream instability. Channel and bank degradation have been noted in the Meramec and Gasconade Rivers in Missouri; such habitat degradation has been attributed to instream aggregate mining, riparian buffer alterations, and accelerated runoff from impervious surfaces in developed areas (USFWS, 2018).
- Pollutants
  Pink Mucket populations may be affected by various pollutants. An increasing number of streams throughout the United States receive municipal, agricultural, and industrial water discharges. Historical studies in the Tennessee River drainage reported loss of mussels downstream of industrial plants, including paper mills and wood extracting plants (USFWS, 1985). Point source discharges have been reduced since inception of the Clean Water Act (1972), but recent toxicological studies demonstrated that the U.S. Environmental Protection Agency (EPA) water quality criteria for copper and ammonia were not protective of all mussel life stages. EPA water quality criteria have recently been revised to include mussel data in toxicity databases, but delays in implementing revised criteria may occur (USFWS, 2018).
- Resource extraction activities
  Metal mining, instream aggregate mining, and fossil fuel extraction occurs in various streams throughout the range of Pink Mucket and may threaten mussel populations; take from aggregate mining is a perpetual concern for the species in these streams despite regulatory oversight (USFWS, 2018).
- Invasive species
  Invasive zebra mussels (*Dreissena polymorpha*) have invaded streams throughout most of the range of Pink Mucket, and may affect native mussels both directly, by attaching to native mussels' shells, or indirectly, by competing for food or resources. Zebra mussels are most prevalent in navigation channels, where their spread is facilitated by commercial navigation traffic. However, zebra mussel density in the Ohio River has declined markedly in recent years, and density remains low in most other Pink Mucket streams, suggesting that the threat of zebra mussels has abated (USFWS, 2018).
- Climate change
  Climate change may affect Pink Mucket and other native mussel species. Although the ultimate results of climate change remain unknown, changes in precipitation and water temperatures may have sub-lethal effects on Pink Mucket populations (USFWS, 2018).

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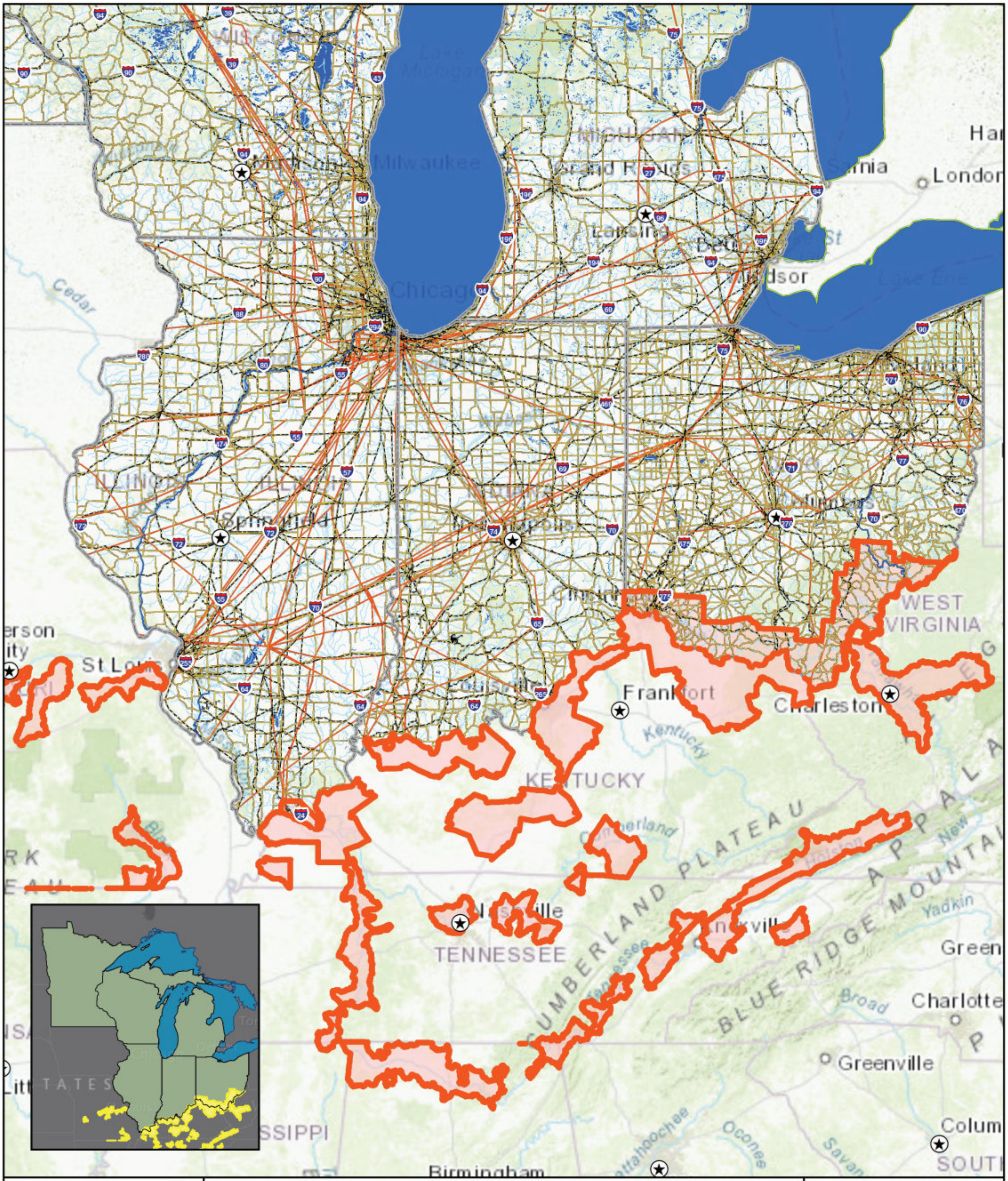

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Miles
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PINK MUCKET (*LAMPSILIS ABRUPTA*)
ACTION AREA OVERVIEW MAP

SCALE 1:7,000,000

- Petroleum Pipeline
- Major Road
- ------ Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- 🟦 Lakes & Ponds
- 🟩 1-Mile Coastal Inland Buffer
- 🟨 Action Area
- 🟥 Pink Mucket (*Lampsilis abrupta*) Counties of Occurrence.

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Basemap courtesy of Esri. Date: 5/25/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS Projection: WGS 1984 Web Mercator

Purple Cat’s Paw Pearlymussel (*Epioblasma obliquata obliquata*)

Federal Listing: Endangered
State Listing within the AA: Endangered in Ohio

Species Description

The Purple Cat’s Paw Pearlymussel shell is small and subquadrate to oval in shape. The species is sexually dimorphic. Males are larger than females, the posterior end of the shell is bluntly pointed, and a wide sulcus or depression is present between the posterior ridges. The female shell is truncated, ribbed, and notched at the posterior end, and the posterior-ventral portion of the shell is inflated with fine grooves radiating from the umbo to the margin of the shell (Cummings & Mayer, 1992). The umbos are even with the hinge line and directed forward. The periostracum is yellow, yellowish-green, or brown with numerous fine, wavy green rays (Cummings & Mayer, 1992; USFWS, 1992). The pseudocardinal teeth are wide and serrated and the lateral teeth are short and straight to slightly curved (Cummings & Mayer, 1992). The nacre is purplish to deep purple (USFWS, 1992).

Species Distribution

The Purple Cat’s Paw Pearlymussel has been characterized as a large river species. It has been reported in boulder and sand substrates in moderate to swift current (USFWS, 1992). The Purple Cat’s Paw Pearlymussel was historically distributed in the Ohio, Cumberland, and Tennessee River systems in Ohio, Illinois, Indiana, Kentucky, Tennessee, and Alabama (USFWS, 1992). However, at the time of listing, only two known populations remained: one in the Green River, Kentucky, and one in the Cumberland River, Tennessee. The state of Indiana had no current records of the Purple Cat’s Paw Pearlymussel, the species had not been collected in Illinois in over 100 years, the historic collection site in Alabama had been impounded, and the species was apparently extirpated from Ohio (USFWS, 1992). A new reproducing population of Purple Cat’s Paw Pearlymussel was identified in Killbuck Creek, Ohio in the 1990s, but later survey efforts in 2006 – 2009 suggested the population had drastically declined (USFWS, 2010). Despite the decline, the Killbuck Creek population persists. In addition, Purple Cat’s Paw Pearlymussel individuals were reintroduced into the Ohio River, Walhonding River, Green River, Licking River, and Duck River in 2017, although natural reproduction has not yet been documented in these populations (USFWS, 2020). The species is presumed extirpated from the Cumberland River (USFWS, 2020).

Distribution within Action Area

ECOS only indicates the species may occur in Coshocton County, Ohio (Killbuck Creek). It is unclear whether this county also includes the reintroduced Walhonding River population.

Critical Habitat

No critical habitat has been designated for the Purple Cat’s Paw Pearlymussel.

Life History

Life history of the Purple Cat’s Paw Pearlymussel is similar to that of other unionid mussel species. Females brood glochidia (larvae) in their gills, and, once released, glochidia must attach to the gills or fins of a suitable host, typically a fish, to complete the transformation from the larval stage to a juvenile mussel. Rock Bass (*Amploplites rupestris*), Mottled Sculpin (*Cottus bairdii*), Stonecat (*Noturus flavus*), Blackside Darter (*Percina maculata*), and Logperch (*Percina caprodes*) have been identified as suitable hosts for Purple Cat’s Paw Pearlymussel (USFWS, 2020).

Current Stressors and Threats

- Impoundments
  The Purple Cat’s Paw Pearlymussel recovery plan noted that many of the historic populations were apparently lost when the river sections they inhabited were impounded; the impoundments reduced the availability of riverine habitat and likely affected the distribution and availability of host fish (USFWS,

1992). These impoundments are still present throughout the species' historic range. One dam removal project occurred on the Green River (Kentucky) in 2017, with a second dam removal on the Green River and a dam removal on the Walhonding River also planned for the near future. These dam removal projects are anticipated to help restore sections of these rivers to habitat suitable for the Purple Cat's Paw Pearlymussel (USFWS, 2020).

- Water quality degradation
  Water quality issues may pose a threat to Purple Cat's Paw Pearlymussel. The Green River (Kentucky) has experienced water quality problems related to impacts from oil and gas production in the watershed (USFWS, 1992). The Killbuck Creek watershed also contains many operating oil and gas wells, though it is unknown if these wells are impacting the creek (USFWS, 2020). Researchers noted that mussel habitat in Killbuck Creek was "severely degraded" with the creek entrenched among steep eroding banks. Deadfalls and debris piles were common in the creek and point bar formations were evidence of massive bed-load movement during high surface flows. Researchers also noted high sediment load in the creek, which inhibited mussel sampling efforts (USFWS, 2020).
- Invasive species
  Invasive Asian clams (*Corbicula fluminea*) are known to occur in Killbuck Creek and may affect Purple Cat's Paw Pearlymussel populations. Asian clams appeared to have a massive die-off in 2011 but have appeared to rebound and are currently relatively common in the stream. It is interesting to note that the 2011 die-off correlates with the timing of the recent recruitment of Purple Cat's Paw Pearlymussel in Killbuck Creek. When Asian clam numbers were very low the Purple Cat's Paw Pearlymussel had successful recruitment. It is not known if these two events are related. However, it has been suggested that Asian clams may adversely impact native mussels by consuming a significant portion of their sperm and that they may compete with native mussels for food and space (USFWS, 2020).
- Climate change
  Climate change likely constitutes a threat to Purple Cat's Paw Pearlymussel. Although the specific effects of climate change on the species are unknown, altered hydrology in rivers, increased frequency of extreme weather events, and a changing abundance and distribution of fish species have the potential to adversely affect this species (USFWS, 2020).
- Small population size
  Perhaps the greatest threat to Purple Cat's Paw Pearlymussel is small population size. Only a few known populations of the species exist, most of which consist of a few recently reintroduced individuals. These small populations with limited distributions are highly vulnerable to stochastic events.

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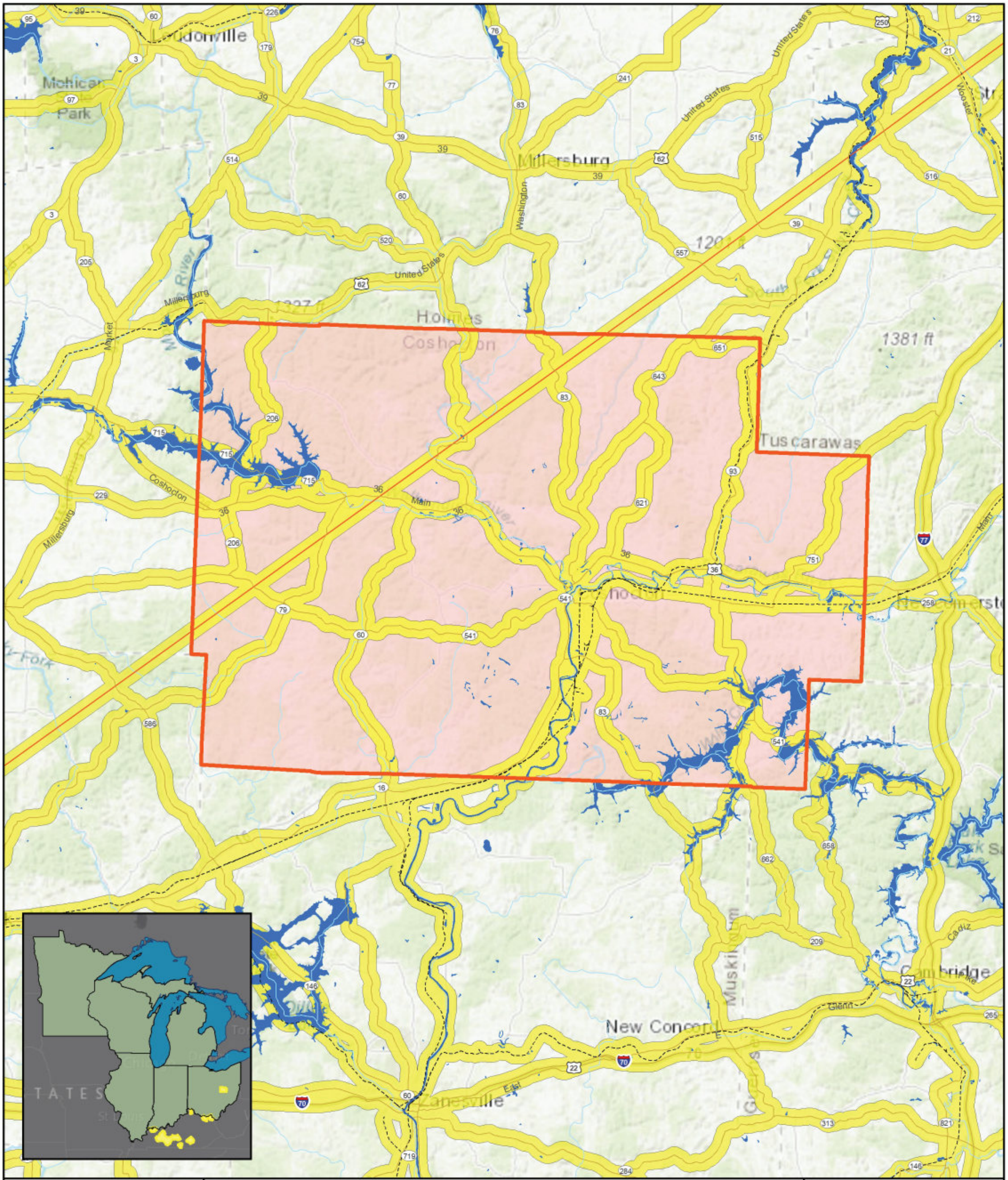

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PURPLE CAT'S PAW PEARLYMUSSEL (*EPIOBLASMA OBLIQUATA OBLIQUATA*) ACTION AREA OVERVIEW MAP

SCALE 1:500,000

- Petroleum Pipeline
- Major Road
- Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- Lakes & Ponds
- 🟩 1-Mile Coastal Inland Buffer
- 🟨 Action Area
- Purple Cat's Paw Pearlymussel (*Epioblasma obliquata obliquata*) Counties of Occurrence

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Basemap courtesy of Esri.

Date: 5/25/2021

Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS

Projection: WGS 1984 Web Mercator

Pyramid (Pink) Pigtoe (*Pleurobema rubrum*)

Federal Listing: Under Review. The Pyramid Pigtoe was petitioned for Federal listing under the Endangered Species Act in 2010, and a 90-day finding was issued in 2011 (76 FR 59836).
State Listing within the AA: Endangered in Ohio

Species Description

The shell of the Pyramid Pigtoe is triangular and elongate, thick, and moderately inflated. The anterior margin of the shell is rounded and the posterior end is bluntly pointed. The beaks are high and project anterior to the rest of the shell (Cummings & Mayer, 1992; Roe, 2002). A prominent but shallow sulcus runs from the beak toward the ventral margin (Roe, 2002). The periostracum is brown or chestnut, often with a satiny appearance, and may have faint green rays on the beaks (Cummings & Mayer, 1992; Roe, 2002). The pseudocardinal teeth are well developed, and the lateral teeth are heavy and straight to slightly curved. The beak cavity is deep. The nacre may be pink, rose-colored, or white (Cummings & Mayer, 1992; Roe, 2002).

Species Distribution

The Pyramid Pigtoe occurs in medium to large rivers in riffles and shoals with moderate to swift current (Roe, 2002). Historically the species was distributed throughout the Mississippi, Wabash, Tennessee, and Ohio River systems and was reported from Alabama, Arkansas, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Mississippi, Missouri, Nebraska, Ohio, Oklahoma, Pennsylvania, Tennessee, Virginia, and West Virginia (NatureServe, 2021). It is now presumed extirpated in Iowa, Illinois, and Indiana, and possibly extirpated from Pennsylvania, West Virginia, and Virginia (NatureServe, 2021). The best extant populations appear to be in a few sections of the Green River drainage in Kentucky and in the Little Missouri, Ouachita, White, St. Francis, and Saline Rivers in Arkansas (CBD, 2010; NatureServe, 2021).

Distribution within Action Area

ECOS does not list this species as occurring in the Action Area. However, it is still believed to be extant in the lowermost portion of the Muskingum River (downstream of Devola Lock & Dam) in Washington County, Ohio (USFWS, pers. comm., 2022).

Critical Habitat

No critical habitat has been designated for the Pyramid Pigtoe.

Life History

Life history of the Pyramid Pigtoe is similar to that of other unionid mussel species. Females brood glochidia (larvae) in their gills, and, once released, glochidia must attach to the gills or fins of a suitable host, typically a fish, to complete the transformation from the larval stage to a juvenile mussel. Like other mussels in the genus *Pleurobema*, the Pyramid Pigtoe is thought to be a short-term brooder (tachytictic; Roe, 2002; Culp et al., 2009). Females may release glochidia in conglutinates (Culp et al., 2009). Host fish for the Pyramid Pigtoe include Spotfin Shiner (*Cyprinella spiloptera*), Streamline Chub (*Erimystax dissimilis*), Scarlet Shiner (*Lythrurus fasciolaris*), and Silver Shiner (*Notropis photogenis*; Culp et al., 2009).

Current Stressors and Threats

Many factors have been implicated in the decline of native freshwater mussels, including destruction of habitat caused by impoundment construction, siltation, gravel mining, and channel modification, as well as pollution and the introduction of non-native species (Roe, 2002; CBD, 2010; NatureServe, 2021).

- Impoundments

  Impoundments can dramatically alter the habitat of freshwater mussels by changing flow, temperature, dissolved oxygen, and substrate composition. Construction of the Norris Reservoir on the Clinch River in Tennessee reportedly resulted in the extirpation of the majority of mussel species below the dam, including the Pyramid Pigtoe (NatureServe, 2021). In addition, dams can isolate mussels from their host fish, interfering with reproduction (Roe, 2002).

- Siltation
  Siltation has long been implicated in the decline of native mussels. Fine sediments can interfere with mussel respiration and feeding, and heavy sediment loads may smother juvenile mussels. Sediment can also affect mussels by affecting their host species (Roe, 2002).
- Pollution
  Pollution from point (industrial and residential discharge) and non-point (siltation, herbicide, surface runoff) sources is also a great threat to mussels. Many types of industrial and domestic substances have been shown to be toxic to mussels (Roe, 2002). Recent toxicology research suggests mussels are among the most sensitive organisms to some contaminants, such as ammonia and copper.
- Invasive species
  The introduction of zebra mussels (*Dreissena polymorpha*) in the 1980s has severely impacted native mussel populations (Roe, 2002). Zebra mussels may directly affect native mussels by attaching to the native mussels' shells. Attached zebra mussels can interfere with feeding, respiration, excretion, and locomotion (Roe, 2002). While it is unclear how susceptible the Pyramid Pigtoe may be to zebra mussels, zebra mussels have become widespread throughout the Ohio River system and have the potential to seriously impact the native mussels in that system (Roe, 2002).

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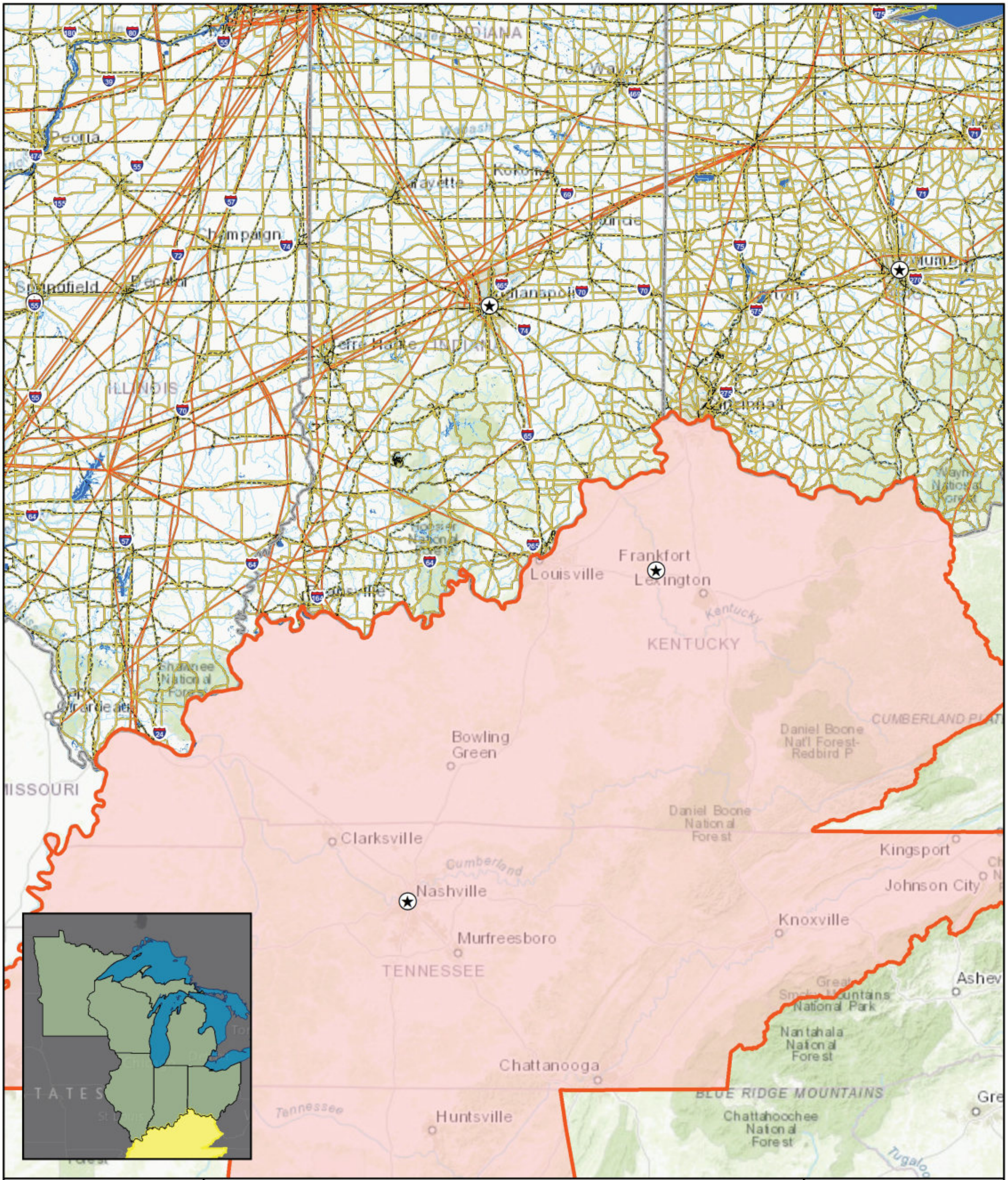

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0 10 20 40 60 80
Kilometers

PYRIMID (PINK) PIGTOE (*PLEUROBEMA RUBRUM*) ACTION AREA OVERVIEW MAP

SCALE 1:4,500,000

Petroleum Pipeline
Major Road
------ Railroad
Commercial Navigable Waterway
Rivers & Streams
🟦 Lakes & Ponds
🟩 1-Mile Coastal Inland Buffer
🟨 Action Area
▭ Pyrimid (Pink) Pigtoe (*Pleurobema rubrum*) Counties of Occurrence

N

Basemap courtesy of Esri.
Date: 5/25/2021
Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS
Projection: WGS 1984 Web Mercator

Rabbitsfoot (*Quadrula cylindrica cylindrica*)

Federal Listing: Threatened
State Listing within the AA: Endangered in Illinois, Indiana, and Ohio

Species Description

The Rabbitsfoot is a medium to large mussel that may reach 6in (12cm) in length (USFWS, 2021). The shell is elongate and rectangular and the posterior end is truncated or squared. The beaks are low and only slightly elevated above the hinge line. Beak sculpture consists of two rows of knobs or ridges that continue down the surface of the shell. Shell sculpture consists of a few large, rounded, low tubercles on the posterior slope and smaller pustules or tubercles on the anterior portion of the shell. The periostracum is greenish or yellowish brown and is typically marked with dark green or black chevrons or triangles (Cummings & Mayer, 1992; USFWS, 2021). The pseudocardinal teeth are serrated and well developed and the lateral teeth are very long and straight. The beak cavity is deep. The nacre is white, sometimes tinged with gray or green in the beak cavity, and iridescent posteriorly (Cummings & Mayer, 1992; USFWS, 2021).

Species Distribution

Suitable habitat for the Rabbitsfoot occurs in small- to medium-sized streams and some larger rivers, primarily in mixed sand and gravel substrate (USFWS, 2020). At the time of listing, Rabbitsfoot had been documented from nearly 140 rivers and streams in Alabama, Arkansas, Georgia, Illinois, Indiana, Kansas, Kentucky, Louisiana, Mississippi, Missouri, Ohio, Oklahoma, Pennsylvania, Tennessee, and West Virginia. However, only 51 of the historically known populations were considered extant at the time of listing, and the species was believed to be extirpated in Georgia and West Virginia (USFWS, 2020). Additional Rabbitsfoot occurrences were documented in several streams after the species was listed. The Rabbitsfoot is currently considered extant in 63 rivers and streams in Alabama, Arkansas, Illinois, Indiana, Kansas, Kentucky, Louisiana, Mississippi, Missouri, Ohio, Oklahoma, Pennsylvania, and Tennessee; it is still considered extirpated from Georgia and West Virginia (USFWS, 2020).

Distribution within Action Area

- Illinois: Alexander, Clark, Crawford, Hardin, Jasper, Lawrence, Massac, Pope, Pulaski, Vermilion, Wabash, and White Counties (Ohio River, Wabash River, North Fork Vermilion River)
- Indiana: Carroll, Cass, Fulton, Miami, Perry, Posey, Pulaski, Spencer, Starke, Tippecanoe, Vanderburgh, Warrick, and White Counties (Ohio River, Wabash River, Tippecanoe River, Eel River, Fish Creek)
- Ohio: Adams, Champaign, Coshocton, Franklin, Hamilton, Lawrence, Madison, Morgan, Muskingum, Pickaway, Scioto, Union, Washington, and Williams Counties (Ohio River, Muskingum River, Walhonding River, Big Darby Creek, Little Darby Creek, Fish Creek)

Critical Habitat

Thirty-one critical habitat units have been designated for Rabbitsfoot, encompassing approximately 2,300 river kilometers in Alabama, Arkansas, Illinois, Indiana, Kansas, Kentucky, Mississippi, Missouri, Ohio, Oklahoma, Pennsylvania, and Tennessee (80 FR 24692). Critical habitat was designated based on five primary constituent elements: geomorphically stable river channels, hydrologic flow regime necessary to maintain benthic habitats for Rabbitsfoot and its host fish, suitable water and sediment quality, occurrence of natural fish assemblages, and low abundance of competitive or predaceous species (80 FR 24692). Critical habitat units within USCG Region 5 include segments of the Ohio River (Illinois), Tippecanoe River (Indiana), Walhonding River (Ohio), Little Darby Creek (Ohio), North Fork Vermilion River and Middle Branch North Fork Vermilion River (Illinois), and Fish Creek (Ohio; 80 FR 24692).

Life History

Life history of the Rabbitsfoot is similar to that of other unionid mussel species. Females brood glochidia (larvae) in their gills, and, once released, glochidia must attach to the gills or fins of a suitable host, typically a fish, to complete the transformation from the larval stage to a juvenile mussel. The Rabbitsfoot is a short-term brooder (tachytictic), with females brooding between May and late August (USFWS, 2020). Females display a mantle lure, consisting of an orange excurrent aperture encircled by white mantle tissue, and release glochidia in conglutinates when a host fish approaches and/or touches the excurrent aperture. Rabbitsfoot primarily utilizes cyprinid fish as hosts, with successful transformation of glochidia observed on various shiner species (USFWS, 2020).

Current Stressors and Threats

Threats to the Rabbitsfoot include habitat alterations due to impoundments, sedimentation, chemical contaminants, and mining, as well as population fragmentation, invasive species, temperature, and climate change (USFWS, 2020).

- Impoundments

  Dams eliminate and alter river flow within impounded areas, trap silt leading to increased sediment deposition, alter water quality, change hydrology and channel geomorphology, decrease habitat heterogeneity, affect normal flood patterns, and block upstream and downstream movement of mussels and their fish hosts. Impoundments have contributed more to losses of populations of the Rabbitsfoot than any other factor (e.g. Tennessee and Ohio River basins). Impoundments have fragmented riverine habitat throughout the range of the Rabbitsfoot often resulting in short, isolated patches of habitat, where fish hosts necessary for reproduction and dispersal may not be available. Because these isolated populations are unable to naturally recolonize suitable habitat upstream/downstream they become more prone to extirpation from stochastic events, such as severe drought, chemical spills, or unauthorized discharges (USFWS, 2020).
- Siltation

  Excessive sediments adversely affect riverine mussel populations that require clean, stable streams. Sedimentation remains a threat to the Rabbitsfoot. Specific biological effects include reduced feeding and respiratory efficiency from clogged gills, disrupted metabolic processes, reduced growth rates, limited burrowing activity, physical smothering, and disrupted host fish attraction mechanisms. Increased sedimentation may explain in part why the Rabbitsfoot is experiencing recruitment failure in some streams. Interstitial spaces in the substrate provide crucial shelter and nutrient uptake for juvenile mussel survival. When interstitial spaces are clogged, interstitial flow rates and spaces are reduced, decreasing habitat for juvenile mussels (USFWS, 2020).
- Chemical contaminants

  Chemical contaminants are ubiquitous in the environment and a major threat in the decline of mussel species. Studies conducted in accordance with standard mussel testing methods demonstrated that mussels are among the most sensitive freshwater species to a variety of contaminants, including copper, nickel, chloride, sulfate, potassium, and ammonia. Although the Clean Water Act has regulated and reduced some point source discharges, it may not provide adequate protection for filter-feeding organisms that are sensitive to extremely low levels of contaminants, and it may not adequately protect Rabbitsfoot habitat from nonpoint source pollution resulting from activities such as timber clear-cutting, clearing of riparian vegetation, urbanization, road construction, and other practices that allow sediment to enter streams (USFWS, 2020).
- Population fragmentation

  Population fragmentation and isolation prohibit the natural interchange of genetic material between populations. Most of the remaining the Rabbitsfoot populations are small and geographically isolated, and, thus, are susceptible to genetic drift, inbreeding depression, and stochastic changes to the environment, such as toxic chemical spills. Although changes in the environment may cause populations to fluctuate naturally, small and low-density populations are more likely to fluctuate below a minimum viable population size, which is the minimum or threshold number of individuals needed in a population to persist in a viable state for a given interval. Because of the restricted distribution of the Rabbitsfoot and the number of populations represented by a few individuals, the probability that some populations of this mussel species are below effective population size (EPS), the number of individuals in a population contributing offspring to the next generation, is great. Even in the absence of existing or new anthropogenic threats, low EPS may reduce population viability and presents conservation challenges.

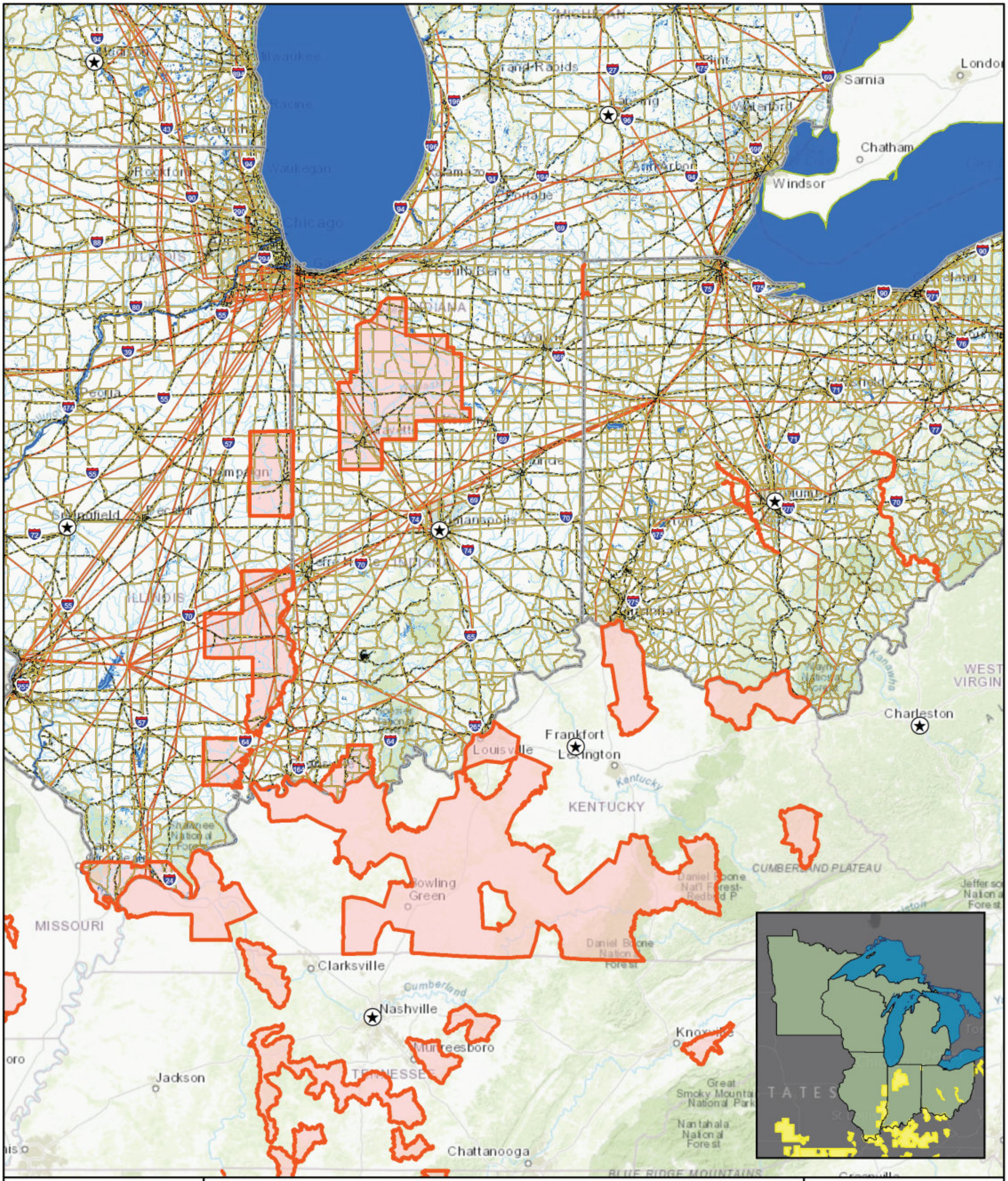
- Invasive species
  Invasive species, such as zebra mussels (*Dreissena polymorpha*) and Asian clams (*Corbicula fluminea*) pose significant threats to the Rabbitsfoot. Zebra mussels may directly affect Rabbitsfoot mussels by attaching to the Rabbitsfoot's shell, and both zebra mussels and Asian clams may compete with native mussels for resources such as food, nutrients, and space. Introduced fish species, including Black Carp (*Mylopharyngodon piceus*) and Round Goby (*Neogobius melanostomus*), feed on mollusks and may pose a threat to Rabbitsfoot reproduction (USFWS, 2020).
- Climate change
  Finally, temperature and climate change may threaten Rabbitsfoot populations. Impoundments, tail water releases from dams, industrial and municipal effluents, changes in riparian habitat, and droughts may alter natural temperature regimes. In addition, long-term climate changes, such as widespread changes in precipitation and aspects of extreme weather including droughts, heavy precipitation, and heat waves, may affect distribution of both native mussels and their host fish (USFWS, 2020).

List of References

Cummings, K.S., & Mayer, C.A. (1992). *Field guide to freshwater mussels of the Midwest*. Illinois Natural History Survey Manual 5.

U.S. Fish & Wildlife Service (USFWS). (2020). Rabbitsfoot (*Quadrula cylindrica cylindrica*) 5-year review: summary and evaluation. Conway, Arkansas. 95pp + appendices.

U.S. Fish & Wildlife Service (USFWS). (2021). Rabbitsfoot (*Quadrula cylindrica cylindrica*) species profile. Retrieved from https://ecos.fws.gov/ecp/species/5165



RABBITSFOOT (*QUADRULA CYLINDRICA CYLINDRICAI*) ACTION AREA OVERVIEW MAP

SCALE 1:5,500,000

- Petroleum Pipeline
- Major Road
- ------ Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- 🟦 Lakes & Ponds
- 🟩 1-Mile Coastal Inland Buffer
- 🟨 Action Area
- ▨ Rabbitsfoot (*Quadrula cylindrica cylindrical*) Critical Habitat
- ☐ Rabbitsfoot (*Quadrula cylindrica cylindrical*) Counties of Occurrence

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Basemap courtesy of Esri. Date: 5/25/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS Projection: WGS 1984 Web Mercator

Rayed Bean (*Villosa fabalis*)

Federal Listing: Endangered
State Listing within the AA: Endangered in Indiana, Michigan, and Ohio

Species Description

The Rayed Bean is a small mussel, usually less than 1.5in (3.8cm) in length. The shell outline is elongate or ovate in males and elliptical in females, and moderately inflated in both sexes, but more so in females (USFWS, 2021). The valves are thick and solid. The anterior end is rounded in females and bluntly pointed in males (Cummings & Mayer, 1992). The beaks are slightly elevated above the hinge line, with sculpture consisting of double loops with some nodules (USFWS, 2021). The shell surface is smooth and the periostracum is green, yellowish-green, or brown in color, with numerous, wavy, dark-green rays of various widths (sometimes obscure in older, blackened specimens) (Cummings & Mayer, 1992; USFWS, 2021). The pseudocardinal teeth are triangular and relatively heavy, and the lateral teeth are short and heavy (Cummings & Mayer, 1992). The nacre is silvery white or bluish and iridescent posteriorly (USFWS, 2021).

Species Distribution

The Rayed Bean is generally known from smaller headwater creeks but has been documented in larger rivers and one lake. It is typically found in or near shoal or riffle areas in sand and gravel substrate (USFWS, 2018). The Rayed Bean was historically distributed in at least 115 streams, lakes, and some human-made canals in the Great Lakes (29 populations), Ohio River (74 populations), and Tennessee River (12 populations) systems in 10 states (Illinois, Indiana, Kentucky, Michigan, New York, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia) and Ontario, Canada. At the time of listing in 2012, the species was known to be extant in only 31 streams and 1 lake in 7 states (Indiana, Michigan, New York, Ohio, Pennsylvania, Tennessee, and West Virginia) and Ontario, Canada. Three new extant populations have been discovered since the species was listed, two in New York and one in Michigan. Thirteen populations of Rayed Bean are currently known from the lower Great Lakes sub-basin, 21 populations are known from the Ohio River system, and only one population is extant in the Tennessee River system; this population was reintroduced in 2008 (USFWS, 2018).

Distribution within Action Area

- Indiana: Allen and DeKalb Counties (St. Joseph River, Fish Creek); Carroll, Fulton, Kosciusko, Marshall, Pulaski, Starke, Tippecanoe, and White Counties (Tippecanoe River, Lake Maxinkuckee); Johnson County (Sugar Creek); Dearborn, Ohio, and Switzerland Counties (Ohio River)
- Michigan: Lenawee, Monroe, Oakland, and St. Clair Counties (Great Lakes basin)
- Ohio: 31 counties (Ohio River and Great Lakes basins)

Critical Habitat

No critical habitat has been designated for the Rayed Bean.

Life History

Life history of the Rayed Bean is similar to that of other unionid mussel species. Females brood glochidia (larvae) in their gills, and, once released, glochidia must attach to the gills or fins of a suitable host, typically a fish, to complete the transformation from the larval stage to a juvenile mussel. The Rayed Bean is thought to be a long-term brooder (bradytictic), with gravid females found in May through October (77 FR 8632). The only verified host fish for Rayed Bean are Tippecanoe Darter (*Etheostoma tippecanoe*) and Spotted Darter (*Etheostoma maculatum*; USFWS, 2018). Other darter and sculpin species may also be suitable host fish for Rayed Bean but have not been verified (77 FR 8632).

Current Stressors and Threats

At the time of listing, destruction, modification, and curtailment of the Rayed Bean's range was considered to be a threat to the species. The Rayed Bean has experienced significant curtailment of its occupied range and has been eliminated from about 70 percent of the streams in which it historically occurred. The primary cause of range curtailment is modification and destruction of river and stream habitats, primarily by the construction of impoundments. Other factors contributing to the reduction in range include dredging and channelization, chemical contamination, oil and gas production, sand and gravel mining, and siltation.

- Impoundments
  Impoundments result in the dramatic modification of riffle and shoal habitats and a resulting loss of mussel resources, especially in larger rivers. Stream habitat throughout major portions of the range of Rayed Bean has been impounded. Dams interrupt a river's ecological processes by modifying flood pulses; controlling impounded water elevations; altering water flow, sediments, nutrients, and energy inputs and outputs; increasing depth; decreasing habitat heterogeneity; decreasing stability due to subsequent sedimentation; blocking host fish passage; and isolating mussel populations from fish hosts. Even small, low-head dams can have some of these effects on mussels (77 FR 8632).
- Dredging and channelization
  Dredging and channelization activities have profoundly altered riverine habitats nationwide. Channelization impacts a stream's physical (accelerated erosion, reduced depth, decreased habitat diversity, geomorphic instability, and riparian canopy loss) and biological (decreased fish and mussel diversity, changed species composition and abundance, decreased biomass, and reduced growth rates) characteristics, and channel maintenance may result in profound impacts downstream, such as increases in turbidity and sedimentation, which may smother benthic (bottom-dwelling) organisms. Activities associated with navigation channels may have contributed to the elimination of the Rayed Bean from the Ohio, lower Allegheny, and Muskingum Rivers, and potentially others (77 FR 8632).
- Chemical contaminants
  Chemical contaminants are ubiquitous throughout the environment and are considered a major threat in the decline of freshwater mussel species. Chemicals enter the environment through both point and nonpoint discharges, including spills, industrial sources, municipal effluents, and agricultural runoff. These sources contribute organic compounds, heavy metals, pesticides, and a wide variety of newly emerging contaminants to the aquatic environment. As a result, water and sediment quality can be degraded to the extent that mussel populations are adversely impacted. Although point source discharges within the range of the Rayed Bean have been reduced since the inception of the Clean Water Act, it is unclear if these regulatory mechanisms provide adequate protection for filter-feeding organisms that can be impacted by extremely low levels of contaminants.
- Resource extraction activities
  Sand and gravel dredging continues to occur in some reaches occupied by the Rayed Bean (such as the Allegheny River), and a recent study found evidence that habitat alteration and loss from sand and gravel dredging has had an adverse effect on the mussel fauna in the navigation pools of the Allegheny River. Adverse impacts from heavy-metal-rich drainage from coal mining and associated sedimentation have been documented in portions of historical Rayed Bean habitat in the upper Ohio basin. Oil and gas resources extraction has increased dramatically in recent years, particularly in Pennsylvania and West Virginia. Although oil and gas extraction generally occurs away from the river, extensive road networks are required to construct and maintain wells. These road networks frequently cross or occur near tributaries, contributing sediment to the receiving waterway. In addition, the construction and operation of wells may result in the discharge of brine (salt water), which can cause acute toxicity and mortality of mussels if mussel tolerance levels are exceeded (77 FR 8632).
- Sedimentation
  Sedimentation has been implicated in the decline of mussel populations nationwide and is a threat to Rayed Bean. Physical habitat effects include altered suspended and bed material loads, and bed sediment composition associated with increased sediment production and run-off; clogged interstitial habitats and reduced interstitial flow rates and dissolved oxygen levels; changed channels in form, position, and degree of stability; altered depth or width-depth ratio that affects light penetration and flow

regime; aggraded (filling) or degraded (scouring) channels; and changed channel positions that dewater mussel beds. In addition, sediment can clog interstitial spaces in the substrate, which serve as essential habitat for juvenile mussels (77 FR 8632).

- Climate change
  Factors associated with climate change likely to affect regional mussel populations include changes in stream temperature regimes and precipitation levels that may indirectly result in reduced habitat and declines in host fish stocks.
- Invasive species
  Various exotic species are well established with the range of the Rayed Bean. Exotic species, including the zebra mussel (*Dreissena polymorpha*), Asian clam (*Corbicula fluminea*), Round Goby (*Neogobius melanostomus*), and Black Carp (*Mylopharyngodon piceus*), threaten the Rayed Bean, or its host fish, or both, through mechanisms such as habitat modification, competition, and predation (USFWS, 2018).

List of References

Cummings, K.S., & Mayer, C.A. (1992). *Field guide to freshwater mussels of the Midwest*. Illinois Natural History Survey Manual 5.

U.S. Fish & Wildlife Service (USFWS). (2018). Rayed Bean (*Villosa fabalis*) 5-year review: summary and evaluation. Columbus, Ohio. 26pp.

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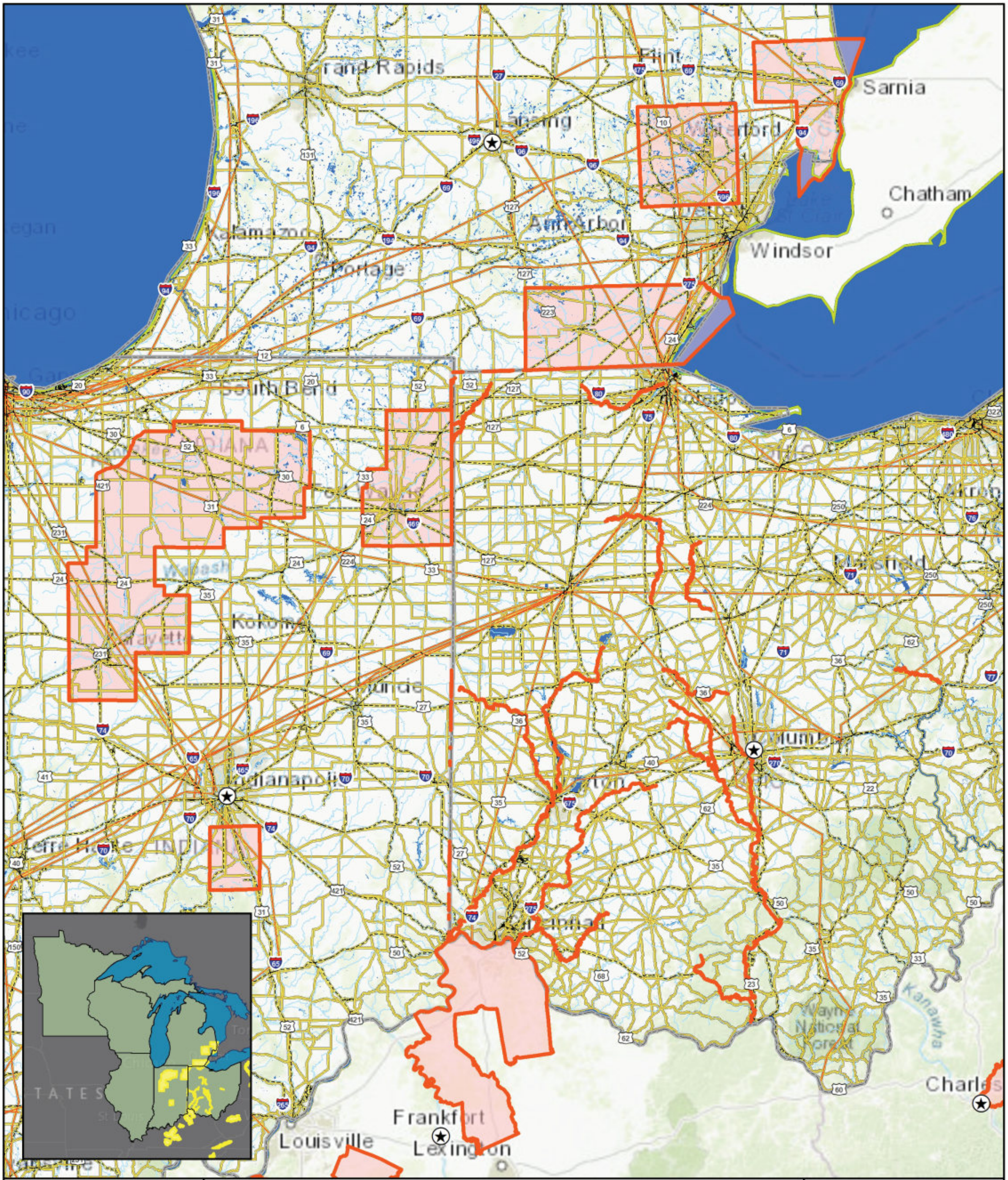

0 10 20 40 60
Miles
0 10 20 40 60 80
Kilometers

RAYED BEAN (*VILLOSA FABALIS*)
ACTION AREA OVERVIEW MAP

SCALE 1:3,500,000

- Petroleum Pipeline
- Major Road
- Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- Lakes & Ponds
- 1-Mile Coastal Inland Buffer
- Action Area
- Rayed Bean (*Villosa fabalis*) Counties of Occurrence

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Basemap courtesy of Esri. Date: 5/25/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS Projection: WGS 1984 Web Mercator

Rough Pigtoe (*Pleurobema plenum*)

Federal Listing: Endangered
State Listing within the AA: Endangered in Indiana

Species Description

The shell of Rough Pigtoe is subtriangular, moderately thick, and inflated. The shell has a prominent posterior ridge and most older specimens have a slight sulcus. The umbos are inflated, elevated above the hinge line, and turned forward. Beak sculpture consists of a few elevated ridges. The periostracum is textured with a cloth-like or satin-like appearance and ranges from yellowish brown in young individuals to reddish or dark brown in adults. Some shells may have faint green rays visible near the beaks (USFWS, 1984; Cummings & Mayer, 1992). The pseudocardinal teeth are solid, heavy, and thick, and the lateral teeth are short and straight. The beak cavity is deep and compressed. The nacre is usually white but may be pink or orange (USFWS, 1984; Cummings & Mayer, 1992).

Species Distribution

The Rough Pigtoe occurs in medium to large rivers in sand and gravel substrates (USFWS, 1984; Cummings & Mayer, 1992). The Rough Pigtoe was historically widespread, with records from 15 streams in the Ohio River basin in Alabama, Indiana, Kentucky, Pennsylvania, Tennessee, and Virginia (USFWS, 1984; USFWS, 2021). At the time of listing, Rough Pigtoe was only known to occur in the Tennessee River, Cumberland River, Clinch River, Green River, and Barren River in Alabama, Kentucky, and Tennessee (USFWS, 1984). The species' distribution appears to have remained relatively unchanged since listing. A single Rough Pigtoe individual was collected live in the East Fork White River, Indiana, in 1992. Although Rough Pigtoe has not been observed in the East Fork White River since, the species may persist in this river system as well (USFWS, 2014).

Distribution within Action Area

Only believed to occur in Lawrence and Martin Counties, Indiana (East Fork White River), though it has not been collected live in this system since 1992.

Critical Habitat

No critical habitat has been designated for the Rough Pigtoe.

Life History

Specific life history details of the Rough Pigtoe are unknown but are likely similar to other unionid mussel species. Females brood glochidia (larvae) in their gills, and, once released, glochidia must attach to the gills or fins of a suitable host, typically a fish, to complete the transformation from the larval stage to a juvenile mussel. Gravid females have been observed in late spring or early summer, suggesting Rough Pigtoe is a short-term brooder (tachytictic; USFWS, 1984; USFWS, 2014). The host fish(es) for Rough Pigtoe are not known (USFWS, 1984).

Current Stressors and Threats

The Rough Pigtoe recovery plan identified three primary factors responsible for the decline of Rough Pigtoe populations: siltation, impoundments, and pollution (USFWS, 1984).

- Water quality degradation

  Ongoing threats to the Rough Pigtoe include water quality degradation from point and non-point sources, particularly in tributaries that have limited capability to dilute and assimilate sewage, agricultural runoff, and other pollutants. Freshwater mussels appear to exhibit more sensitivity to some pollutants than do the organisms typically used in toxicity testing. As a result, some of the water quality criteria established by the U.S. Environmental Protection Agency to protect aquatic life may not be protective of mussels. Agriculture and suburban and urban land uses continue to expand in many watersheds within the current range of the Rough Pigtoe. These land use changes alter runoff patterns and flow in this species' habitat, and the consequences of such changes to these remaining populations are not known (USFWS, 2014).

- Impoundments
  Rough Pigtoe is affected by hydrologic and water quality alterations resulting from the operation of impoundments. Over 50 impoundments had been constructed throughout the Tennessee and Cumberland River systems from the 1930s to the time of listing (USFWS, 1984). The presence of impoundments may have ameliorated the effects of downstream siltation on Rough Pigtoe, but these structures also control river discharges and the many environmental parameters influenced by discharge, which may profoundly affect the ability of these populations to occupy or successfully reduce in downstream habitats (USFWS, 2014).
- Instream activities
  A variety of instream activities (e.g. sand and gravel dredging, road construction, etc.) continue to threaten Rough Pigtoe populations. Protecting these populations from the direct physical disturbance of such activities depends on accurately identifying the location of the populations. The indirect effects of altering the streambed configuration may cause changes in previously suitable habitat (USFWS, 2019).
- Resource extraction activities
  Coal, oil, and natural gas resources are present in some of the watersheds known to support Rough Pigtoe mussels, especially the Green, Barren, and Clinch Rivers. Exploration and extraction of these resources can result in increased siltation, an altered hydrograph, and degraded water quality. Although these resource extraction activities generally occur away from the river, extensive road and pipeline networks are required to access sites. These road networks frequently cross or occur near tributaries, contributing sediment to the receiving waterway. In addition, the construction and operation of wells may result in the discharge of brine (USFWS, 2014).
- Development and urbanization
  Land-based development including residential and agricultural activities near streams often results in loss of riparian habitat, increased stormwater runoff due to increased impervious surfaces, increased sedimentation due to loss of streamside vegetation, and subsequent degradation of streambanks (USFWS, 2019). High levels of suspended solids may clog gills or feeding structures of mollusks, causing nutritional stress and mortality (USFWS, 1984).
- Invasive species
  Invasive zebra mussels (*Dreissena polymorpha*) may affect native freshwater mussels both directly, by physically attaching to the shells of native mussels, and indirectly, through competition or changes in water quality. Direct attachment of zebra mussels may inhibit locomotion, feeding, respiration, or excretion by preventing native mussels from opening or closing. As filter feeders, zebra mussels may strip the water of food and nutrients, and excretion by zebra mussels may increase ambient ammonia concentrations. Although zebra mussels have continued to spread in North American waterways since their accidental introduction in the 1980s, zebra mussels presently do not appear to be having any negative impact on known Rough Pigtoe populations (USFWS, 2014).

List of References

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U.S. Fish & Wildlife Service (USFWS). (1984). Rough Pigtoe pearly mussel (*Pleurobema plenum*) recovery plan. Atlanta, Georgia. 51pp.

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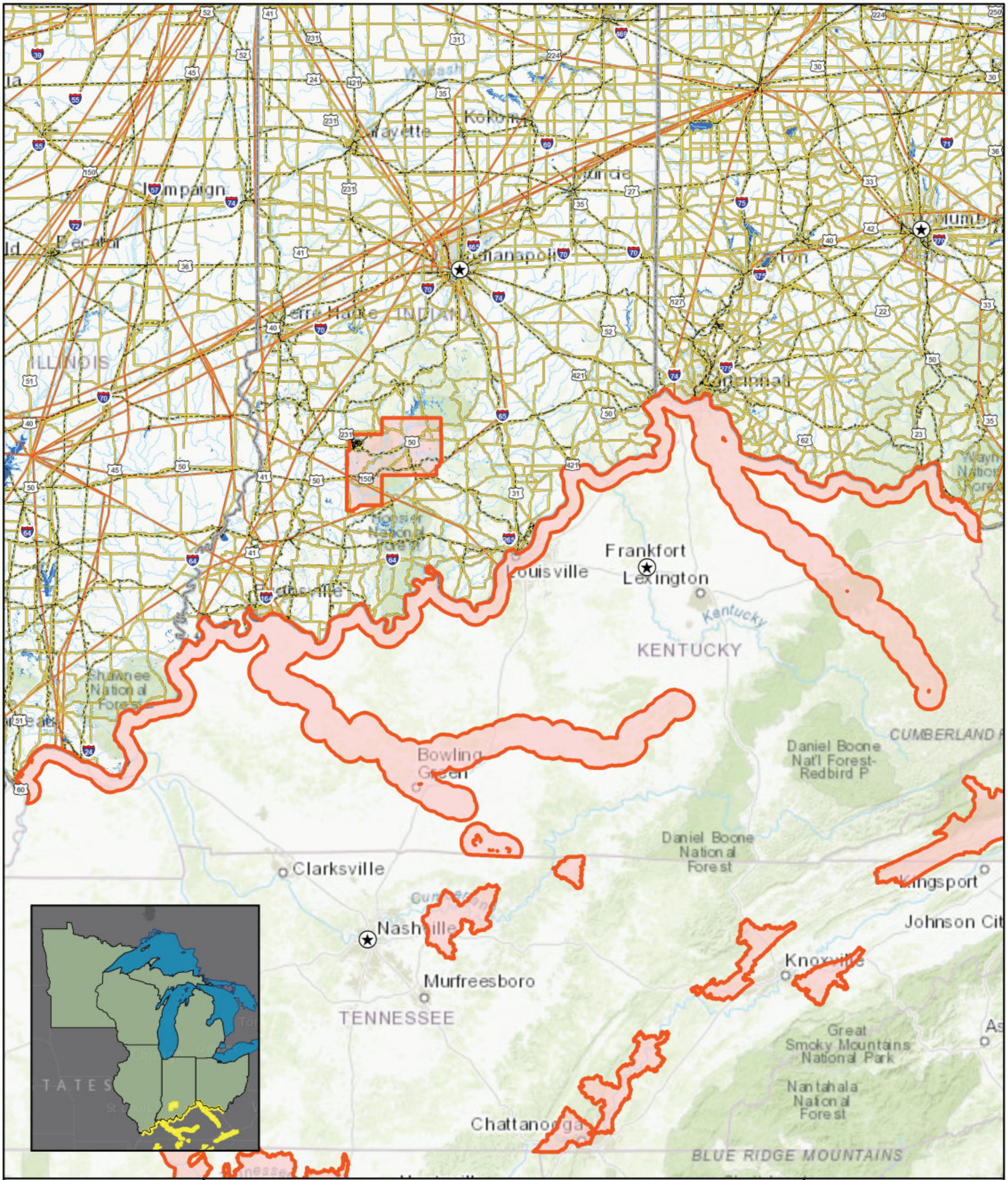

ROUGH PIGTOE (*PLEUROBEMA PLENUM*)
ACTION AREA OVERVIEW MAP

SCALE 1:4,000,000

Petroleum Pipeline	Commercial Navigable Waterway	🟩 1-Mile Coastal Inland Buffer
Major Road	Rivers & Streams	🟨 Action Area
------ Railroad	🟦 Lakes & Ponds	▭ Rough Pigtoe (*Pleurobema plenum*) Counties of Occurrence

Basemap courtesy of Esri. Date: 5/25/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS Projection: WGS 1984 Web Mercator

Round Hickorynut (*Obovaria subrotunda*)

Federal Listing: Proposed Threatened. The Round Hickorynut was petitioned for Federal listing under the Endangered Species Act in 2010. The U.S. Fish & Wildlife Service proposed listing the species as Threatened in 2020 (85 FR 61384).
State Listing within the AA: Endangered in Indiana and Michigan

Species Description

The Round Hickorynut is a small to medium-sized mussel that may reach a length of 3in (7.6cm) but is usually less than 2.4in (6.0cm; Cummings & Mayer, 1992; USFWS, 2019). The shell is round or circular, thick, and moderately inflated. The beaks are low and centrally located and beak sculpture consists of a few indistinct concentric ridges, usually only visible in young individuals. The periostracum is greenish-olive to dark or chestnut brown, sometimes blackish in older individuals, and may have a yellowish band dorsally (USFWS, 2019). The pseudocardinal teeth are moderately small and serrated and the lateral teeth are fairly short and slightly curved (Cummings & Mayer, 1992). The beak cavity is moderately deep and wide. The nacre is silvery white, iridescent posteriorly (Cummings & Mayer, 1992; USFWS, 2019).

Species Distribution

The Round Hickorynut generally inhabits medium-sized streams and is found in sand and gravel in riffle, run, and pool habitats in streams and rivers, but also may be found in sandy mud (USFWS, 2019). The Round Hickorynut is wide-ranging, with records from the Lower Mississippi, Tennessee, Cumberland, Ohio River, and Great Lakes basins. The species is historically known from 297 populations in 12 states, including Alabama, Georgia, Illinois, Indiana, Kentucky, Michigan, Mississippi, New York, Ohio, Pennsylvania, Tennessee, and West Virginia (USFWS, 2019). Results of surveys conducted since 2000 indicate the currently occupied range of the Round Hickorynut in the U.S. includes 65 rivers and streams. The species is still extant in each of the drainage basins listed above, though the Cumberland basin is only represented by two populations and the Lower Mississippi basin is only represented by one population. Many of the historically known populations are considered extirpated, and the species is considered extirpated from Georgia, Illinois, and New York (USFWS, 2019).

Distribution within Action Area

- Indiana: 15 counties (Tippecanoe River and Wabash River basins)
- Michigan: Lapeer, Macomb, Oakland, Sanilac, St. Clair, and Wayne Counties (Lake St. Clair & Lake Erie basins)
- Ohio: 28 counties (Great Lakes and Ohio River basins)

Critical Habitat

No critical habitat has been designated for the Round Hickorynut.

Life History

Life history of the Round Hickorynut is similar to that of other unionid mussel species. Females brood glochidia (larvae) in their gills, and, once released, glochidia must attach to the gills or fins of a suitable host, typically a fish, to complete the transformation from the larval stage to a juvenile mussel. The Round Hickorynut is a long-term brooder, gravid year-round in some southern populations in the Tennessee River basin, but with gravid period potentially more contracted in the northernmost portions of its range (USFWS, 2019). The Round Hickorynut releases glochidia in conglutinates, which are targeted by sight-feeding darters and burst when bitten by the fish, facilitating attachment of the glochidia to the gills and fins of the fish (USFWS, 2019). Several host fish species have been documented for the Round Hickorynut, but the dominant host fishes appear to be darters of the genera *Ammocrypta*, *Etheostoma*, and *Percina* (USFWS, 2019).

Current Stressors and Threats

Like other rare native mussels, habitat degradation or loss, genetic isolation and displacement, and invasive species are potential threats to the Round Hickorynut.

- Development and urbanization
  Development and/or urbanization may affect mussels by altering water quality, water quantity, and habitat, and roads in particular are generally associated with negative effects on the biotic integrity of aquatic ecosystems (USFWS, 2019).
- Dredging and channelization
  Dredging and channelization to maintain waterways for commercial navigation have also profoundly altered riverine habitats nationwide.
- Impoundments
  Extensive construction of dams and impoundments throughout the range of Round Hickorynut may affect mussels both upstream of the dam (change from flowing to impounded waters, increased depths, increased buildup of sediments, decreased dissolved oxygen, and the drastic alteration in resident fish populations) and downstream of the dam (fluctuations in flow regimes, minimal releases and scouring flows, seasonal depletion of dissolved oxygen, reduced or increased water temperatures, and changes in fish assemblages; USFWS, 2019).
- Contaminants
  Contaminants contained in point and non-point discharges can degrade water and substrate quality and adversely impact mussel populations. Although chemical spills and other point sources of contaminants may directly result in mussel mortality, widespread decreases in density and diversity may result in part from the subtle, pervasive effects of chronic, low-level contamination (USFWS, 2019). In addition, chemical control methods used in agriculture, including herbicides, fungicides, insecticides, and their surfactants and adjuvants, are highly toxic to juvenile and adult freshwater mussels (USFWS, 2019).
- Resource extraction activities
  Resource extraction activities may also threaten Round Hickorynut populations. Across the Round Hickorynut's range, the most significant resource extraction impacts are from coal mining and oil and gas exploration. Activities associated with coal mining and oil and gas drilling can contribute chemical pollutants to streams, and natural gas extraction has been associated with increased sedimentation due to increases in impervious surface and tree removal for drill pads and pipelines (USFWS, 2019). Instream sand and alluvial gravel mining has been implicated in the loss of mussel populations, including the Round Hickorynut, in the Tennessee, Cumberland, Ohio, and Lower Mississippi basins. Negative impacts associated with gravel mining include stream channel modifications such as altered habitat, disrupted flow patterns, and sediment transport, and water quality modifications, including increased turbidity, temperature, and sedimentation (USFWS, 2019).
- Invasive species
  Several invasive species are established throughout the range of Round Hickorynut and may threaten the species. Mussels are adversely affected by zebra mussels (*Dreissena polymorpha*) through direct colonization, reduction of available habitat, changes in the biotic environment, or a reduction in food sources. The Asian Clam (*Corbicula fluminea*) alters benthic substrates, may filter mussel sperm or glochidia, competes with native species for limited resources, and causes ammonia spikes in surrounding water when they die off en masse (USFWS, 2019). The Round Goby (*Neogobius melanostomus*) can out-compete native benthic fishes (such as darters and sculpin) for food and other resources, and may also prey especially heavily on juvenile native mussels such as Round Hickorynut. The Black Carp (Mylopharyngodon piceus), a molluscivorous fish, may negatively impact native aquatic communities by direct predation, thus reducing populations of native mussels and snails, many of which are considered endangered or threatened (USFWS, 2019).

- Inherent factors
  The Round Hickorynut exhibits several inherent traits that influence population viability, including relatively small population size and limited recruitment at many locations compared to other mussels. Small population size puts the species at greater risk of extirpation from stochastic events (e.g., drought) or anthropomorphic changes and management activities that affect habitat. In addition, small, isolated Round Hickorynut populations may have reduced genetic diversity, be less genetically fit, and more susceptible to disease during extreme environmental conditions compared to large populations (USFWS, 2019).

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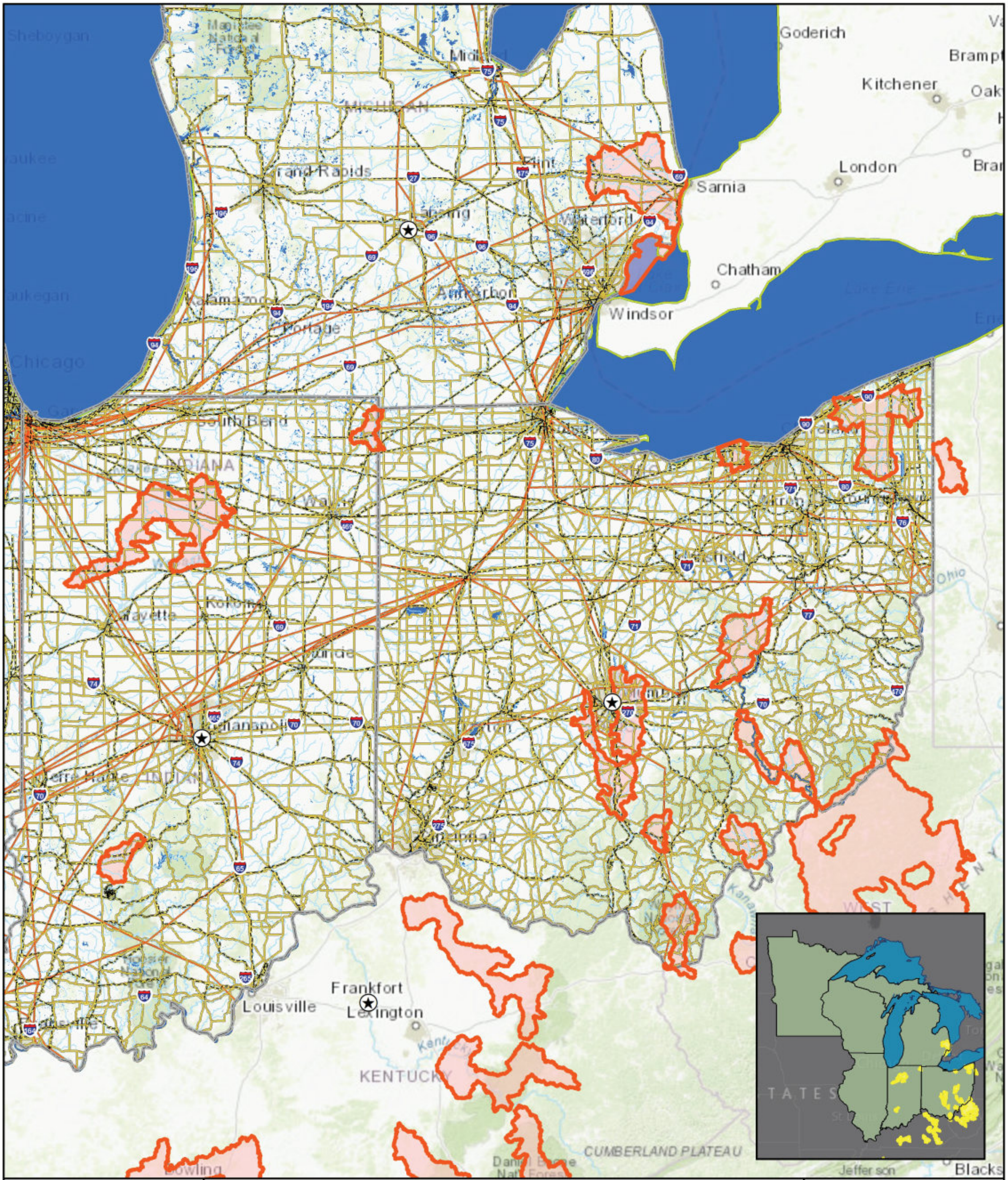

ROUND HICKORYNUT (*OBOVARIA SUBROTUNDA*) ACTION AREA OVERVIEW MAP

SCALE 1:4,500,000

- Petroleum Pipeline
- Major Road
- Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- Lakes & Ponds
- 1-Mile Coastal Inland Buffer
- Action Area
- Round Hickorynut (*Obovaria subrotunda*) Counties of Occurrence

N

Basemap courtesy of Esri.

Date: 5/25/2021

Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS

Projection: WGS 1984 Web Mercator

Salamander Mussel (*Simpsonaias ambigua*)

Federal Listing: Under Review. The Salamander Mussel was petitioned for Federal listing under the Endangered Species Act in 2010, and a 90-day finding was issued in 2011 (76 FR 59836).
State Listing within the AA: Endangered in Illinois, Michigan, and Minnesota; Threatened in Wisconsin; Species of Special Concern in Indiana

Species Description

The shell of the Salamander Mussel is small, thin, and elliptical or oval. The anterior and posterior ends are rounded and the dorsal and ventral margins are parallel. Beaks are raised slightly above the hinge line and directed anteriorly. Beak sculpture consists of several double-looped bars. The periostracum is smooth, yellowish tan to dark brown, and lacks rays. One small, thin pseudocardinal tooth is present in each valve and lateral teeth are indistinct or absent. The beak cavity is shallow. The nacre is bluish white and iridescent posteriorly (Cummings & Mayer, 1992; Carman, 2002; WIDNR, 2021).

Species Distribution

The Salamander Mussel is found in medium to large rivers. It is a habitat specialist, typically occurring under flat rocks or ledges of rock walls, though it has also been reported from mud and gravel bars (Carman, 2002; Roe, 2003; MNDNR, 2021). The Salamander Mussel is known from the Lake St. Clair, Lake Huron, and Lake Erie drainages, and from the Ohio River, Cumberland River, and upper Mississippi River basins (Roe, 2003). It is considered imperiled or highly imperiled in Arkansas, Illinois, Indiana, Kentucky, Michigan, Minnesota, Missouri, Ohio, Pennsylvania, West Virginia, Wisconsin, and Ontario, Canada, and is presumed extirpated or possibly extirpated from Iowa, New York, and Tennessee (Carman, 2002; Roe, 2003). In many of these states, extant populations are only known from one or two rivers (Carman, 2002; CBD, 2010; MNDNR, 2021).

Distribution within Action Area

ECOS does not provide a county list for this species. Salamander Mussel may occur in:

- Illinois: Upper Mississippi River basin
- Indiana: Ohio River basin
- Michigan: Great Lakes basin
- Minnesota: Upper Mississippi River basin
- Ohio: Lake Erie and Ohio River basins
- Wisconsin: Upper Mississippi River basin

Critical Habitat

No critical habitat has been designated for the Salamander Mussel.

Life History

Life history of the Salamander Mussel is similar to that of other unionid mussel species. Females brood glochidia (larvae) in their gills, and, once released, glochidia must attach to the gills or fins of a suitable host, typically a fish, to complete the transformation from the larval stage to a juvenile mussel. However, the Salamander Mussel is the only North American unionid known to parasitize a non-fish host; glochidia of this species are only known to use the Mudpuppy (*Necturus maculosus*) as a host (Roe, 2003). The Salamander Mussel is believed to be a long-term brooder (bradytictic). Gravid females have been collected in April, and Mudpuppies infested with glochidia have been observed in mid-October (Roe, 2003).

Current Stressors and Threats

Many factors have been implicated in the decline of native freshwater mussels, including destruction of habitat caused by impoundment construction, siltation, gravel mining, and channel modification, as well as pollution and the introduction of non-native species (Carman, 2002; Roe, 2003, MNDNR, 2021).

- Impoundments
  Impoundments can dramatically alter the habitat of freshwater mussels by changing flow, temperature, dissolved oxygen, and substrate composition. Salamander Mussels in Minnesota may be threatened by high stream-flow variations on the St. Croix River, caused by seasonal peaking operation of a hydroelectric dam (MNDNR, 2021). In addition, dams can isolate mussels from their host fish, interfering with reproduction (Roe, 2003).
- Siltation
  Siltation has long been implicated in the decline of native mussels. Fine sediments can interfere with mussel respiration and feeding, and heavy sediment loads may smother juvenile mussels. Sediment can also affect mussels by affecting their host species.
- Pollution
  Pollution from point (industrial and residential discharge) and non-point (siltation, herbicide, surface runoff) sources is also a great threat to mussels. Many types of industrial and domestic substances have been shown to be toxic to mussels. Recent toxicology research suggests mussels are among the most sensitive organisms to some contaminants, such as ammonia and copper (Roe, 2003).
- Invasive species
  The introduction of zebra mussels (*Dreissena polymorpha*) in the 1980s has severely impacted native mussel populations (Roe, 2003). Zebra mussels may directly affect native mussels by attaching to the native mussels' shells. Attached zebra mussels can interfere with feeding, respiration, excretion, and locomotion, and may eventually cause death by suffocation (Roe, 2003; MNDNR, 2021). While it is unclear how susceptible the Salamander Mussel may be to zebra mussel colonization, its preference for remaining under large flat rocks might reduce its exposure (Roe, 2003).

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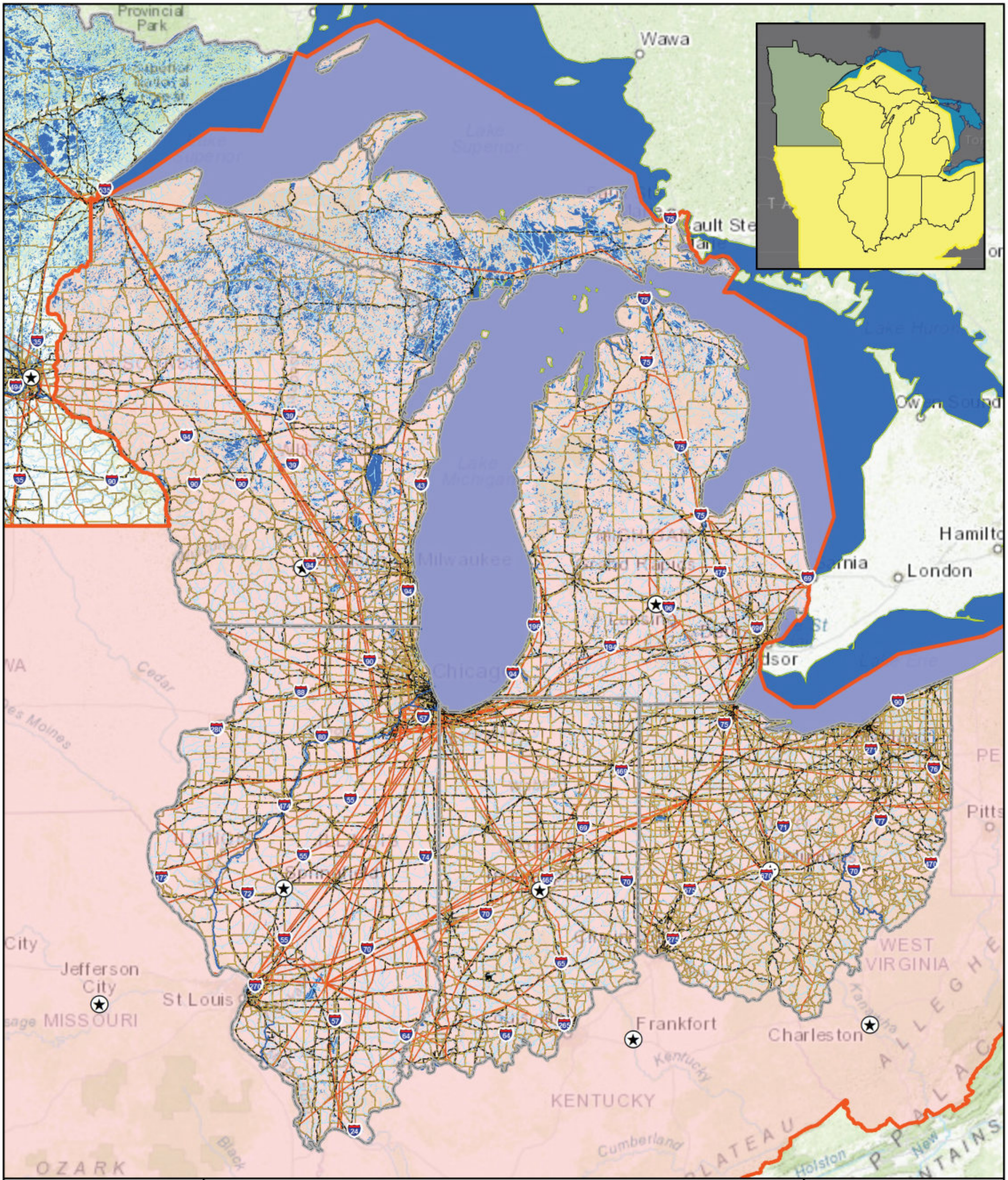

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Miles
0 20 40 80 120 160
Kilometers

SALAMANDER MUSSEL (*SIMPSONAIAS AMBIGUA*)
ACTION AREA OVERVIEW MAP

SCALE 1:8,000,000

- Petroleum Pipeline
- Major Road
- Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- Lakes & Ponds
- 1-Mile Coastal Inland Buffer
- Action Area
- Salamander Mussel (*Simpsonaias ambigua*) Counties of Occurrence

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Basemap courtesy of Esri.

Date: 5/25/2021

Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS

Projection: WGS 1984 Web Mercator

Scaleshell (*Leptodea leptodon*)

Federal Listing: Endangered
State Listing within the AA: Endangered in Illinois and Michigan

Species Description

The Scaleshell is a medium-sized mussel that may reach a length of 10 to 12cm. The shell is elongate, very thin, compressed, and rhomboidal. Individuals are sexually dimorphic. The posterior end of the shell is bluntly pointed in males. In females, the periostracum forms a broad, ruffled extension of the posterior end of the shell (USFWS, 2010). The beaks are small, low, and nearly even with the hinge line. Beak sculpture, if visible, consists of four or five double-looped ridges. The periostracum is smooth, yellowish green or brown, with numerous faint green rays (USFWS, 2010). The pseudocardinal teeth are reduced to a small, thickened ridge, and the lateral teeth are moderately long and fine. The beak cavity is very shallow. The nacre is pinkish white or light purple and highly iridescent (Cummings & Mayer, 1992; USFWS, 2010).

Species Distribution

The Scaleshell occurs in medium to large rivers and is primarily found in stable riffles and runs with slow to moderate current velocity. The Scaleshell historically occurred in 56 rivers in 13 states (Alabama, Arkansas, Illinois, Indiana, Iowa, Kentucky, Ohio, Oklahoma, Minnesota, Missouri, South Dakota, Tennessee, and Wisconsin) within the Mississippi River drainage but was considered rare throughout this range (USFWS, 2010). At the time of listing, the Scaleshell was considered extirpated in Iowa, Minnesota, Wisconsin, and all states east of the Mississippi River, and considered extant in only 14 streams in Missouri, Arkansas, and Oklahoma (USFWS, 2010, 2011). Since 2011, the species has been reported from several additional streams within its historic range, including the Illinois River, from which the Scaleshell had been considered extirpated. Currently, the Meramec, Bourbeuse, and Gasconade Rivers are considered the stronghold populations for the species, and records from other streams over the last 25 years consist of only a few sporadic live individuals (USFWS, 2021).

Distribution within Action Area

Only known to occur in Grundy County, Illinois (Illinois River).

Critical Habitat

No critical habitat has been designated for the Scaleshell.

Life History

Life history of the Scaleshell is similar to other unionid mussel species. Females brood glochidia (larvae) in their gills, and, once released, glochidia must attach to the gills or fins of a suitable host, typically a fish, to complete the transformation from the larval stage to a juvenile mussel. The Scaleshell is a long-term brooder (bradytictic); in Missouri, observations of gravid females suggest females begin brooding in early August and release glochidia the following June (USFWS, 2010). The Scaleshell appears to utilize the Freshwater Drum (*Aplodinotus grunniens*) exclusively as a host for its larvae (USFWS, 2010).

Current Stressors and Threats

The Scaleshell recovery plan identified several threats to the species, including water quality degradation, sedimentation, channelization, sand and gravel mining, dredging, impoundments, and invasive species (USFWS, 2010).

- Water quality degradtaion
  Nonpoint and point source pollution is a concern in most streams, but is particularly a problem in the Meramec, Bourbeuse, and Gasconade rivers in Missouri, Spring River in Arkansas (Gordon and the Little River in Oklahoma. Mussels appear to be among the most sensitive organisms to heavy metals. Lead and barite mining in the Big River basin, Missouri, may have contributed to mussel declines in this river. Although most mining operations have ceased, numerous dams retaining mine waste remain

in the Big River basin, and the poor condition of the dams has led to large influxes of mine waste into the Big River from dam collapse. Mussels are also sensitive to ammonia, which is a common pollutant in streams associated with animal feedlots, nitrogenous fertilizers, and the effluents of municipal wastewater treatment plants (USFWS, 2010).

- Sedimentation
  Sedimentation threatens Scaleshell populations throughout the species' range. Although sedimentation is a natural process, intensive agricultural practices, channelization, impoundments, timber harvesting within riparian zones, heavy recreational use, urbanization, and other land use activities can accelerate erosion. Heavy sediment loads can directly affect freshwater mussel survival by interfering with respiration and feeding and may also carry contaminants that are toxic to mussels (USFWS, 2010).
- Sand and gravel mining/dredging
  Sand and gravel mining and dredging are eliminating important pool habitat (for both the Scaleshell and potential fish hosts) in the Meramec, Bourbeuse, Big, and Gasconade Rivers in Missouri. Channelization, sand and gravel mining, and dredging operations physically remove mussels from the water and may also bury or crush mussels. More lasting effects of these activities involve the alteration or destruction of important unionid habitat that can extend upstream and downstream of the excavated area. For example, headcutting, the upstream progression of stream bed destabilization and accelerated bank erosion, can affect an area much larger than the dredging site (USFWS, 2010).
- Impoundments
  Impoundments negatively affect mussels both upstream and downstream by inducing bank and channel scouring, altering water temperature regimes, and altering habitat, food, and fish host availability. Impoundments permanently flood stream channels and eliminate flowing water that is essential habitat for most unionids, including the Scaleshell, and scouring is a major cause of mussel mortality below dams. In addition, impoundments interfere with movement of host fishes, alter fish host assemblages, and isolate mussel beds from each other and from host fish, resulting in diminished recruitment (USFWS, 2010).
- Invasive species
  The recent invasion of the exotic zebra mussel (*Dreissena polymorpha*) poses a substantial threat to native unionids, including Scaleshell. Zebra mussels starve and suffocate native mussels by attaching to their shells and the surrounding habitat in large numbers. Zebra mussels have spread throughout much of the Mississippi River Basin, but at this time, no large, established populations are known to occur in streams occupied by the Scaleshell. However, they are likely to invade these streams based on the proliferation and spread that has already occurred. The Asian clam (Corbicula fluminea) is another introduced freshwater bivalve that is believed to compete with native mussels for food, nutrients, and space. Black Carp (Mylopharyngodon piceus) poses a significant threat to Scaleshell in the near future. This molluscivorous fish was accidentally introduced into the United States in the 1970s and 1980s, and the number of reports of black carp captured in Arkansas, Illinois, Mississippi, and Missouri suggests that the species may be established and reproducing in the wild. Because Black Carp feed on freshwater mollusks extensively, it poses a major threat to the native freshwater mussel fauna if allowed to escape into the wild and establish reproducing populations (USFWS, 2010).

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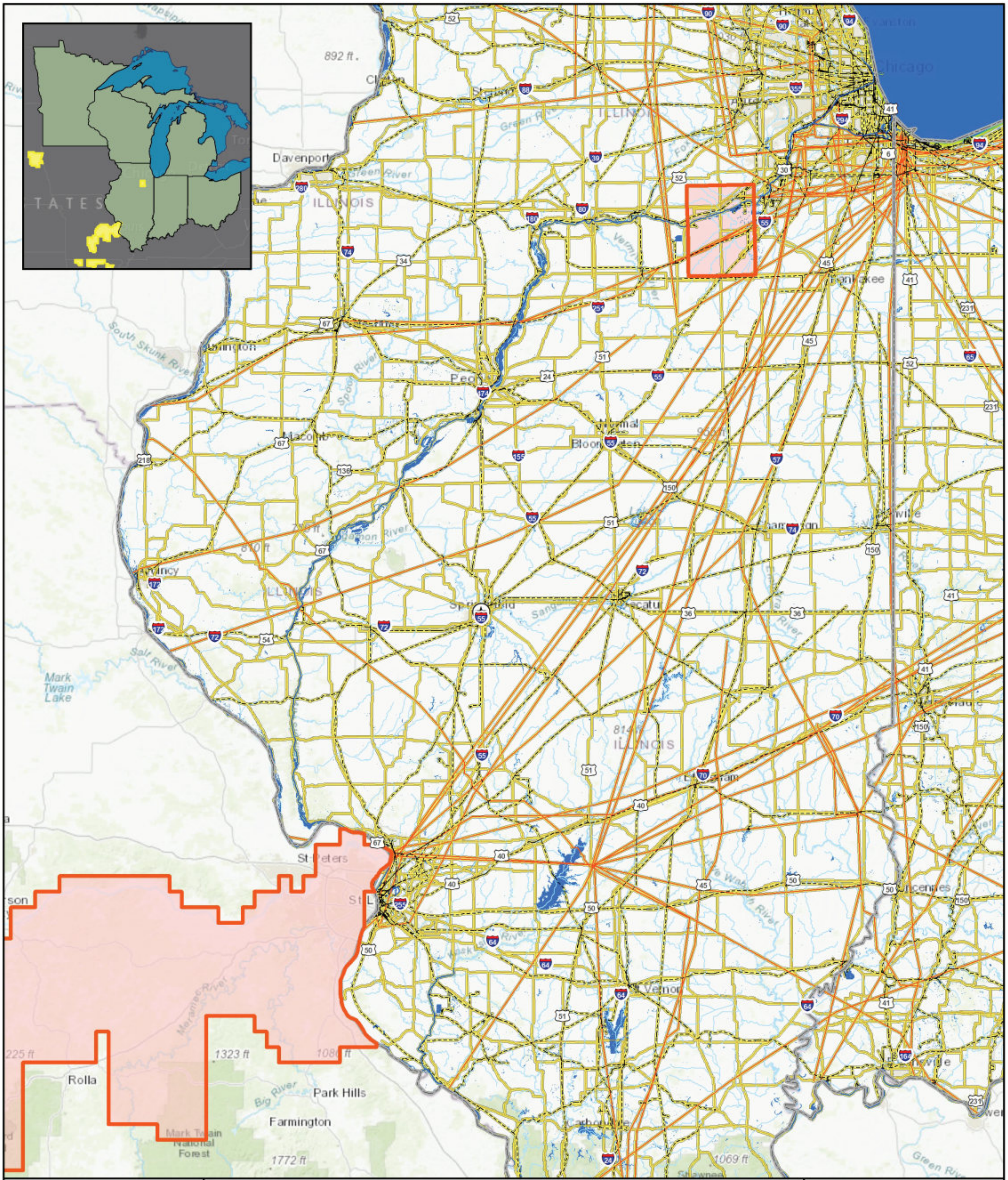

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SCALESHELL (*LEPTODEA LEPTODON*) ACTION AREA OVERVIEW MAP

SCALE 1:3,000,000

- — Petroleum Pipeline
- — Major Road
- ------ Railroad
- — Commercial Navigable Waterway
- — Rivers & Streams
- ▬ Lakes & Ponds
- 🟩 1-Mile Coastal Inland Buffer
- 🟨 Action
- ☐ Scaleshell (*Leptodea leptodon*) Counties of Occurrence

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Basemap courtesy of Esri.

Date: 5/25/2021

Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS

Projection: WGS 1984 Web Mercator

Sheepnose (*Plethobasus cyphyus*)

Federal Listing: Endangered
State Listing within the AA: Endangered in Illinois, Indiana, Minnesota, Ohio, and Wisconsin

Species Description

The shell of Sheepnose is ovate, somewhat elongated, moderately inflated, and thick. The anterior end is rounded and the posterior end is bluntly pointed. The beaks are elevated and placed near the anterior margin. Beak sculpture consists of a few concentric ridges, usually only visible in juvenile individuals. The shell is smooth except for a row of broad knobs or tubercles running from the beaks to the ventral margin. The periostracum is rayless, yellow or light brown in juveniles, becoming chestnut to dark brown in adults (Cummings & Mayer, 1992; 77 FR 14914). The pseudocardinal teeth are triangular and roughened, and the lateral teeth are long, heavy, and slightly curved. The beak cavity is shallow to moderately deep. The nacre is white, occasionally tinged with pink or salmon (Cummings & Mayer, 1992; 77 FR 14914).

Species Distribution

The Sheepnose is a larger-stream species occurring primarily in shallow shoal habitats with moderate to swift currents over coarse sand in gravel, although Sheepnose in larger rivers may occur in deeper water (77 FR 14914). Records indicate Sheepnose historically occurred in at least 76 streams in 14 states, including Alabama, Illinois, Indiana, Iowa, Kentucky, Minnesota, Mississippi, Missouri, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and Wisconsin. Extant populations of Sheepnose are known from 25 streams in all 14 states of historical occurrence, primarily in the Upper Mississippi and Ohio Rivers and their tributaries (USFWS, 2020).

Distribution within Action Area

- Illinois: 13 counties (Mississippi River, Kankakee River, Rock River, Ohio River)
- Indiana: 24 counties (Ohio River, Tippecanoe River, Eel River)
- Ohio: 13 counties (Ohio River, Muskingum River, Walhonding River)
- Wisconsin: 13 counties (Mississippi River, Chippewa River, Flambeau River, Wisconsin River)
- ECOS does not provide a list of Minnesota counties in which Sheepnose may occur, but does indicate the species is known or believed to occur in Minnesota (Mississippi River).

Critical Habitat

No critical habitat has been designated for the Sheepnose.

Life History

Life history of the Sheepnose is similar to other unionid mussel species. Females brood glochidia (larvae) in their gills, and, once released, glochidia must attach to the gills or fins of a suitable host, typically a fish, to complete the transformation from the larval stage to a juvenile mussel. Sheepnose are thought to be short-term brooders, with gravid females observed from May through early August in Wisconsin (USFWS, 2020). Sheepnose glochidia are released in conglutinates, which resemble small pink worms, and glochidia infest the host fish when the fish attempts to eat the conglutinates. Laboratory studies have identified roughly 30 suitable host fish for Sheepnose, most of which are cyprinids (minnows and topminnows). Sauger has also been identified as a natural host for Sheepnose (USFWS, 2020).

Current Stressors and Threats

The Sheepnose final listing rule identified habitat loss and degradation, due to impoundments, channelization, chemical contaminants, mining, oil and gas development, and sedimentation, as the primary reason for the species’ decline.

- Impoundments
  Dams eliminate or reduce river flow within impounded areas, trap silts and cause sediment deposition, alter water temperature and dissolved oxygen levels, change downstream water flow and quality, decrease habitat heterogeneity, affect normal flood patterns, and block upstream and downstream movement of species. Within impounded areas, mussel declines have been attributed to sedimentation, decreased dissolved oxygen, and alteration in resident fish populations. Mussel declines below dams are associated with changes and fluctuation in flow regime, scouring and erosion, reduced dissolved oxygen levels and water temperatures, and changes in resident fish assemblages. The decline and imperilment of freshwater mussels, including Sheepnose, in several streams in the Tennessee, Cumberland, Mississippi, Missouri, and Ohio River basins have been directly attributed to construction of numerous impoundments in those systems (77 FR 14914).
- Sedimentation
  Excessive sediments are believed to impact riverine mollusks requiring clean, stable streams. Sediments have been shown to affect respiration, growth, reproductive success, and behavior of freshwater mussels, and to affect fish growth, survival, and reproduction. Potential sediment sources within a watershed include virtually all activities that disturb the land surface, and most localities currently occupied by the Sheepnose are affected to varying degrees by sedimentation. Increased sedimentation and siltation may explain in part why Sheepnose mussels appear to be experiencing recruitment failure in some streams. Interstitial spaces in the substrate provide crucial habitat for juvenile mussels. When clogged, interstitial flow rates and spaces are reduced, thus reducing juvenile habitat (77 FR 14914).
- Dredging and channelization
  Dredging and channelization activities have profoundly altered riverine habitats nationwide. Channelization impacts streams physically (for example, accelerated erosion, reduced depth, decreased habitat diversity, geomorphic instability, and loss of riparian vegetation) and biologically (for example, decreased fish and mussel diversity, altered species composition and abundance, decreased biomass, and reduced growth rates). Channel maintenance operations for commercial navigation have impacted habitat for Sheepnose in many large rivers rangewide, and periodic channel maintenance may continue to adversely affect this species in the upper Mississippi, Ohio, Muskingum, and Tennessee Rivers (77 FR 14914).
- Resource extraction activities
  Instream gravel mining has been implicated in the destruction of mussel populations. Negative impacts associated with gravel mining include stream channel modifications, water quality modifications, macroinvertebrate population changes, and changes in fish populations. Gravel mining occurs in several streams known to harbor Sheepnose populations and may impact those populations. In addition, heavy metal-rich drainage from coal mining and associated sedimentation has adversely affected portions of river systems in which Sheepnose occurs, and coal mining related discharges may have local impacts on survival and recruitment (77 FR 14914). Coal, oil, and gas resources are present in a number of the basins where Sheepnose occur, and extraction of these resources has increased dramatically in recent years, particularly in Pennsylvania and West Virginia. Exploration and extraction of these energy resources can result in increased siltation, a changed hydrograph, and altered water quality even at a distance from the mine or well field. Sheepnose habitat in larger streams can be threatened by the cumulative effects of multiple mines and well fields (77 FR 14914).
- Chemical contaminants
  Chemical contaminants are ubiquitous throughout the environment and are considered a major threat in the decline of freshwater mussel species. Chemicals enter the environment through both point and nonpoint discharges including spills, industrial sources, municipal effluents, and agricultural runoff. These sources contribute organic compounds, heavy metals, pesticides, and a wide variety of newly emerging contaminants to the aquatic environment. As a result, water and sediment quality can be degraded to the extent that mussel populations are adversely affected. Freshwater mussels, including Sheepnose, have been shown to be particularly sensitive to many contaminants, such as ammonia and

heavy metals, and introduction of these contaminants into Sheepnose habitats may threaten the species (77 FR 14914).

- Invasive species
  The recent invasion of the exotic zebra mussel (*Dreissena polymorpha*) poses a substantial threat to native unionids, including Scaleshell. Zebra mussels starve and suffocate native mussels by attaching to their shells and the surrounding habitat in large numbers. Zebra mussels are established throughout the upper Mississippi, Ohio, and Tennessee Rivers, overlapping much of the current range of Sheepnose. The Asian clam (*Corbicula fluminea*) is another introduced freshwater bivalve that is believed to compete with native mussels for food, nutrients, and space. Other invasive fish, including Black Carp (*Mylopharyngodon piceus*) and Round Goby (*Neogobius melanostomus*), have the potential to become established in streams within the Sheepnose's range and may affect Sheepnose by direct predation on mussels or by predation on potential host fish (77 FR 14914).

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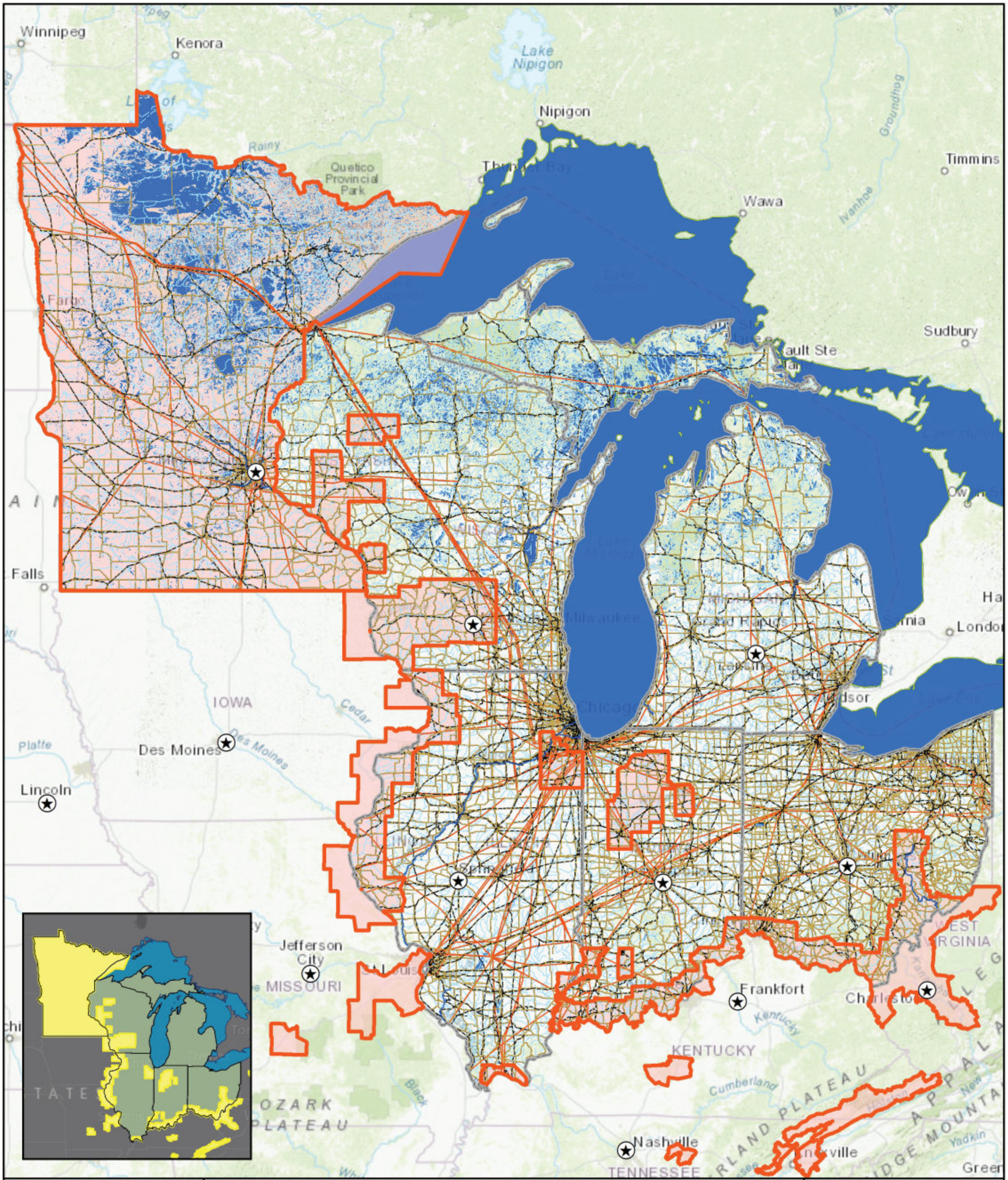

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SHEEPNOSE (*PLETHOBASUS CYPHYUS*) ACTION AREA OVERVIEW MAP

SCALE 1:10,000,000

Petroleum Pipeline	Commercial Navigable Waterway	🟩 1-Mile Coastal Inland Buffer
Major Road	Rivers & Streams	🟨 Action Area
------ Railroad	🟦 Lakes & Ponds	🟥 Sheepnose (*Plethobasus cyphyus*) Counties of Occurrence

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Basemap courtesy of Esri. Date: 5/25/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS Projection: WGS 1984 Web Mercator

Snuffbox (*Epioblasma triquetra*)

Federal Listing: Endangered
State Listing within the AA: Endangered in Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin

Species Description

The Snuffbox is a small- to medium-sized mussel, with males reaching up to 7.0cm in length and females reaching 4.5cm (Cummings & Mayer, 1992; USFWS, 2021). The shape of the shell is somewhat triangular (females), oblong, or ovate (males), with the valves solid, thick, and very inflated. The anterior end of the shell is rounded, and the posterior end is truncated, highly so in females. The posterior ridge and slope in females is covered with fine ridges and grooves, and the posterioventral shell edge is finely toothed. The beaks are swollen, turned forward and inward, and extended above the hingeline. Beak sculpture consists of three or four faint, double-looped bars. The periostracum is generally smooth and yellowish or yellowish-green in young individuals, becoming darker with age. Green, squarish, triangular, or chevron-shaped marks cover the dorsal portion of the shell but become poorly delineated stripes with age (Cummings & Mayer, 1992; USFWS, 2021). The pseudocardinal teeth are thin and triangular and the lateral teeth are short and slightly curved. The beak cavity is wide and deep. The nacre is white, often with a silvery luster, and a gray-blue or gray-green tinge in the beak cavity (Cummings & Mayer, 1992; USFWS, 2021).

Species Distribution

The Snuffbox occurs in small- to medium-sized creeks, larger rivers, and lakes. It is found in riffles and shoals with swift current and wave-washed shores of lakes over gravel and sand with occasional cobble and boulders (77 FR 8632). The Snuffbox historically occurred in 210 streams and lakes in 18 states (Alabama, Arkansas, Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Mississippi, Missouri, New York, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and Wisconsin) and Ontario, Canada (77 FR 8632). The Snuffbox is currently considered to be extant in 82 streams in 14 states (Alabama, Arkansas, Illinois, Indiana, Kentucky, Michigan, Minnesota, Missouri, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and Wisconsin) and Ontario, Canada (USFWS, 2019). Populations in the Grand River (Michigan), Ausable River (Ontario), Sydenham River (Ontario), Bourbeuse River (Missouri), French Creek (Pennsylvania), Clinch River (Tennessee and Virginia), and Paint Rock River (Alabama) have been categorized as stronghold populations (USFWS, 2019).

Distribution within Action Area

- Illinois: 11 counties (Mississippi River and Ohio River basins)
- Indiana: 15 counties (Ohio River and Great Lakes basins)
- Michigan: 12 counties (Great Lakes basin)
- Minnesota: Chisago, Hennepin, Ramsey, and Washington Counties (Mississippi River, St. Croix River)
- Ohio: 25 counties (Lake Erie and Ohio River basins)
- Wisconsin: Outagamie, Pierce, Polk, Shawano, St. Croix, Waupaca, and Waushara counties (St. Croix River, Wolf River, Little Wolf River, Embarrass River)

Critical Habitat

No critical habitat has been designated for the Snuffbox.

Life History

Life history of the Snuffbox is similar to that of other unionid mussel species. Females brood glochidia (larvae) in their gills, and, once released, glochidia must attach to the gills or fins of a suitable host, typically a fish, to complete the transformation from the larval stage to a juvenile mussel. The Snuffbox is thought to be a long-term brooder (bradytictic), with gravid females found in September through May (77 FR 8632). Female Snuffbox mussels display their mantle to attract host fish, and, when a host fish approaches, will often close their valves on the fish's head or snout, trapping the fish and ensuring that glochidia are released into the fish's gills (USFWS, 2012). Juvenile Snuffbox have successfully transformed on Logperch *(Percina caprodes),* Blackside Darter *(Percina maculata),* Rainbow Darter (*Etheostoma caeruleum*), Iowa Darter *(Etheostoma exile),* Blackspotted Topminnow *(Fundulus olivaceous),* Mottled Sculpin (*Cottus bairdi*), Banded Sculpin *(Cottus carolinae),* Ozark Sculpin *(Cottus hypselurus),* Largemouth Bass (*Micropterus salmoides*), and Brook Stickleback *(Culaea inconstans)* in laboratory tests (77 FR 8632).

Current Stressors and Threats

At the time of listing, destruction, modification, and curtailment of the Snuffbox's range was considered to be a threat to the species. The Snuffbox has experienced significant curtailment of its occupied range and has been eliminated from about 62 percent of the streams in which it historically occurred. The primary cause of range curtailment is modification and destruction of river and stream habitats, primarily by the construction of impoundments. Other factors contributing to the reduction in range include dredging and channelization, chemical contamination, oil and gas production, sand and gravel mining, and siltation.

- Impoundments
  Impoundments result in the dramatic modification of riffle and shoal habitats and a resulting loss of mussel resources, especially in larger rivers. Stream habitat throughout major portions of the range of Snuffbox has been impounded. Dams interrupt a river's ecological processes by modifying flood pulses; controlling impounded water elevations; altering water flow, sediments, nutrients, and energy inputs and outputs; increasing depth; decreasing habitat heterogeneity; decreasing stability due to subsequent sedimentation; blocking host fish passage; and isolating mussel populations from fish hosts. Even small, low-head dams can have some of these effects on mussels (77 FR 8632). Since the time of listing, five dam removals have occurred in Snuffbox streams, but an improvement to the status of the Snuffbox populations in these streams has not yet been documented (USFWS, 2019).
- Dredging and channelization
  Dredging and channelization activities have profoundly altered riverine habitats nationwide. Channelization impacts a stream's physical (accelerated erosion, reduced depth, decreased habitat diversity, geomorphic instability, and riparian canopy loss) and biological (decreased fish and mussel diversity, changed species composition and abundance, decreased biomass, and reduced growth rates) characteristics, and channel maintenance may result in profound impacts downstream, such as increases in turbidity and sedimentation, which may smother benthic (bottom-dwelling) organisms. Hundreds of miles of streams containing Snuffbox were dredged and channelized decades ago, and some populations have been eliminated from these streams (77 FR 8632).
- Chemical contaminants
  Chemical contaminants are ubiquitous throughout the environment and are considered a major threat in the decline of freshwater mussel species. Chemicals enter the environment through both point and nonpoint discharges, including spills, industrial sources, municipal effluents, and agricultural runoff. These sources contribute organic compounds, heavy metals, pesticides, and a wide variety of newly emerging contaminants to the aquatic environment. As a result, water and sediment quality can be degraded to the extent that mussel populations are adversely impacted. Although point source discharges within the range of the Snuffbox have been reduced since the inception of the Clean Water Act, it is unclear if these regulatory mechanisms provide adequate protection for filter-feeding organisms that can be impacted by extremely low levels of contaminants (77 FR 8632).
- Resource extraction activities
  Various mining and resource extraction activities threaten Snuffbox populations. Adverse impacts from heavy-metal-rich drainage from coal mining and associated sedimentation have been documented in portions of historical Snuffbox habitat in the upper Ohio basin. Oil and gas resources extraction has increased dramatically in recent years, particularly in Pennsylvania and West Virginia. Although oil and gas extraction generally occurs away from the river, extensive road networks are required to construct and maintain wells. These road networks frequently cross or occur near tributaries, contributing sediment to the receiving waterway. In addition, the construction and operation of wells may result in the discharge of brine (salt water), which can cause acute toxicity and mortality of mussels if mussel

tolerance levels are exceeded. Instream gravel mining and mining for metals may also continue to threaten Snuffbox populations in various locations (77 FR 8632).

- Sedimentation
  Sedimentation has been implicated in the decline of mussel populations nationwide and is a threat to the Snuffbox. Physical habitat effects include altered suspended and bed material loads, and bed sediment composition associated with increased sediment production and run-off; clogged interstitial habitats and reduced interstitial flow rates and dissolved oxygen levels; changed channels in form, position, and degree of stability; altered depth or width-depth ratio that affects light penetration and flow regime; aggraded (filling) or degraded (scouring) channels; and changed channel positions that dewater mussel beds. In addition, sediment can clog interstitial spaces in the substrate, which serve as essential habitat for juvenile mussels (77 FR 8632).
- Climate change
  Factors associated with climate change likely to affect regional mussel populations include changes in stream temperature regimes and precipitation levels that may indirectly result in reduced habitat and declines in host fish stocks.
- Invasive species
  Various exotic species are well established with the range of the Snuffbox. Exotic species, including the zebra mussel (*Dreissena polymorpha*), Asian clam (*Corbicula fluminea*), Round Goby (*Neogobius melanostomus*), and Black Carp (*Mylopharyngodon piceus*), threaten the Snuffbox, or its host fish, or both, through mechanisms such as habitat modification, competition, and predation (USFWS, 2019).

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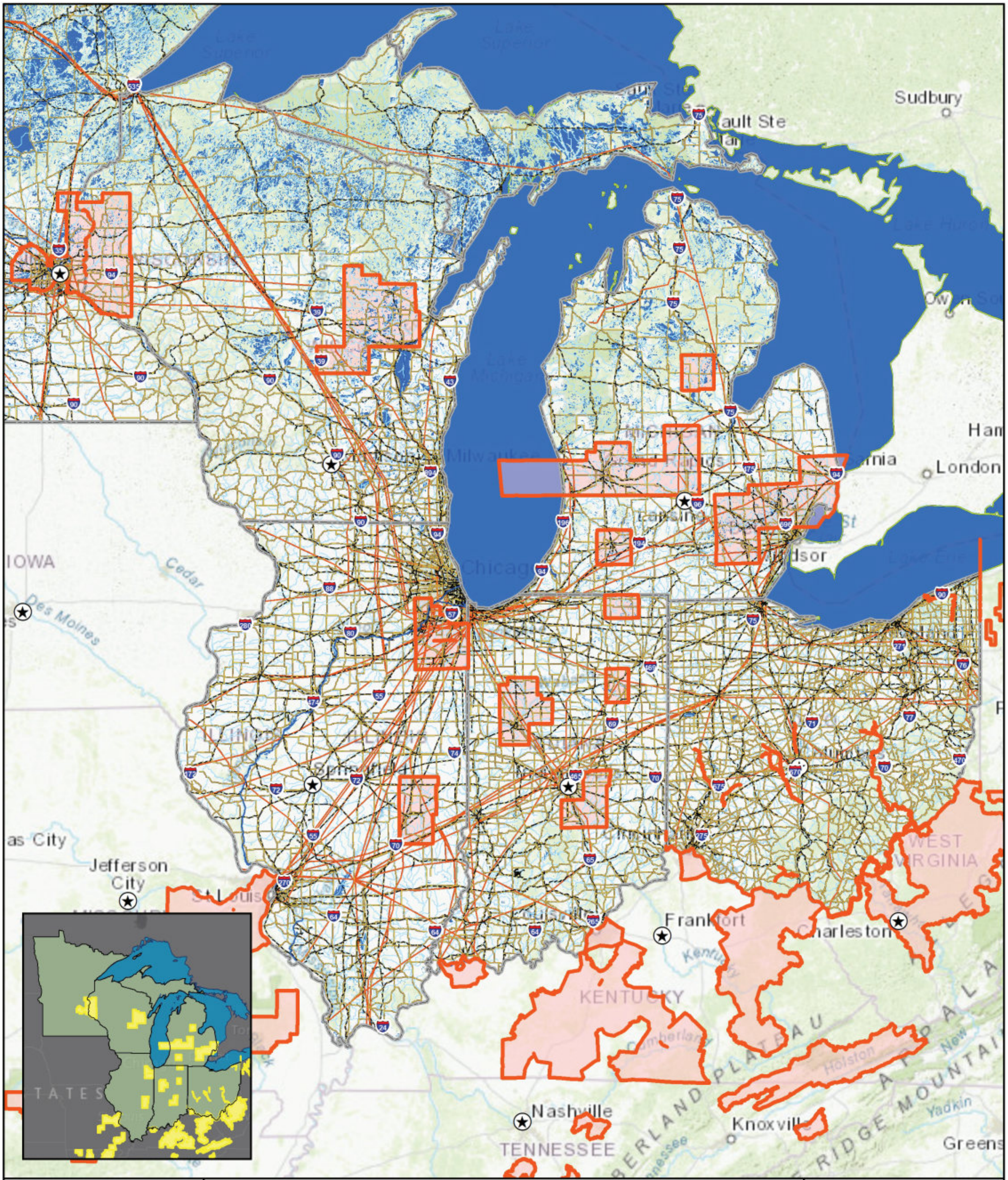

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SNUFFBOX (*EPIOBLASMA TRIQUETRA*)
ACTION AREA OVERVIEW MAP

SCALE 1:8,000,000

—— Petroleum Pipeline
—— Major Road
------ Railroad
—— Commercial Navigable Waterway
—— Rivers & Streams
🟦 Lakes & Ponds
🟩 1-Mile Coastal Inland Buffer
🟨 Action Area
🟥 Snuffbox (*Epioblasma triquetra*) Counties of Occurrence

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Basemap courtesy of Esri.

Date: 5/25/2021

Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS

Projection: WGS 1984 Web Mercator

Spectaclecase (*Cumberlandia monodonta*)

Federal Listing: Endangered
State Listing within the AA: Endangered in Illinois, Minnesota, and Wisconsin

Species Description

The Spectaclecase is a large mussel that reaches at least 23.5cm in length. 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. The beaks are only slightly elevated above the hinge line. Beak sculpture, if visible, consists of three or four heavy ridges. 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. The single pseudocardinal tooth is simple and peg-like in the right valve, fitting into a depression in the left. The lateral teeth are straight and single in the right valve, and double in the left valve, but become fused with age into an indistinct raised hinge line. The beak cavity is moderately shallow. The nacre is white, mostly iridescent in young specimens, but becoming iridescent posteriorly in older shells (Cummings & Mayer, 1992; USFWS, 2014).

Species Distribution

The Spectaclecase is a large river species that is most often found between large rocks but has also been found in mud and sand to gravel, cobble, and boulders in relatively shallow riffles and shoals with slow to swift current. Spectaclecase mussels are often found aggregated under slab boulders or bedrock shelves, where they are protected from the current (USFWS, 2014). The Spectaclecase historically occurred in at least 44 streams in the Mississippi, Ohio, and Missouri River basins and its distribution comprised portions of 14 states (Alabama, Arkansas, Illinois, Indiana, Iowa, Kansas, Kentucky, Minnesota, Missouri, Ohio, Tennessee, Virginia, West Virginia, and Wisconsin; USFWS, 2014). The species is now known from only 20 of the 44 historical streams in the Mississippi, Ohio, and lower Missouri River basins, and is considered extirpated from Indiana, Kansas, and Ohio. The only remaining populations that are considered relatively strong are in the Meramec and Gasconade Rivers in Missouri and the St. Croix River in Minnesota and Wisconsin (USFWS, 2014).

Distribution within Action Area

- Illinois: Adams, Hancock, Henderson, Madison, Massac, Mercer, Pike, and Rock Island Counties (Mississippi River, Ohio River)
- Minnesota: Chisago, Pine, and Washington Counties (Mississippi River, St. Croix River)
- Wisconsin: Burnett, Chippewa, Crawford, Grant, Pierce, Polk, and St. Croix Counties (Mississippi River, St. Croix River)

Critical Habitat

No critical habitat has been designated for the Spectaclecase.

Life History

Life history of the Spectaclecase is similar to other unionid mussel species. Females brood glochidia (larvae) in their gills, and, once released, glochidia must attach to the gills or fins of a suitable host, typically a fish, to complete the transformation from the larval stage to a juvenile mussel. The Spectaclecase is thought to release glochidia from early April to late May in the Meramec and Gasconade Rivers in Missouri, and has been reported as producing two broods, one in spring or early summer and the other in the fall, in the Meramec River (USFWS, 2014). Mooneye (*Hiodon tergisus*) and Goldeye (*Hiodon alosoides*) have been identified as suitable host fish for Spectaclecase glochidia (USFWS, 2019).

Current Stressors and Threats

The Spectaclecase final listing rule identified habitat loss and degradation, due to impoundments, channelization, chemical contaminants, mining, oil and gas development, and sedimentation, as the primary reason for the species' decline.

- Impoundments
  Dams eliminate or reduce river flow within impounded areas, trap silts and cause sediment deposition, alter water temperature and dissolved oxygen levels, change downstream water flow and quality, decrease habitat heterogeneity, affect normal flood patterns, and block upstream and downstream movement of species. Within impounded areas, mussel declines have been attributed to sedimentation, decreased dissolved oxygen, and alteration in resident fish populations. Mussel declines below dams are associated with changes and fluctuation in flow regime, scouring and erosion, reduced dissolved oxygen levels and water temperatures, and changes in resident fish assemblages. The decline and imperilment of freshwater mussels, including Spectaclecase, in several streams in the Tennessee, Cumberland, Mississippi, Missouri, and Ohio River basins have been directly attributed to construction of numerous impoundments in those systems (77 FR 14914).
- Sedimentation
  Excessive sediments are believed to impact riverine mollusks requiring clean, stable streams. Sediments have been shown to affect respiration, growth, reproductive success, and behavior of freshwater mussels, and to affect fish growth, survival, and reproduction. Potential sediment sources within a watershed include virtually all activities that disturb the land surface, and most localities currently occupied by the Spectaclecase are affected to varying degrees by sedimentation. Increased sedimentation and siltation may explain in part why Spectaclecase mussels appear to be experiencing recruitment failure in some streams. Interstitial spaces in the substrate provide crucial habitat for juvenile mussels. When clogged, interstitial flow rates and spaces are reduced, thus reducing juvenile habitat (77 FR 14914).
- Dredging and channelization
  Dredging and channelization activities have profoundly altered riverine habitats nationwide. Channelization impacts streams physically (for example, accelerated erosion, reduced depth, decreased habitat diversity, geomorphic instability, and loss of riparian vegetation) and biologically (for example, decreased fish and mussel diversity, altered species composition and abundance, decreased biomass, and reduced growth rates). Channel maintenance operations for commercial navigation have impacted habitat for Spectaclecase in many large rivers rangewide, and periodic channel maintenance may continue to adversely affect this species in the upper Mississippi, Ohio, and Tennessee Rivers (77 FR 14914).
- Resource extraction activities
  Instream gravel mining has been implicated in the destruction of mussel populations. Negative impacts associated with gravel mining include stream channel modifications, water quality modifications, macroinvertebrate population changes, and changes in fish populations. Gravel mining occurs in several streams known to harbor Spectaclecase populations and may impact those populations. In addition, heavy metal-rich drainage from coal mining and associated sedimentation has adversely affected portions of river systems in which Spectaclecase occurs, and coal mining related discharges may have local impacts on survival and recruitment. Similarly, heavy metal contaminated sediments associated with lead mining have negatively affected mussel populations along several miles of the Big River, Missouri (77 FR 14914).
- Chemical contaminants
  Chemical contaminants are ubiquitous throughout the environment and are considered a major threat in the decline of freshwater mussel species. Chemicals enter the environment through both point and nonpoint discharges including spills, industrial sources, municipal effluents, and agricultural runoff. These sources contribute organic compounds, heavy metals, pesticides, and a wide variety of newly emerging contaminants to the aquatic environment. As a result, water and sediment quality can be degraded to the extent that mussel populations are adversely affected. Freshwater mussels have been shown to be particularly sensitive to many contaminants, such as ammonia and heavy metals, and

introduction of these contaminants into Spectaclecase habitats may threaten the species (77 FR 14914).

- Invasive species
  The invasion of the zebra mussel (*Dreissena polymorpha*) poses a serious threat to mussel faunas in many regions, and species extinctions are expected as a result of its continued spread in the eastern United States Zebra mussels impact native mussels primarily through direct fouling of the shells of live native mussels. Zebra mussels may also reduce food concentrations to levels too low to support reproduction, or even survival in extreme cases. The Spectaclecase's colonial tendency could allow for very large numbers to be affected by a single favorable year for zebra mussels. Zebra mussels are established throughout the upper Mississippi, lower St. Croix, Ohio, and Tennessee Rivers, overlapping much of the current range of the Spectaclecase. A molluscivore (mollusk eater), the black carp (*Mylopharyngodon piceus*) is a potential threat to the Spectaclecase; it has been introduced into North America since the 1970s. Black carp are known to eat clams (*Corbicula* spp.) and unionid mussels in China, in addition to snails. Several other Asian carp species, which may disrupt aquatic food chains, are also present in the some of the rivers with extant Spectaclecase populations (USFWS, 2014).

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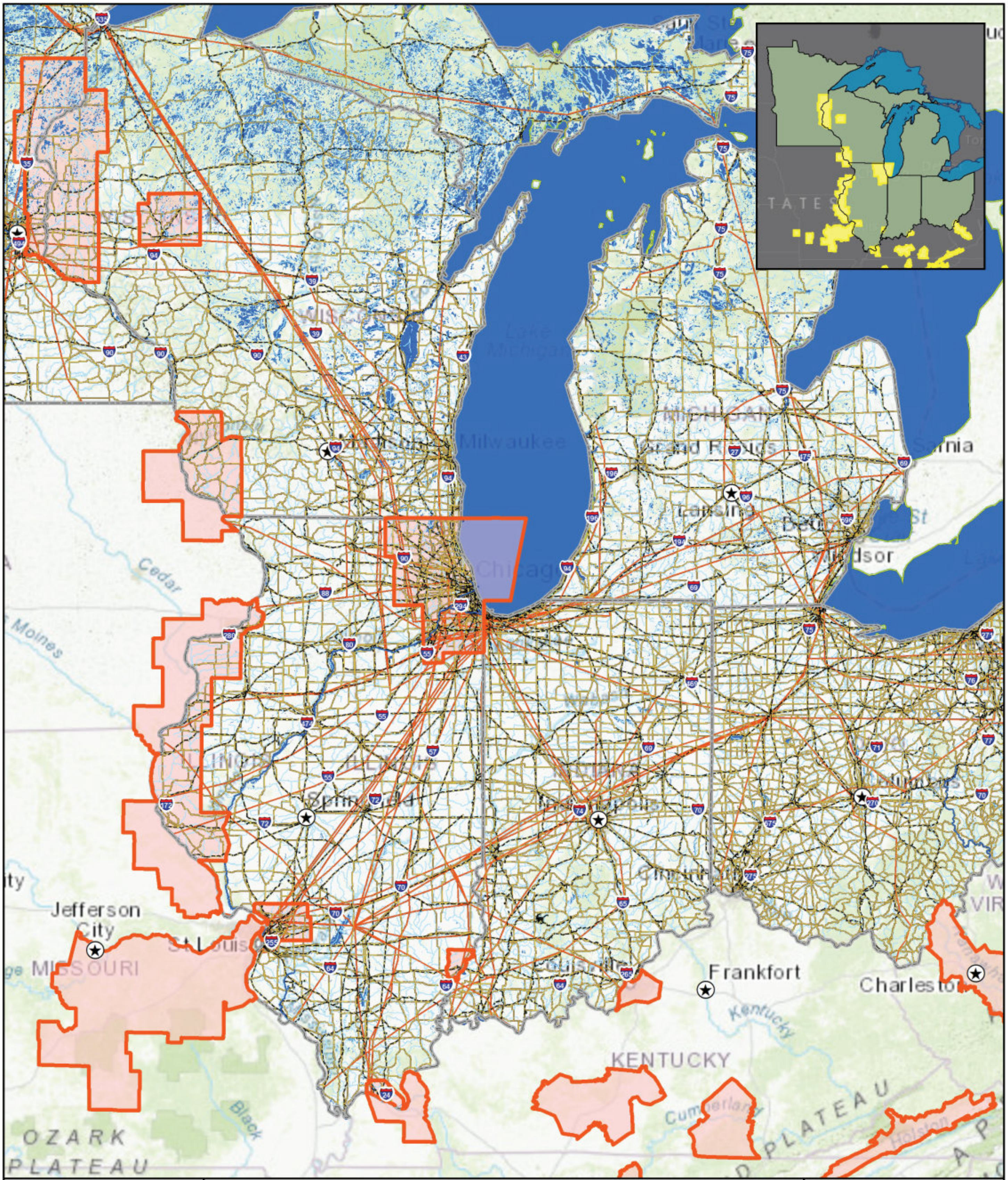

SPECTACLECASE (*CUMBERLANDIA MONODONTA*) ACTION AREA OVERVIEW MAP

SCALE 1:7,000,000

- Petroleum Pipeline
- Major Road
- ------ Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- 🟦 Lakes & Ponds
- 🟩 1-Mile Coastal Inland Buffer
- 🟨 Action Area
- ▭ Spectaclecase (*Cumberlandia monodonta*) Counties of Occurrence

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Basemap courtesy of Esri. Date: 5/25/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS Projection: WGS 1984 Web Mercator

White Cat’s Paw Pearly Mussel (*Epioblasma obliquata perobliqua*)

Federal Listing: Endangered
State Listing within the AA: Endangered in Indiana, Michigan, and Ohio

Species Description

The White Cat’s Paw Pearly Mussel shell is small and subquadrate to oval in shape. The species is sexually dimorphic. Males are larger than females, the posterior end of the shell is bluntly pointed, and a wide sulcus or depression is present between the posterior ridges. The female shell is truncated, ribbed, and notched at the posterior end, with a narrow, slightly swollen postventral expansion bearing a comb-like row of small, sharp denticles on its margin. The umbos are moderately high and beak sculpture is double-looped. The periostracum is yellow, yellowish-green, or brown with numerous fine green rays (USFWS, 1990; Cummings & Mayer, 1992). The pseudocardinal teeth are small and triangular and the lateral teeth are moderately thick. The nacre is white (USFWS, 1990).

Species Distribution

The White Cat’s Paw Pearly Mussel has been reported most frequently from riffle-run reaches of small to moderately large rivers (USFWS, 1990). The species historically occurred in the Wabash, White, Tippecanoe, Maumee, and St. Joseph Rivers in Indiana, and in the Maumee and St. Joseph Rivers and Fish Creek in Ohio. It may also have occurred in the Ohio River, though the museum record is questionable. However, since 1970, the White Cat’s Paw Pearly Mussel has only been collected from Fish Creek in Ohio. It is currently known to exist in only a 3-mile portion of Fish Creek, and the last observation of a live individual was in 1999 (USFWS, 2021).

Distribution within Action Area

Only known to occur in Fish Creek in DeKalb and Steuben Counties, Indiana, and Williams County, Ohio.

Critical Habitat

No critical habitat has been designated for the White Cat’s Paw Pearly Mussel.

Life History

Life history of the White Cat’s Paw Pearly Mussel is presumably similar to that of other unionid mussel species, though specific life history details are not well known due to the scarcity of individuals. Females brood glochidia (larvae) in their gills, and, once released, glochidia must attach to the gills or fins of a suitable host, typically a fish, to complete the transformation from the larval stage to a juvenile mussel. Host fish for the White Cat’s Paw Pearly Mussel are not known, but host fish for the closely related Purple Cat’s Paw Pearlymussel (*Epioblasma obliquata obliquata*) include Rock Bass (*Amploplites rupestris*), Mottled Sculpin (*Cottus bairdii*), Stonecat (*Noturus flavus*), Blackside Darter (*Percina maculata*), and Logperch (*Percina caprodes*), and it is likely that the host fish for White Cat’s Paw Pearly Mussel are also darter or sculpin species (USFWS, 1990; USFWS, 2020).

Current Stressors and Threats

The original White Cat’s Paw Pearly Mussel recovery plan identified several threats to the species, including channelization and other substrate disturbance, siltation, and pollution.

- Channelization and substrate disturbance
  Channelization and other forms of substrate disturbance have contributed substantially to the decline of unionid mollusks. Deforestation, altered flow regimes, drainage of swamps and increases in tilled farmland have been cited as factors contributing to the decline of mussels in Indiana, and gravel dredging operations have been cited as contributing to the abundance of shifting, unstable sand substrate in the lower Wabash River. In addition, one of the largest known mussel beds in the St. Joseph River had declined in large part due to instream construction centered on the mussel bed (USFWS, 1990).

- Siltation
  Siltation is another factor that has contributed to the decline in unionid mussels. High silt loads have been found to reduce filter feeding efficiency and can irritate, damage, or clog the gills of mussels. The White Cat's Paw Pearly Mussel appears to live buried in gravel substrate, and silt deposited over the substrate would quickly cover individuals of this species (USFWS, 1990).
- Pollutants
  Mussels may also be affected by pollutants. Reduction or elimination of mussel beds has been observed downstream of industrial centers, municipal sewage outfalls, and mining operations, and may be the result of reduced water quality downstream from these sources of pollution. In some instances, the contaminants produced mussel die-offs by direct toxic effects, and in other instances reduced populations of mussels are the indirect result of the elimination of fish hosts or food items (USFWS, 1990).
- Climate change
  Global climate change likely constitutes a significant new threat for the species. Current climate change predictions areas in the Northern Hemisphere indicate warmer air temperatures and more intense precipitation events. The predicted impacts on streams include changes in the distribution of algae, plankton, and fish, as well as changes in water temperatures and oxygen levels. Warming of waters in rivers and streams may make these habitats less able to support their current fish and mussel fauna. Although the specific effects of climate change on the White Cat's Paw Pearly Mussel are unknown, altered hydrology in rivers, increased frequency of extreme weather events, and a changing abundance and distribution of fish species have the potential to adversely affect this species. The magnitude of the climate change threat to the White Cat's Paw Pearly Mussel may be severe since this species is only known to occur in a 3-mile reach of only one stream (USFWS, 2013).

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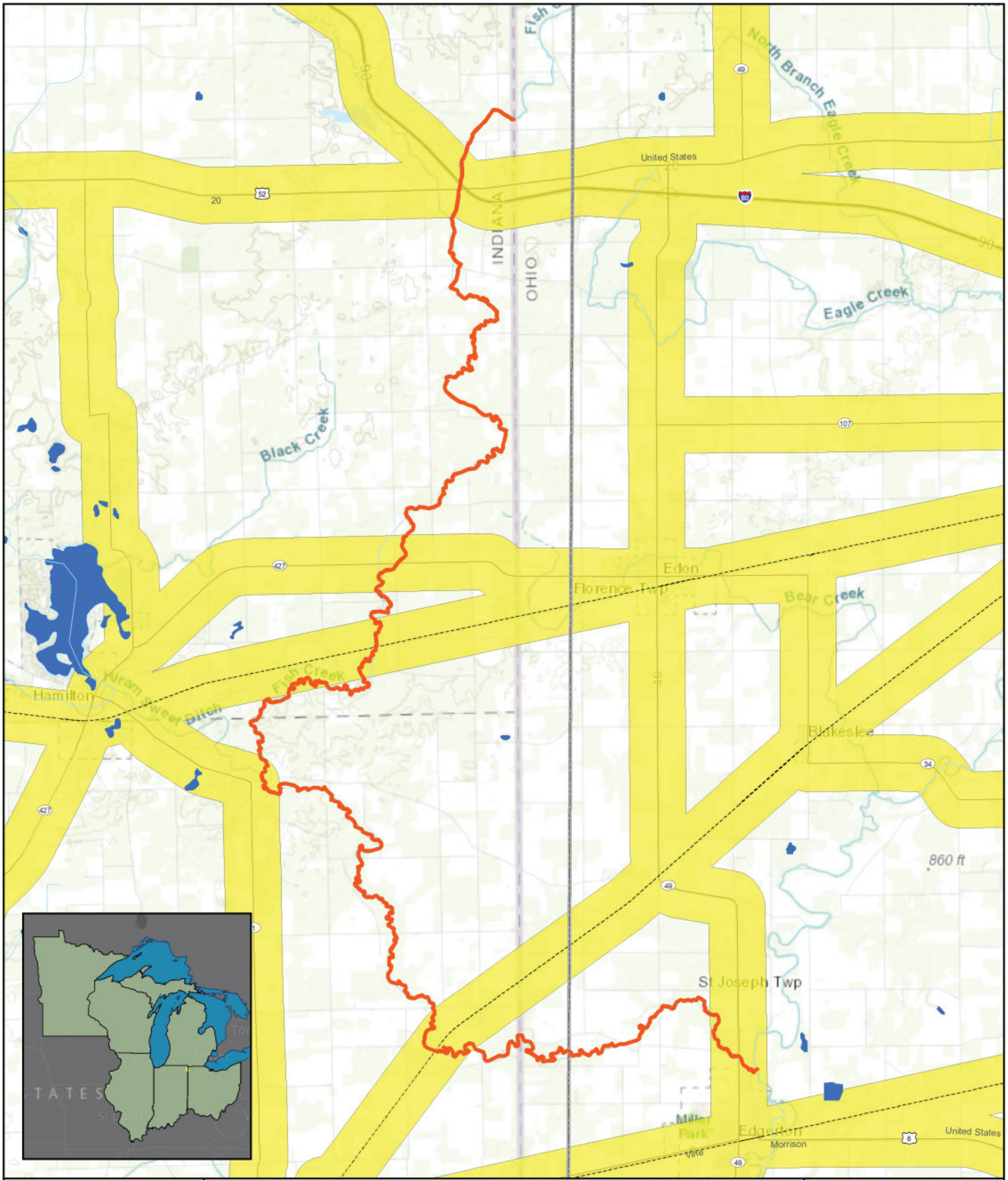

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WHITE CATSPAW (*EPIOBLASMA OBLIQUATA PEROBLIQUA*) ACTION AREA OVERVIEW MAP

SCALE 1:150,000

- Petroleum Pipeline
- Major Road
- ------ Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- 🟦 Lakes & Ponds
- 🟩 1-Mile Coastal Inland Buffer
- 🟨 Action Area
- 🟥 White Catspaw (*Epioblasma obliquata perobliqua*) Counties of Occurrence

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Basemap courtesy of Esri.

Date: 5/25/2021

Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS

Projection: WGS 1984 Web Mercator

Winged Mapleleaf (*Quadrula fragosa*)

Federal Listing: Endangered
State Listing within the AA: Endangered in Minnesota and Wisconsin

Species Description

The Winged Mapleleaf shell is quadrate or square, thick, and moderately inflated. The beaks are prominent and elevated above the hinge line. Beak sculpture consists of two rows of raised bumps or nodules. The sculpturing continues on the lateral surface of the shell as two prominent tuberculated ridges, separated by a sulcus, extending to the ventral margin of the shell. The shell has a prominent wing present posterior to the beak, with radiating rows of pustules or ridges. The periostracum ranges from tan or greenish in juveniles to chestnut or dark brown in adults, often with a few wide, broken green rays (Cummings & Mayer, 1992; USFWS, 1997). The pseudocardinal teeth are large and serrated and the lateral teeth are long and straight. The beak cavity is deep and compressed. The nacre is white, becoming iridescent posteriorly (Cummings & Mayer, 1992; USFWS, 1997).

Species Distribution

Winged Mapleleaf has been characterized as a large-stream species and has been reported from a variety of substrate types, including mud, sand, and gravel (USFWS, 1997). The species appears to consistently inhabit dense and diverse mussel beds (USFWS, 2015). Historically, the Winged Mapleleaf was reported from 34 rivers in 12 states (Alabama, Illinois, Indiana, Iowa, Kentucky, Minnesota, Missouri, Nebraska, Ohio, Oklahoma, Tennessee, and Wisconsin). Most records are from tributaries of the Mississippi River or the Mississippi River itself, though a few records exist for the Ohio River mainstem and tributaries (e.g., the Wabash and Tennessee Rivers; USFWS, 1997). At the time of listing, the only confirmed remaining population was in the St. Croix River between Minnesota and Wisconsin. Since listing, several new populations were identified. Extant populations of Winged Mapleleaf are now known to occur in the St. Croix River Minnesota, Wisconsin), Bourbeuse River (Missouri), Ouachita River (Arkansas), Saline River (Arkansas), and Little River (Arkansas, Oklahoma; USFWS, 2015).

Distribution within Action Area

Only known to occur in the St. Croix River in Chisago, Ramsey, and Washington Counties, Minnesota and Polk and St. Croix Counties, Wisconsin.

Critical Habitat

No critical habitat has been designated for the Winged Mapleleaf.

Life History

The life history of Winged Mapleleaf is similar to other unionid mussels. Females brood larvae, known as glochidia, in their gills and, once released, glochidia must attach to the gills or fins of a suitable host, typically a fish, to complete the transformation from the larval stage to a juvenile mussel. The Winged Mapleleaf is a short-term brooder (tachytictic), with gravid females found between late August and early October in the St. Croix River (USFWS, 2015). The appearance and behavior of brooding Winged Mapleleaf changes markedly when they are ready to infect their host. Brooding females emerge at the substrate surface and, for a few days during the brooding period, the posterior mantle around the excurrent aperture of brooding females becomes greatly expanded with swelling and development of black-ridged crenulations overlaying the mantle. Females brood glochidia in this “mantle magazine” and gape widely. The prominent display allows host fish to trigger rapid release of glochidia (USFWS, 2015). Channel Catfish (*Ictalurus punctatus*) and Blue Catfish (*Ictalurus furcatus*) are the only known suitable host fish for Winged Mapleleaf (USFWS, 2015).

Current Stressors and Threats

- Land use changes
  Changes in land use practices were identified as a potential threat to Winged Mapleleaf in the recovery plan. Increasing levels of fine sediments and increasing flow velocities may be developing threats to Winged Mapleleaf in the St. Croix River. In addition, plans to sell water from the Little River have been proposed. Water withdrawals are likely to negatively affect populations of freshwater mussels unless adequate minimum flows are maintained. Winged Mapleleaf in the Little River may already be threatened by severe droughts, which are projected to increase in frequency and severity throughout the 21st century in Oklahoma (USFWS, 2015).
- River channel modifications
  The species was usually found in well-preserved large to medium-sized clear-water streams in riffles or on gravel bars. These areas have been lost due to the development of impoundments, channelization, soil erosion, and sediment accumulation originating from land use practices. Peaking operation at the St. Croix Falls dam, upstream of the St. Croix River Winged Mapleleaf population, was identified as a potential threat, as winter dam operations apparently did not release enough water to cover the mussel beds at night (56 FR 28345). A memorandum of understanding with Wisconsin Department of Natural Resources was later signed to operate the dam in a run-of-river mode to avoid causing low flows and substantial changes in flow levels (USFWS, 2015).
- Chemical contaminants
  Toxic substance spills and point discharges of harmful chemicals have been identified as a threat to Winged Mapleleaf populations (56 FR 28345).
- Inherent factors
  The Winged Mapleleaf recovery plan also identified range reduction, small population size, potential lack of reproductive success as reasons for listing the species as endangered. At the time of listing, Winged Mapleleaf was only known to occur in a single reach of the St. Croix River. The population was thought to be small and therefore vulnerable to stochastic disturbances, such as toxic substance spills or low water levels. In addition, the small population size may jeopardize reproductive success, as no brooding females or young individuals had been recently collected, and small populations are vulnerable to various genetic constraints (USFWS, 1997). Since listing, four new populations of Winged Mapleleaf have been identified. Although the new populations represent a marked change from the presumed distribution in 1997, Winged Mapleleaf is still absent from a substantial portion of its historic range (USFWS, 2015). The St. Croix River population may still be vulnerable to stochastic disturbances, as it still only inhabits a short reach of the river. However, the Little River, Ouachita River, and Saline River populations are more broadly distributed and may be less vulnerable to stochastic events (USFWS, 2015).

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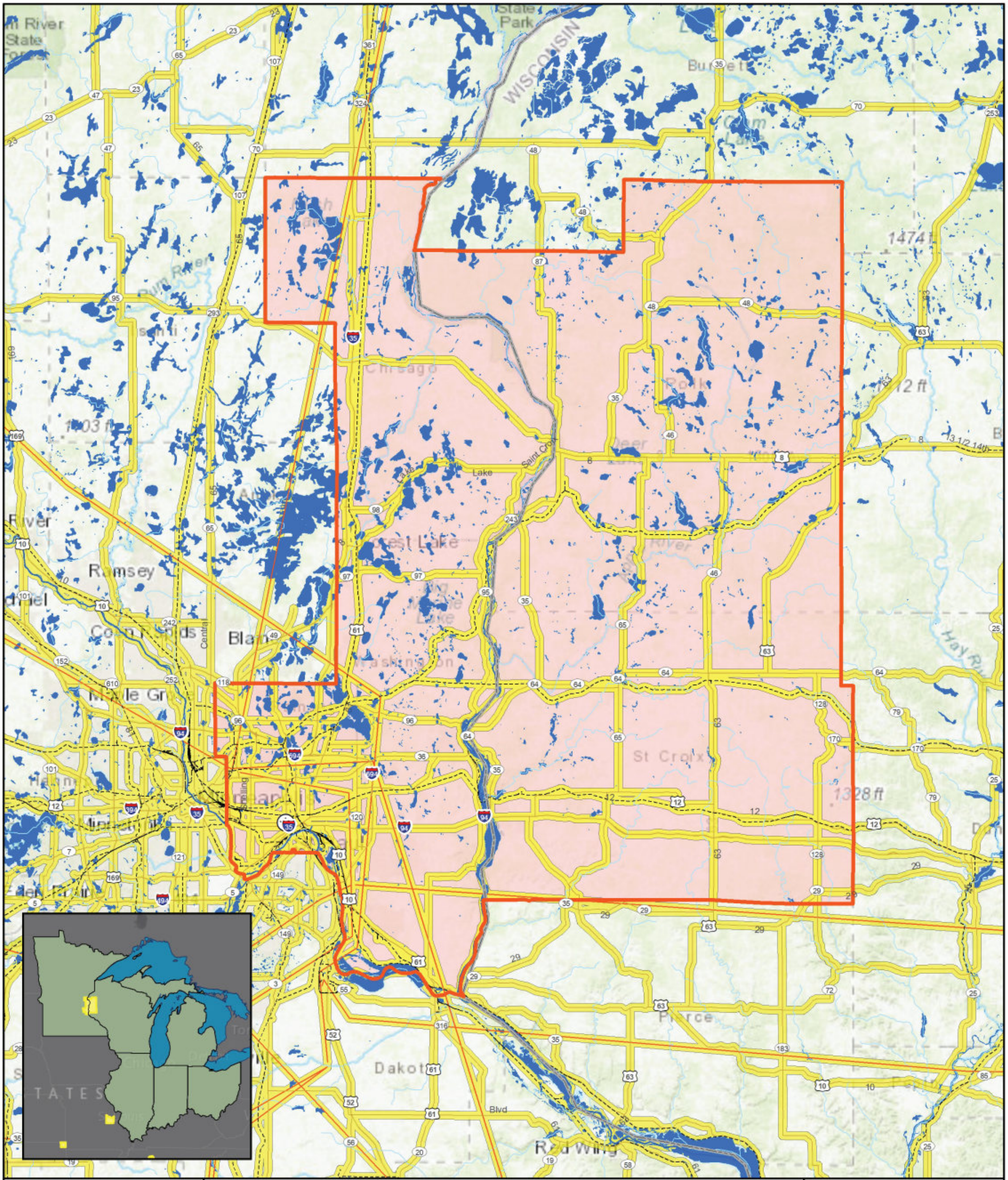

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WINGED MAPLELEAF (*QUADRULA FRAGOSA*)
ACTION AREA OVERVIEW MAP

SCALE 1:1,000,000

- Petroleum Pipeline
- Major Road
- Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- 🟦 Lakes & Ponds
- 🟩 1-Mile Coastal Inland Buffer
- 🟨 Action Area
- 🟥 Winged Mapleleaf (*Quadrula fragosa*) Counties of Occurrence

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Basemap courtesy of Esri. Date: 5/25/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS Projection: WGS 1984 Web Mercator

CRUSTRACEANS

Illinois Cave Amphipod (*Gammarus acherondytes*)

Federal Listing: Endangered
State Listing within the AA: Endangered in Illinois

Species Description

The Illinois Cave Amphipod is a small freshwater crustacean which has been found in cave streams in Monroe and St. Clair Counties in southwestern Illinois. Sexually mature males measure up to 20mm (0.8in) long; sexually mature females are 12 to 16mm (0.5 to 0.63in) long. They are usually light gray-blue and their eyes are small, sub-reniform, degenerate, with the pigment drawn away from the facets in an irregular black mass. The first antenna is long and slender, more than half the length of the body. The flagellum of the antenna has up to forty articles and the accessory flagellum has up to six. The second antenna is about three-fourths as long as the first antenna. The flagellum has up to 18 articles and lacks sensory organs in either sex. The palmar margin of the propodus of the first gnathopod of the male is very oblique, straight, and continuous with the posterior margin. The palmar margin of the second gnathopod of the male is only slightly oblique, straight or concave. The palmar margins of both gnathopoda of the female are strongly convex. The propodus of the second gnathopod is almost twice as long as it is wide in the male and is twice as it is long as wide in the female (USFWS, 2002).

The third uropod of the male has slightly curved rami, the inner ramus being about 0.75 times as long as the outer ramus. The outer margin of the outer ramus is armed with numerous fascicles of 1 to 10 setae. One seta in each fascicle is plumose, except in those fascicles which contain spines, in which case there are no plumose setae. The inner ramus and the inner margin of the outer ramus are armed with small fascicles of 1 to 4 setae, one of which is plumose. The second segment of the outer ramus is not armed with plumose setae. The third uropod of the female is similar to that of the male but smaller in proportion to the body. The telson exceeds the peduncle of the third uropod in length, is cleft to the base, and armed distally with 2 to 3 spines and several setae, and laterally with one spine and a variable number of setae (USFWS, 2002).

Species Distribution

The Illinois Cave Amphipod has never been widely distributed. It is endemic to the Illinois Sinkhole Plain in Monroe and St. Clair Counties in southwestern Illinois. Historically, the Illinois Cave Amphipod was known from six cave systems, all within a 10-mile radius of Waterloo, Illinois. These caves are each fed by separate watersheds, with no known connection among them. Therefore, scientists believe it is unlikely that the amphipod could be distributed to other cave systems via streams. Currently, the Illinois Cave Amphipod is found in only three of the original six cave sites. These caves are all in Monroe County, Illinois. Entrances to two caves are owned by the Illinois Department of Natural Resources, which allows public use of one of the sites. Three entrances to the third cave, which is privately owned, are dedicated a Nature Preserves and are protected (USFWS, 1998).

Distribution within Action Area

Currently, the Illinois Cave Amphipod is found in only three of the original six cave sites. These caves are all in Monroe County, Illinois (USFWS, 1998).

Critical Habitat

No critical habitat has been designated for the Illinois Cave Amphipod.

Life History

The Illinois Cave Amphipod lives in the “dark zone” of cave streams. Like other amphipods, this species needs cold water and does not tolerate a wide range in water temperatures. They are sensitive to touch and avoid light. The Illinois Cave Amphipod feeds on all kinds of dead animals and plants as well as the thin bacterial film covering submerged surfaces. Because of its sensitivity to contamination, the Illinois Cave Amphipod is an excellent indicator species of the water quality of cave systems it inhabits and the groundwater from the surrounding area (USFWS, 1998).

In *Gammarus minus*, pairs may remain in amplexus for around two weeks prior to fertilization, but duration of amplexus probably varies between cave and spring populations of this species. Eggs of *Gammarus minus* are released into the brood pouch of the female, and young are released about a month later. For at least some Gammaridae, the incubation period varies with temperature. Depressed oxygen levels can interfere with mate-guarding behavior in freshwater Gammarus (USFWS, 2002).

Amphipods are typically thought of as scavengers, shredding coarse organic debris. More recently, it has been recognized that amphipods may sometimes filter fine particulate matter from water and can be predators on other taxa. Densities of cave invertebrates have been found to be correlated with fungal populations, suggesting fungi as an important food source. One study noted greater weight gain by young *G. pseudolimnaeus* when offered leaves with fungal colonies present than on leaves with only bacteria or autoclaved leaves. Laboratory populations of *G. troglophilus* have successfully been maintained on elm leaves (USFWS, 2002).

Dissection of the gut from the Illinois Cave Amphipod and examination of the contents under low power magnification revealed an amorphous mass light brown in color. Placement of this material on a glass slide and examination with a compound microscope under high power revealed a mixture of brown, somewhat gelatinous material (clay particles plus mucous?), bacterial cells and occasional minute particles of sand. Observing *G. acherondytes* in a shallow (<3cm deep) gravel stream substrate in Fogelpole Cave suggested that the amphipods graze the substrate by slowly walking the bottom. The mouthparts are essentially a network of setose structures that are net or rake-like and can be used to gather material from the substrate and direct it at the animal's mouth. Presumably the amphipods are harvesting a mixture of the inorganic substrate material along with the microbiota present and eating the entire mixture. The organic part is absorbed while the inorganic component is moved through the gut and eliminated (USFWS, 2002).

Current Stressors and Threats

- Urban sprawl
  The amphipod's current range is close to the growing St. Louis metropolitan area, and there is potential for increased impacts on the species.
- Water pollution (agriculture, septic, stormwater)
  The species' survival is threatened by factors affecting shallow karst groundwater. These include agricultural and residential pesticides and fertilizers; human and animal wastes from residential sewage disposal systems and livestock; sedimentation from agricultural and residential runoff; oil well production; surface runoff from roads, storm sewers, and increased surface paving due to urban development; sinkhole dumping of solid waste; and disruption of groundwater flow paths from quarry operations.
- Cave use/species exploitation
  Excessive visitation to caves and over-collecting for scientific purposes may also threaten the species. Problems with many of these pollutants are increased by their rapid transport through sinkholes and other karst features, with little or no dilution, filtration or attenuation (USFWS, 1998, 2002).

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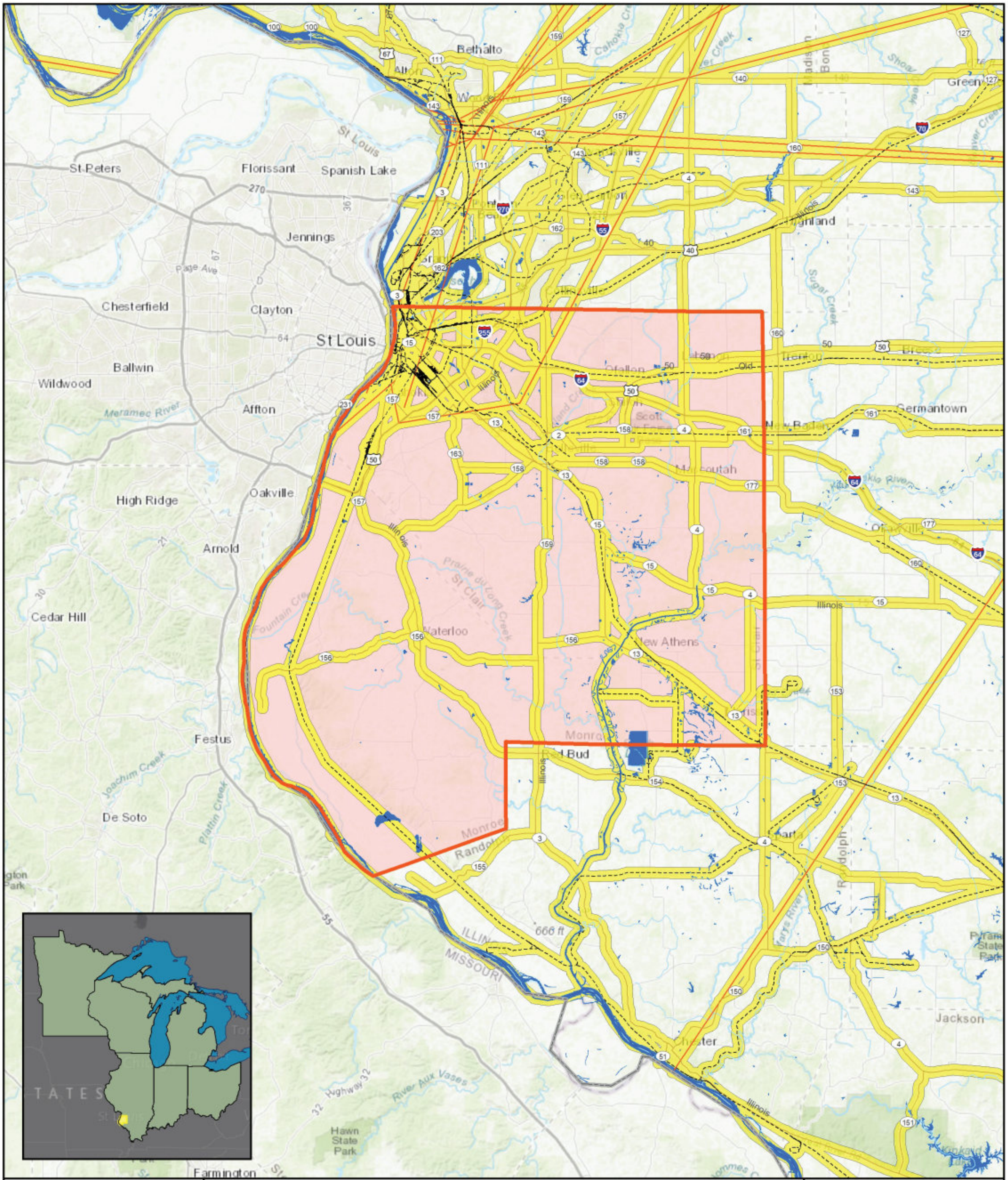

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ILLINOIS CAVE AMPHIPOD (*GAMMARUS ACHERONDYTES*) ACTION AREA OVERVIEW MAP

SCALE 1:750,000

- Petroleum Pipeline
- Major Road
- ------ Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- Lakes & Ponds
- 1-Mile Coastal Inland Buffer
- Action Area
- Illinois Cave Amphipod (*Gammarus acherondytes*) Counties of Occurrence

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Basemap courtesy of Esri.

Date: 5/25/2021

Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS

Projection: WGS 1984 Web Mercator

INSECTS

American Burying Beetle (*Nicrophorus americanus*)

Federal Listing: Threatened. The American Burying Beetle (ABB) was designated as an endangered species in 1989 (54 FR 29652). The species was reclassified from Endangered to Threatened in 2020 (85 FR 65241).
State Listing within the AA: Endangered in Michigan and Ohio

Species Description

The ABB is the largest silphid (carrion beetle) in North America, reaching 1.0 to 1.8in (25 to 35cm) in length. The beetles are black with orange-red markings. Their hardened elytra (wing coverings) are smooth, shiny black, and each elytron has two scallop shaped orange-red markings. The pronotum over the mid-section between the head and wings is circular in shape with flattened margins and a raised central portion (USFWS, 2019). The most diagnostic feature of the ABB is the large orange-red marking on the raised portion of the pronotum, a feature shared with no other members of the genus in North America (USFWS, 1991). The ABB also has an orange-red frons (the upper, anterior part of the head), and a single orange-red marking on the clypeus, which can be viewed/considered as the lower "face" located just above the mandibles. Antennae are large, with notable orange club-shaped tips for chemoreception (USFWS, 2019).

Species Distribution

The ABB is considered a generalist in terms of the vegetation types where it is found, as it has been successfully live-trapped in a wide range of habitats, including wet meadows, partially forested loess canyons, oak-hickory forests, shrub land and grasslands, lightly grazed pasture, riparian zones, coniferous forest, and deciduous forests with open understory (USFWS, 1991). Individuals do not appear to be limited by vegetation types as long as food, shelter, and moisture are available and have been recorded moving between and among these habitat types (USFWS, 2019).

The ABB occurs in various habitat types in portions of nine states: Arkansas, Kansas, Massachusetts, Missouri (recently reintroduced, experimental population), Nebraska, Oklahoma, Rhode Island, Texas (not documented since 2008), and South Dakota, based on the last 15 years of records. *Reintroduction efforts are also underway in Ohio, but survival of reintroduced ABBs into the next year (successful overwintering) has not yet been documented. A report of an ABB in Michigan in 2017 is being investigated to determine if the area supports ABBs populations.* Surveys in 2018 and 2019 failed to verify the report. Currently, there is not enough information on the Michigan report to confirm or assess the status of ABBs in this area (USFWS, 2019).

Historically, the known geographic range of the ABB included 35 states in the United States and the southern borders of three eastern Canadian provinces, covering most of temperate eastern North America. Historical records document ABBs occurrence from the east coast to Nebraska in the 1920s. However, documentation of records is not uniform throughout this broad historical range. More records exist from the Midwest into Canada and in the northeastern United States than from the southern Atlantic and Gulf of Mexico region and some portions of southeastern United States have few or no records. During the 20th century, the ABB disappeared from over 90 percent of its historical range. The last ABB specimens along the mainland of the Atlantic seaboard, from New England to Florida, were collected in the 1940s (USFWS, 1991). At the time of ESA listing in 1989, known populations were limited to one on Block Island, Rhode Island; and one in Latimer County, Oklahoma. After the species was listed, survey efforts increased and the ABB was discovered in more locations, particularly in South Dakota, Nebraska and Oklahoma. The ABB is now known to occur in portions of Arkansas, Kansas, Oklahoma, Nebraska, South Dakota, and Texas (not documented since 2008), on Block Island off the coast of Rhode Island, and reintroduced populations on Nantucket Island off the coast of Massachusetts and in southwest Missouri (USFWS, 2019).

Distribution within Action Area

- Reintroduction efforts are underway in Ohio, encompassing portions of Athens, Guernsey, Hocking, Morgan, Muskingum, Noble, Perry, and Washington counties.
- An ABB was reportedly observed in Michigan in 2017; however, there is currently not enough information on this report to confirm or assess the status of ABBs in this area.

Critical Habitat

No critical habitat has been designated for the American Burying Beetle.

Life History

ABB life history is similar to that of other burying beetles. The ABB is a nocturnal species that lives for only about one year. American Burying Beetles are active from late spring through early fall, occupying a variety of habitats and bury themselves in the soil to hibernate for the duration of the winter. Reproduction occurs in the spring-early summer. New adult beetles or offspring (called tenerals) usually emerge in summer, over-winter (hibernate) as adults, and comprise the breeding population the following summer. Adults and larvae depend on dead animals (carrion) for food, moisture, and reproduction (USFWS, 2019). Burying beetles are unusual in that both the male and female take part in raising the young. Male burying beetles often locate carcasses first and then attract a mate. Beetles often fight over the carcass, with usually the largest male and female individuals winning. The victors bury the carcass, the pair mates, and the female lays her eggs in an adjacent tunnel. Within a few days, the larvae develop and both parents feed and tend their young, an unusual activity among insects. Brood size usually ranges from one to 30 young, but 12 to 15 is the average size. The larvae spend about a week feeding off the carcass then crawl into the soil to pupate or develop. Mature American Burying Beetles emerge from the soil 45 to 60 days after their parents initially bury the carcass (USFWS, 1997). The SSA (2019) provides additional detail and activity periods, movement, and feeding and hydration.

Current Stressors and Threats

The American Burying Beetle Recovery Plan (USFWS, 1991) and the 5-year Status Review of the species (USFWS, 2008) identify the following factors as potential threats to ABB:

- Direct habitat loss and alteration

  The ABB needs properly functioning ecosystems that contain suitable soils sufficient to support diverse vegetative communities that sustain appropriate wildlife populations such that suitable carrion to facilitate reproduction is available. Suitable soils must contain the appropriate abiotic elements (soil temp, soil moisture, particle size, etc.) that are favorable for excavation and formation of brood chambers and contribute to proper growth and development of young. Soils that are too compact prevent ABBs from completing their reproductive cycle or if compaction occurs after the onset of reproduction, may affect ABB young emerging during the following spring. Additionally, soils that are unsuitable may prohibit ABBs from overwintering underground during periods of adverse weather conditions. If the ABB cannot bury themselves during these periods, considerable localized mortality may occur. These suitable areas must be of sufficient size to support the survival of adequate numbers of individual ABBs such that the opportunity to find a mate is not diminished and that the presence and abundance of carrion to support breeding and feeding are uninterrupted. The ABB is an annual species and is dependent upon annual reproduction to sustain extant populations. Sufficiently sized areas also contribute to opportunities for populations to at least remain stable over time. Ideally areas should be of sufficient size to support a positive growth rate and enable populations to expand over time. These suitable areas also must be connected with other suitable, occupied ABB habitats so that gene flow and genetic diversity are maintained, if not enhanced, and individuals have access to refugia, when needed, across the landscape. The Service does not currently have information on the minimum size of suitable areas (habitat patch size) needed to maintain a viable population of ABBs. The minimum area to support a viable population would be dependent on the habitat quality which could include climate, soils, vegetation, carrion availability, predators, and competition (USFWS, 2019).

- Increase in competition for prey, inter and intra-specific competition, increase in edge habitat, decrease in abundance of prey
- Loss of genetic diversity in isolated populations
  Smaller populations typically are more susceptible to random demographic and environmental events that negatively influence persistence over time.
- Disease/pathogens, DDT
- Agricultural and grazing practices, and
- Invasive species.

None of these factors alone adequately explain why ABBs declined over much of their historic range, while congeneric species remain relatively common range wide [there are eight sympatric congeners which are not in peril] (USFWS, 2019). The prevailing theory regarding the ABB's decline over a large portion of their historical range is habitat change (USFWS, 1991) which: (1) reduced the carrion prey base of the appropriate size for ABB reproduction, and (2) increased the vertebrate scavenger competition for this resource. Although much of the evidence suggesting the reduction of carrion resources as a primary mechanism of decline is circumstantial, this hypothesis fits the temporal and geographical pattern of the disappearance of ABBs and is sufficient to explain why ABBs declined while related species did not (USFWS, 2019).

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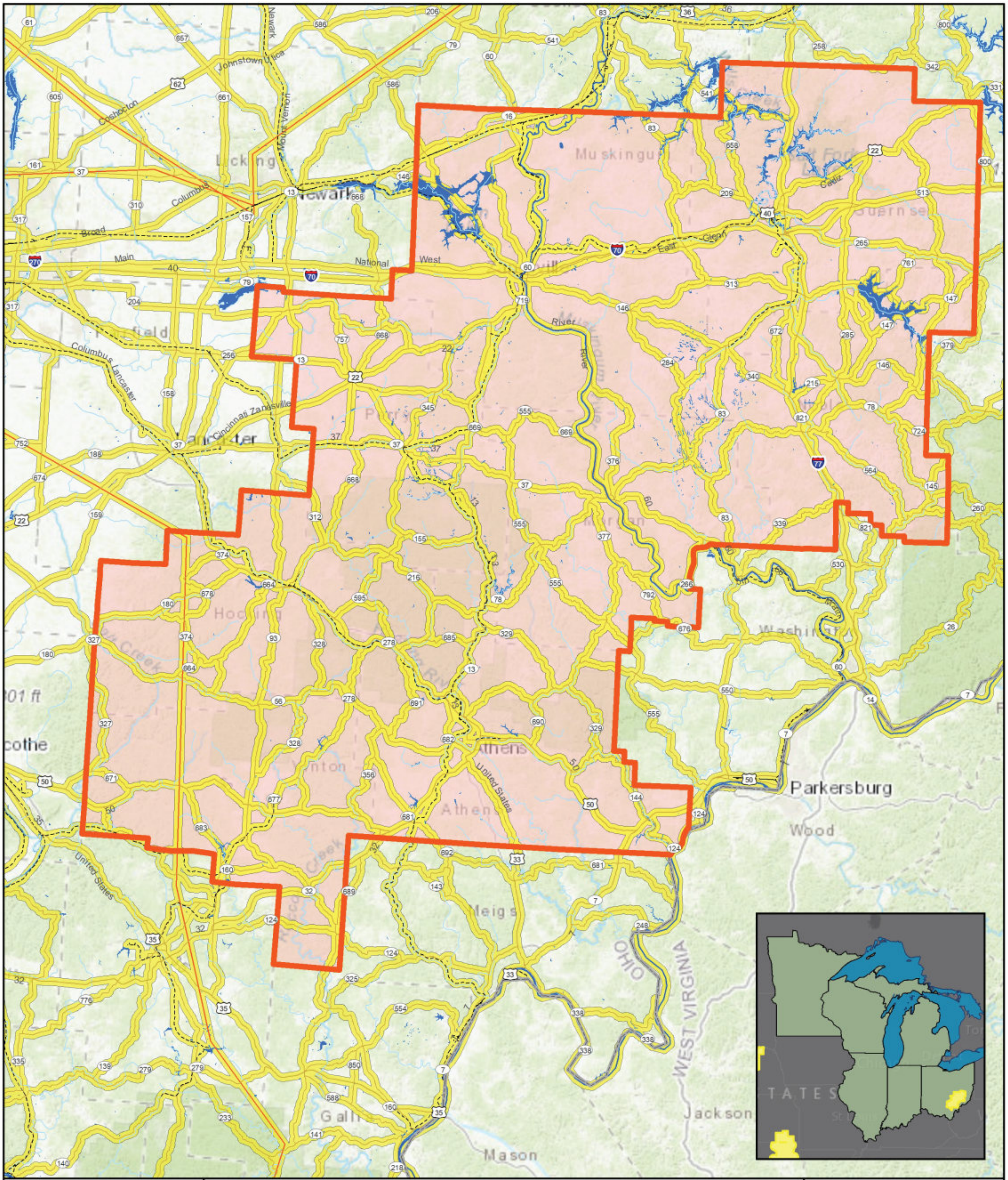

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Miles

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Kilometers

AMERICAN BURYING BEETLE (*NICROPHORUS AMERICANUS*) ACTION AREA OVERVIEW MAP

SCALE 1:1,000,000

- Petroleum Pipeline
- Major Road
- Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- Lakes & Ponds
- 1-Mile Coastal Inland Buffer
- Action Area
- American Burying Beetle (*Nicrophorus americanus*) Counties of Occurrence.

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Basemap courtesy of Esri. Date: 5/25/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS Projection: WGS 1984 Web Mercator

Bog (Bogbean) Buckmoth (*Hemileuca sp.*)

Federal Listing: Not Listed. The U.S. Fish and Wildlife Service is undertaking a discretionary status review of this species and will make a listing determination by the end of fiscal year 2021 (USFWS, 2020).
State Listing within the AA: Midwestern Fen Buckmoth (*Hemileuca nevadensis* ssp. 3) Special Concern in Wisconsin

In North America, there are approximately 20 species of buckmoths (*Hemileuca*), a well-studied group of silk moths (Saturniidae). Populations of buckmoth in the Great Lakes region vary to some extent in morphology, ecology and behavior, and these different populations have been identified as *H. maia, H. lucina,* or *H. nevadensis.* Collectively, these species are referred to as the *H. maia* complex, *maia* being the oldest name in the group. The Great Lakes populations comprise a sub-set of this complex. Bogbean Buckmoth (also known as Cryan's Buckmoth), is part of the *H. maia* species complex. As the species boundaries in this group are not well defined, the species-level classification of Bogbean Buckmoth remains tentative (Environment Canada, 2015).

Species Description

Adult Bog Buckmoths are large, black moths with translucent wings containing white bands and eyespots. Males have red tufts on the apical segments of the abdomen and bipectinate antennae, while females have simple antennae and lack the red tuft. Wingspan has been reported to be 6.5cm and males have forewings of 26 to 32mm in length, while females have 32- to 36-mm-long forewing. Larvae are dark, with rusty-orange, branched spines dorsally, and a reddish-brown head capsule and prolegs. The spines are urticating and can cause a welt if handled. This description is similar to other *Hemileuca* species, but Bog Buckmoth larvae have reduced yellow markings on the body compared to other species, and lack a yellow spiracular stripe ascribed to others in the *H. maia* complex (NYNHP, 2021)

Probably only a very distinctive subspecies of *H. nevadensis* (or *latifascia*), but was initially treated by NatureServe and others as a full species based on numerous and obvious differences in ecology. However, it has since been shown that some Midwestern populations do feed to some degree on *Menyanthes* so the foodplant restriction is not as unique as was formerly thought. There is no reliable character for the adults, but in series compared to other eastern buckmoths they are large (usually so for their latitude), very translucent (comparable to other buckmoths this far north) and with scalloped forewing bands and many can be correctly sorted. Separation of any stage from *H. maia* appears easy but characters match or widely overlap *H. nevadensis* subspecies 3 except that few if any other wetland buckmoth larvae have the normal yellow as reduced or even absent as this taxon does. More western populations with normal yellow larval pattern in which larvae use *Menyanthes* to varying degrees along with normal foodplants are not included in this taxon. To date no populations in the Midwest have been shown to specialize on that plant. While many more eastern wetland buckmoth populations will not accept *Menyanthes* some populations in at least Wisconsin do use that herb to some extent along with the usual willows. However such Wisconsin larvae are normal, resembling other populations from New Jersey to central Wisconsin in having a prominent yellow spiracular band and some dorsal yellow. Last instar Bogbean Buckmoth larvae have greatly reduced yellow or virtually none. Aside from the few in Ontario and New York assigned to this taxon, no other *Hemileuca* populations are known to use *Menyanthes* almost exclusively (NatureServe, 2021).

Species Distribution

The primary foodplant, bog buckbean, is not a full reason to grant a species separation. A population in Wisconsin has been found to feed upon bog buckbean, making the distinctive foodplant restriction not as unique to the New York and Ontario populations as previously thought. However, the larvae resemble other populations that span from New Jersey to central Wisconsin. The ecological differences between Bog Buckmoth and other *Hemileuca* species are significant and are the basis for its species recognition and protection in NY and Ontario. Bog Buckmoths are found on the northeastern margin of the *H. maia* complex distribution, with known populations in central New York and eastern Ontario. In New York, this species occupies 6 wetlands, all within Oswego County. This species inhabits minerotrophic fens (DECNY, 2014).

Distribution within Action Area

The Midwestern Fen Buckmoth (*Hemileuca nevadensis* ssp. 3) has been reported from Douglas, Jackson, Juneau, Marathon, Marquette, Milwaukee, Portage, Waukesha, and Wood Counties, Wisconsin (WIDNR, 2021).

Critical Habitat

No critical habitat has been designated for the Bog Buckmoth.

Life History

Females lay their eggs after mating in the fall, with the eggs left to overwinter. Young hatch from April-June and develop into larvae in from May-July. Larvae pupate within peat and diurnal adults emerge from mid-September through mid-October, with peak flight around September 26-28. Life expectancy averaged 3.7 days, with a maximum of 9 days for adult females and 12 days for males. Females usually mate with the first male to reach them and then oviposit eggs on the same day. Females oviposit their eggs in clumps on shrubs and in rings around stems on a variety of plants. Early instar larvae have been observed feeding on the foliage of the closest plant until the preferred host plant, *Menyanthes trifoliata* emerges. Gravid females have a limited dispersal and move less than 10m between potential oviposition sites, but up to 500m after ovipositing. Mark-recapture studies of adults in New York showed no dispersal between adjacent fens through forested habitat. Adults were found to travel up to 500m within the same fen (DECNY, 2014)

Current Stressors and Threats

- Invasive plant species
  Nutrient enrichment from runoff from adjacent developed areas is a threat to one or more of the sites as increased nitrogen and phosphorus levels can lead to vegetation growth, especially that of the invasive plant Phragmites. Other invasive plants such as purple loosestrife and glossy buckthorn may also impact Bog Buckmoth habitat by outcompeting host plants.
- Hydrological changes
  Habitat change is a significant threat to the species in New York. Hydrological alteration due to water level regulation has constrained the water level range in Lake Ontario to 4ft, rather than the historical 8ft range. Two known sites, which lie directly adjacent to a stream that drains to Lake Ontario, have experienced dramatic expansion of cattails in the 50+ years since regulation began. Hydrological alteration can lead to habitat succession as drier habitat can promote shrub and/or Sphagnum growth, decreasing *M. trifoliata* at sites. Surface flooding is also a threat to this species, which presumably caused a population crash at two of the fens in recent years.
- Succession
- Climate change (Environment Canada, 2015)
  Extreme swings of weather (as seen in the winter of 2007-2008), excessive flooding (a threat to pupae and eggs), and extended dry periods (may support woody succession) are predicted to occur with climate change and could adversely affect the Bog Buckmoth.
- Parasites and predation
  During the egg life stage, in addition to flooding, parasitoid wasps, desiccation, and predation by rodents and birds are threats. Larval parasitoids, such as wasps in the family Ichumonidae, are reportedly common among the buckmoths, have been rarely seen in the New York popuations. A Texas study found parasitoides from the fly family Tachinidae and the wasp family Braconidae infecting Hemileuca larvae. Pupal predation can cause significant declines as well and potential predators on adults at the NY sites include mites, birds, araneid spiders, dragonflies, and carp.
- Inherent factors

Low dispersal ability of adult gravid females makes colonizing new sites of suitable habitat (even relatively closeby) unlikely. However, a comparison genetic variation between two of the NY sites and genetic diversity within sites and found evidence that there may be some gene flow between populations, suggesting that recolonization may be possible. The NY population of Bog Buckmoth exhibits high relative genetic divergence compared to other ecologically divergent populations within the *H. maia* complex, which they best explained by its geographic isolation which limits gene flow.

- Pesticides
  Pesticide spraying, especially for mosquito and gypsy moths could be a threat, depending on timing and concentration (NYNHP, 2021).

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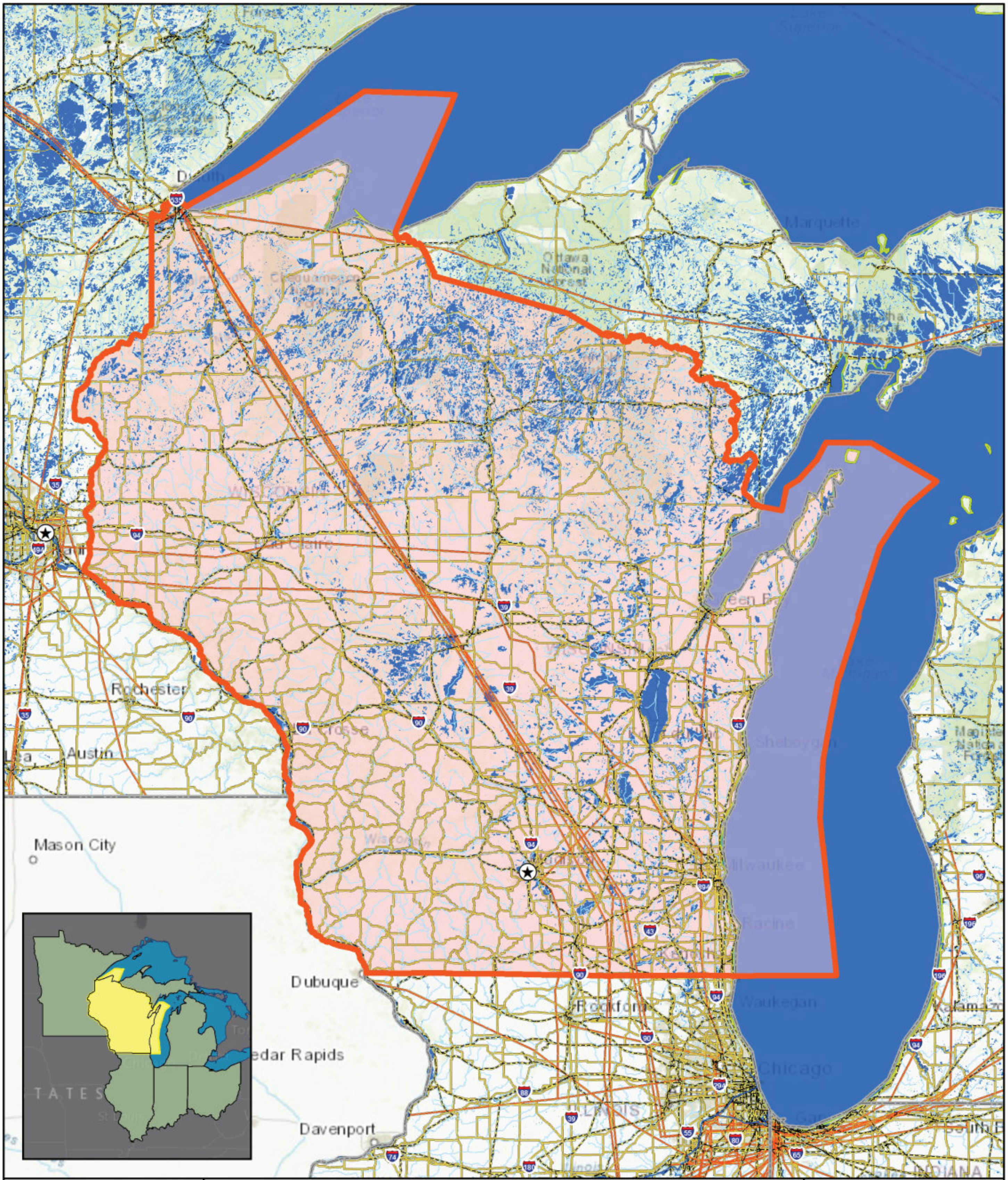

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Miles
0 15 30 60 90 120
Kilometers

BOG BUCKMOTH (*HEMILEUCA SP.*)
ACTION AREA OVERVIEW MAP

SCALE 1:4,500,000

- Petroleum Pipeline
- Major Road
- ------ Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- Lakes & Ponds
- 1-Mile Coastal Inland Buffer
- Action Area
- Bog Buckmoth (*Hemileuca sp.*) Counties of Occurrence

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Basemap courtesy of Esri. Date: 5/25/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS Projection: WGS 1984 Web Mercator

Dakota Skipper (*Hesperia dacotae*)

Federal Listing: Threatened
State Listing within the AA: Endangered in Minnesota

Species Description

The Dakota Skipper is a small to medium-sized butterfly with a wingspan of 2.4 to 3.2cm (0.9 to 1.3in) and hooked antennae. Adult Dakota Skippers have variable markings. The dorsal surface of adult male wings ranges in color from tawny-orange to brown and has a prominent mark on the forewing; the ventral surface is dusty yellow-orange. The dorsal surface of adult females is darker brown with diffused tawny orange spots and a few diffused white spots restricted to the margin of the forewing; the ventral surfaces are dusty gray-brown with a faint white spotband across the middle of the wing. Adult Dakota Skippers may be confused with the Ottoe Skipper (*H. ottoe*), which is somewhat larger with proportionally longer wings. Dakota Skipper pupae are reddish-brown, and the larvae are light brown with a black collar and dark brown head with early instars being described as green with dark head and collar (USFWS, 2018).

Species Distribution

In Minnesota, the Dakota Skipper seems to prefer native dry-mesic to dry prairie where mid-height grasses such as little bluestem (*Schizachyrium scoparium* var*. scoparium*), prairie dropseed (*Sporobolus heterolepis*), and side-oats grama (*Bouteloua curtipendula* var*. curtipendula*) are a major component of the vegetation. In North Dakota, this skipper also occurs in more mesic prairie. The most productive sites in Minnesota feature some topographic variation. Adults will forage into nearby lowland prairie (mesic and wet prairie) for nectar (MNDNR, 2018).

Historically, the species occurred throughout the vast grasslands of the north-central United States and south-central Canada, extending from Illinois to Saskatchewan. There were few records for the species prior to 1960s, so our ability to describe the species' historical distribution is limited. The southernmost and easternmost records in Iowa and Illinois suggest that the species occurred in at least some portions of the prairie that once covered much of these two states, but whose almost complete destruction began in the 1800s. Based on all known records, at least 145 metapopulations and approximately 303 subpopulations can be identified. It is likely, however, that these delineated populations are artifacts that have resulted from the heavy destruction and fragmentation of the species' habitat. It is unclear to what degree distinct populations existed historically and what areas may have contained large panmictic breeding populations. The small genetic differences among seven Dakota Skipper populations in the southern portion of the species' range that are now disjunct, for example, suggest that they were formerly connected prior to European settlement. Nearly half of Dakota Skipper records are from the Prairie Parkland - Prairie Coteau mostly in Minnesota and South Dakota with fewer and more dispersed records located in Manitoba, North Dakota and Iowa (USFWS, 2018).

The skipper has disappeared south and east of Minnesota and has become increasingly rare and local in its remaining range. In pre-agricultural Minnesota, the Dakota Skipper probably occurred in about 40 counties where prairie predominated (Prairie Parkland Province) to at least the eastern limit of Des Moines Lobe calcareous glacial tills in Waseca and Freeborn counties. There are historical records from only 18 of these counties, most along the west edge of the state. As recently as the early 2000s this butterfly still occurred in 11 of these 18 counties with site complexes in four of them that supported good populations. Although observations suggested a possible decline in one of these sites beginning at this time, surveys in 2007 and 2008 still encountered this skipper in all four of these sites with robust numbers in two that were intensively surveyed. These surveys also found it present in several previously known sites that historically had smaller numbers of adults and in three sites searched for the first time. However, extensive surveys beginning in 2012 and continuing every year since have found only one Dakota Skipper population remaining in Minnesota in one of the four major site complexes. Intensive surveys at this site in 2014, 2015, and 2016 suggest that the total number of adults in each annual generation here has been in the low hundreds at most, compared with thousands of adults per year in the mid-1980s (MNDNR, 2018).

Distribution within Action Area

The Dakota Skipper is currently known or believed to occur in Big Stone, Chippewa, Clay, Lac qui Parle, Lincoln, Norman, Pipestone, Stevens, Swift, and Traverse Counties, Minnesota. Critical habitat has been designated in Chippewa, Clay, Kittson, Lincoln, Murray, Norman, Pipestone, Polk, Pope, and Swift Counties, Minnesota.

Critical Habitat

In total, approximately 19,903 acres (8,054 hectares) in Chippewa, Clay, Kittson, Lincoln, Murray, Norman, Pipestone, Polk, Pope, and Swift Counties, Minnesota; McHenry, McKenzie, Ransom, Richland, and Rolette Counties, North Dakota; and Brookings, Day, Deuel, Grant, Marshall, and Roberts Counties, South Dakota, fall within the boundaries of the critical habitat designation for Dakota Skipper (80 FR 59248).

Life History

Dakota Skippers have four basic life stages: egg, larva, pupa and adult. Dakota Skippers are univoltine (having a single flight per year), with an adult flight period that may occur from the middle of June through the end of July and vary across range and year-to year dependent on climatic conditions (USFWS, 2018). Females lay eggs on the underside of leaves. Eggs take about 10 days to hatch into larvae (caterpillar). After hatching, larvae build shelters at or below the ground surface and emerge at night to feed on grass leaves. This continues until fall when larvae become dormant (USFWS, 2019b). They overwinter (diapause) in shelters at or just below ground level, usually in the base of native bunchgrasses. In the spring, larvae resume feeding and undergo two additional molts before they pupate. During the last two instars, larvae shift from buried shelters to horizontal shelters at the soil surface. When Dakota Skipper larvae metamorphose into adults in late June or early July, habitats must provide nectar sources that are sufficient in quality and quantity to meet the butterflies' water and nutritional requirements (USFWS, 2018). Pupation takes about 10 days and usually happens in June. Adult males emerge from pupae about five days before females, and the adults live for three weeks, at most. This brief period is the only time that Dakota Skippers can reproduce. If a female Dakota Skipper lives for the full three weeks and adequate flowers for nectar are available, she may lay up to 250 eggs. Nectar, providing both water and food, is crucial for survival of both sexes during the adult flight period, which often occurs during the hottest part of summer (USFWS, 2019b).

Current Stressors and Threats

Dakota Skipper populations declined historically because of widespread conversion of native prairie to farms, ranches and other land uses. States and Canadian provinces in the historical range of Dakota Skipper have lost 85 percent to 99 percent of their original tallgrass prairie. Small, isolated patches of native prairie are often what remain of this once-vast ecosystem; Dakota Skippers survive on only some of these prairie remnants. Dakota Skippers are almost always absent from overgrazed or otherwise degraded prairies. Because of this sensitivity, historical survival of Dakota Skippers probably depended on the vastness of the prairie, with immigrants available to repopulate areas if the butterfly was eliminated by intense disturbance, such as wildfire or heavy bison grazing. Dakota Skippers and their native prairie habitat depend on periodic disturbance, without which the prairie would become shrubby or forested. Therefore, grazing, fire or mowing (haying) is necessary for the skipper. At the same time, these practices may eliminate populations, depending on how they are carried out, so they must be managed carefully to ensure skipper survival (USFWS, 2019b).

Loss of native prairie and the degradation of remaining patches of habitat have led to the decline of Dakota Skipper and pose continuing threats to the species' continued existence (79 FR 63672). Factors responsible for habitat loss, fragmentation, and degradation include:

- Conversion of native prairie for agriculture or urbanization (e.g. row crops, roads, gravel mining)

- Ecological succession of native prairie to habitats dominated by brush or trees
- Invasive species
- Direct and indirect effects of pesticides including herbicides
- Flooding
- Land management regimes (grazing, haying, or fire) if done in a fashion that degrades the species' habitat

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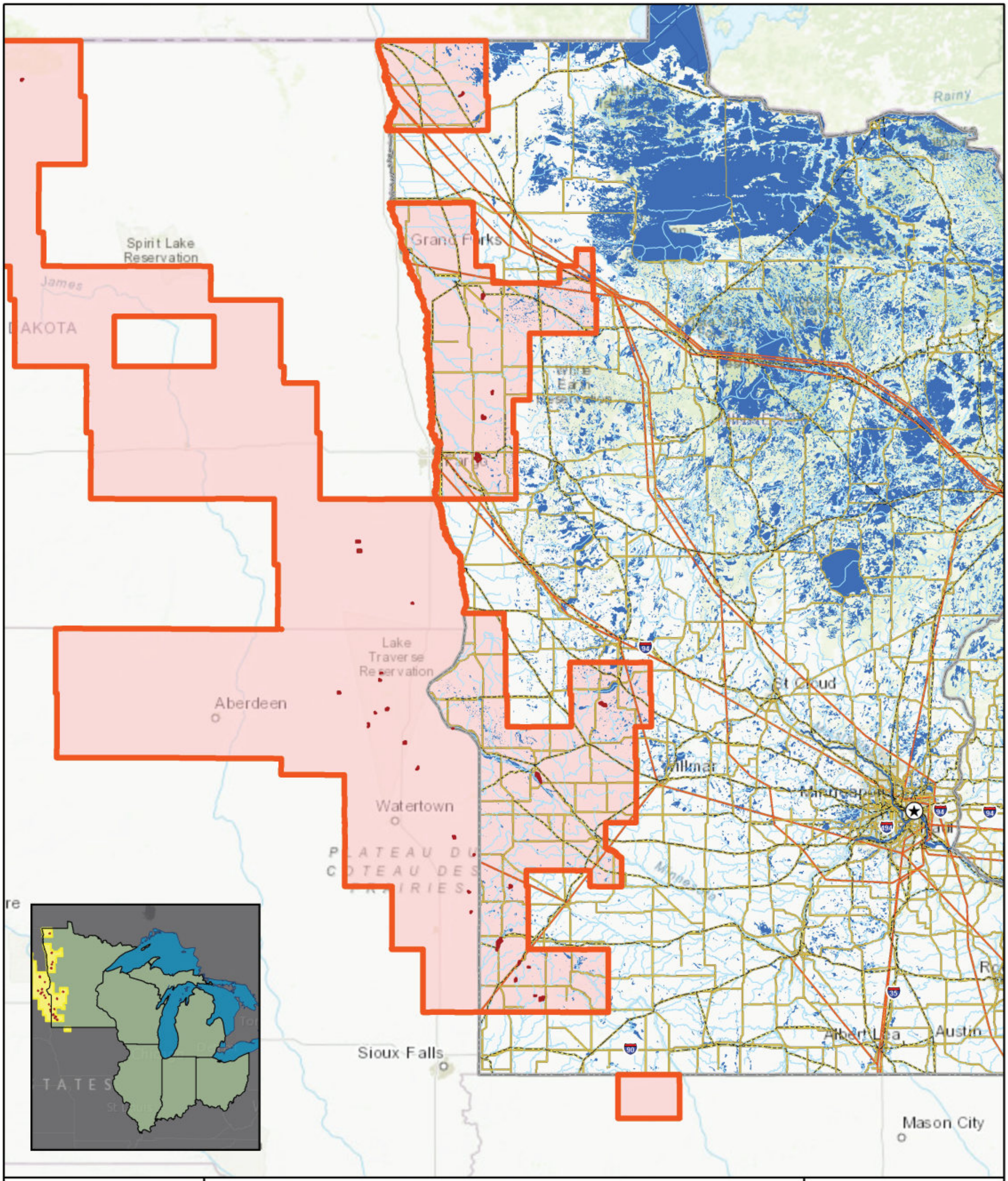

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DAKOTA SKIPPER (*HESPERIA DACOTAE*) ACTION AREA OVERVIEW MAP

SCALE 1:4,500,000

— Petroleum Pipeline	— Commercial Navigable Waterway	🟩 1-Mile Coastal Inland Buffer
— Major Road	— Rivers & Streams	🟨 Action Area
------ Railroad	🟦 Lakes & Ponds	▨ Dakota Skipper (*Hesperia dacotae*) Critical Habitat
		☐ Dakota Skipper (*Hesperia dacotae*) Counties of Occurrence

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Basemap courtesy of Esri. Date: 5/24/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS Projection: WGS 1984 Web Mercator

Frosted Elfin Butterfly (*Callophrys irus*)

Federal Listing: Not Listed. The U.S. Fish & Wildlife Service is proactively assessing the conservation status of this species and will determine whether Frosted Elfin needs protection under the Endangered Species Act by September 30, 2023 (USFWS, 2019).
State Listing within the AA: Endangered in Indiana and Ohio; Threatened in Michigan and Wisconsin; likely extirpated from Illinois.

Species Description
While all elfins are small butterflies, the Frosted Elfin is larger than most with a 22 to 36mm (0.87 to 1.42in) wingspan and short tails projecting from the hindwings. The upperside of the wings are uniform dark gray brown in color. The underside of the wings is also largely gray brown, but variegated, with a dusting of pale scales on the outer margin of the hindwing, with a dark spot and an irregular dark line. Male and female butterflies look very similar; however, they can be identified in flight as females tend to have an orange hue to il wings, appear to be larger, and do not exhibit territorial. Males also have a dark stigma on the forewing. While all populations of Frosted Elfins have adults that exhibit variations in appearance, some consistent tendencies have been observed. There is some evidence of phenotypical differences between lupine versus indigo feeders, with darker and larger individuals typically found feeding on indigo. We do not know if this is an important life history characteristic. In most locations, the larvae (caterpillars) are pale greenish white, with a pale lateral line and oblique dashes along the sides, and covered in short whitish hairs. However, in Oklahoma, larvae are yellow. Two similar looking species overlap in range with the Frosted Elfin. Henry's Elfin and hoary Elfin (*Callophrys polios*) also have dusting of pale scales on the hindwing margin. Henry's elfin usually does not have the distinctive dark spot near the tail and has more contrast between outer and inner halves of the hindwing. The hoary elfin lacks a tail, is smaller, and has pale scales on the forewing margin (USFWS, 2018).

Species Distribution
Frosted Elfins typically occur in small, localized populations that are reliant on managed or disturbance-dependent habitats. These habitats are composed of a mosaic of habitat types ranging from herbaceous openings with abundant host plants to forested areas with relatively closed canopies. Frosted Elfins are closely associated with their host plants. Adults, especially indigo feeders, are virtually never seen more than 20 meters (65.6 feet) from stands of the food plant. Frosted Elfins are found within oak-pine barrens, oak savannas, prairie and dry oak woodlands, and similar anthropogenic habitats such as powerline cuts, railways, old sand/gravel pits, and airports. Wild lupine and wild indigo plants both rely on disturbance (natural or anthropogenic) and open to semi-open habitats with partial to full sunlight. In areas with advanced regeneration, such as closed canopy forests and dense shrubby areas, these host plants are usually absent (USFWS, 2018).

The distribution of the Frosted Elfin once extended from southern Ontario and the northeastern United States, south to Florida, and west to Texas and Wisconsin. Maine was previously considered part of the range, but this appears to have been in error due to confusion with *Callophrys Henrici*. The Frosted Elfin continues to have a wide range (25 states) in North America. However, the species is likely extirpated from Ontario, Canada, and the District of Columbia, Georgia, Illinois, and Vermont due to loss of host plants as a result of incompatible vegetation management, loss of Frosted Elfin populations and habitat from catastrophic fire, and residential development. Most Frosted Elfin populations are essentially isolated from one another, and repopulation of extirpated locations from extant sites is unlikely to occur without active management. There are no known records from Mississippi. A portion of the range overlaps with the federally listed endangered Karner blue butterfly (*Lycaeides melissa samuelis*) and positive correlations have been found between abundances of the two species in Wisconsin. Where the species co-occur, both use wild blue lupine as host plants and face similar threats or potential benefits from management (USFWS, 2018).

Distribution within Action Area

ECOS does not provide county listings for this species. The Frosted Elfin Butterfly is considered critically imperiled in Indiana, Ohio, and Wisconsin, imperiled in Michigan, and presumed extirpated in Illinois. Per USFWS, the only known extant populations in Ohio occur in Lucas County (USFWS, pers. comm., 2022).

Critical Habitat

No critical habitat has been designated for the Frosted Elfin Butterfly.

Life History

This species is univoltine (single adult flight period) and adults are diurnal. The single flight period lasts approximately 4 to 8 weeks, generally from late April through mid-June in the northern parts of the range, with the peak flight usually occurring in mid-May. In Florida, adults may begin emerging in mid-to-late February, but cold spells may delay emergence to late March to mid-April. In Wisconsin, Frosted Elfin sightings occurred between 14 to 31.5°C (52.7 to 88.7°F) and elfin density (detectability) was strongly associated with increasing temperature and no other weather variables. In New Jersey, Frosted Elfins have been observed to emerge when wild indigo sprouts are greater than or equal to 6in (15.2cm) in height. While the flight period for multiple individuals within a population or state can last up to 2 months, individual adults may live 2 to 3 weeks. Adult males actively defend wild lupine patches against other males to gain exclusive access to females for breeding. In addition to host plants, adult Frosted Elfins require nectar sources that are available during their short flight window. The Frosted Elfin is a generalist when it comes to flower selection for nectaring. They have been observed feeding on a variety of flowers including wild lupine, bird-foot violet (*Viola pedata*), blueberry (*Vaccinium* spp.), huckleberry (*Gaylussacia* spp.), pin cherry (*Prunus pensylvanica*), sweetbells (*Leucothoe racemosa),* staggerbush (*Lyonia mariana*), and *Rubus* spp. Adult Frosted Elfins were also reported to feed on moist sand. After mating, adult females visit multiple host plants where they deposit a single egg, usually nestled in the apical shoot of a wild indigo plant or among the young flower stalks and buds of lupine. The duration of the egg and larval stages varies with temperature, but eggs generally hatch into larvae within 2 weeks of spring adult emergence. During a period of approximately 5 to 6 weeks, larvae feed on one of two specific host plants, either wild lupine or wild indigo, but individuals have not been observed to use both. During this time, they grow in size and pass through four instars. Frosted Elfin larvae typically consume flowers and seedpods of wild lupine and entire leaves and flower shoots of. Indigo plants flower later in the summer than wild lupine and flowers are not available during the time that caterpillars are feeding. Late instar larvae are known to girdle stems of the indigo, presumably to increase leaf nutrient concentrations or reduce stem toxicity. Caterpillars of wild lupine-feeding Frosted Elfin are reported to be cannibalistic and will also consume caterpillars of other butterfly species. Larvae pupate in mid to late spring in Florida and by late July in Massachusetts, and remain in pupal diapause until the following spring. Larvae pupate at the base of the plant, at the soil surface, in the duff, and below the leaf litter (USFWS, 2018).

Current Stressors and Threats

- Inherent factors

  Frosted Elfins exhibit several inherent traits that influence population viability, including: specialized habitat requirements, limited dispersal ability, small population size, area of occupancy, or extent of occurrence.
- Habitat loss and degradation

  The Frosted Elfin faces habitat loss from a variety of sources, including conversion of habitat as a result of human mediated causes such as development, invasive plant species, recreational activity, dumping in rights-of-way (ROWs), and fire exclusion or management, as well as natural causes such as succession. The Frosted Elfin overlaps with the Karner Blue Butterfly within the northern states and that species is influenced by similar factors.
- Insecticides

Insecticides are a tool to chemically control the spread of invasive insects. Use of insecticides may result in mortality of non-target species, depending upon the type of chemical, the application method, length of exposure, and the insect’s tolerance.

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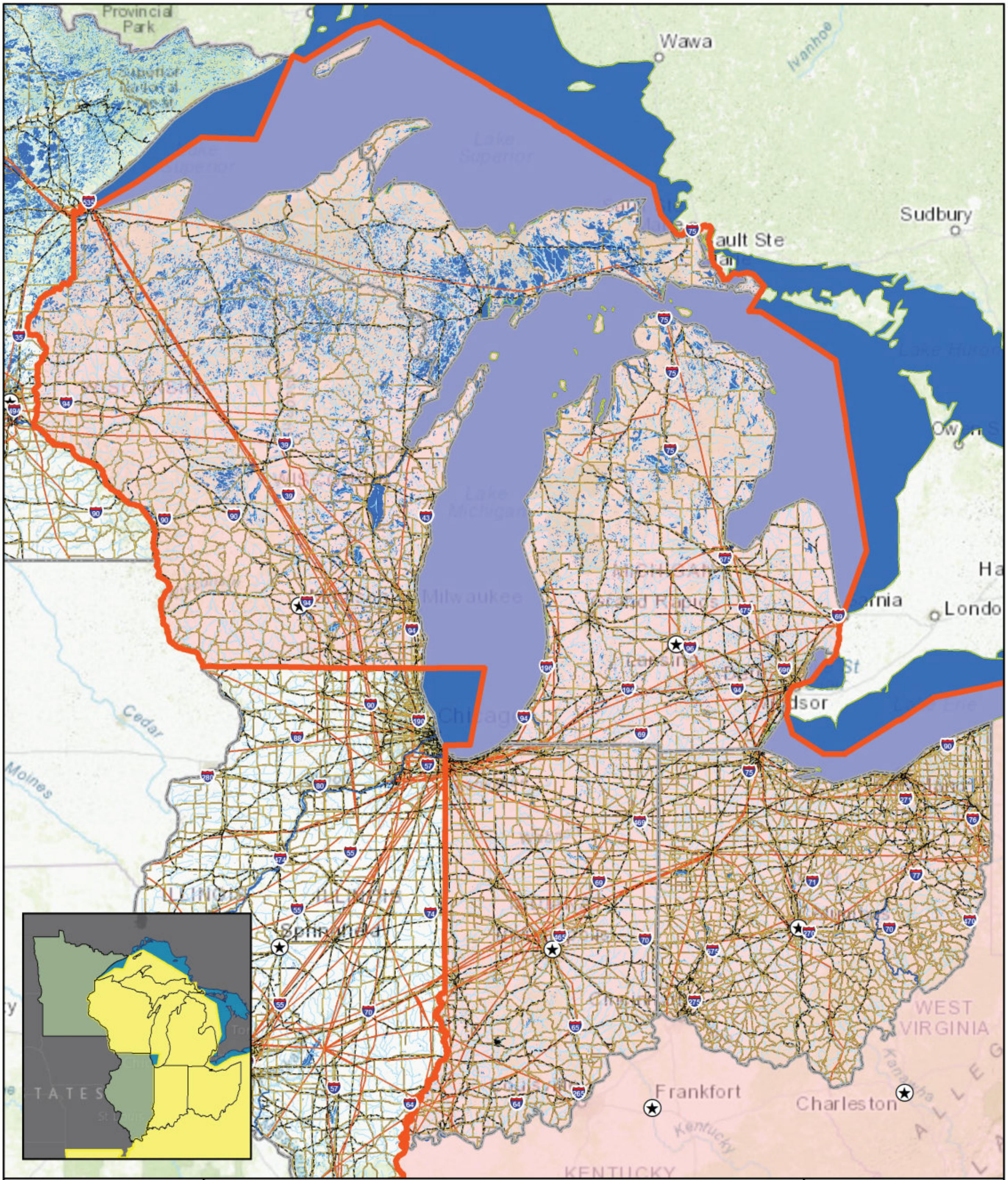

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FROSTED ELFIN BUTTERFLY (*CALLOPHRYS IRUS*) ACTION AREA OVERVIEW MAP

SCALE 1:7,500,000

- Petroleum Pipeline
- Major Road
- ------ Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- ▆ Lakes & Ponds
- ▆ 1-Mile Coastal Inland Buffer
- ▆ Action Area
- ▭ Frosted Elfin Butterfly (*Callophrys irus*) Counties of Occurrence

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Basemap courtesy of Esri. Date: 5/25/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS Projection: WGS 1984 Web Mercator

Hine's Emerald Dragonfly (*Somatochlora hineana*)

Federal Listing: Endangered (Not Listed in Winnebago County, IL and Columbia, Iowa, Richland, and Rock Counties, WI)
State Listing within the AA: Endangered in Illinois, Michigan, and Wisconsin

Species Description
Hine's Emerald Dragonfly, like many other members of its family, has brilliant green eyes. It is distinguished from all other species of *Somatachlora* by its dark metallic green thorax with two distinct creamy-yellow lateral lines, and distinctively-shapes male terminal appendages and female ovipositor. Adults have a body length of 60 to 65mm (2.3 to 2.5in) and wingspan of 90 to 95mm (3.5 to 3.7in). The wings are clear and may have an amber hue towards the base of the hind wings. Other species of *Somatochlora* that occur in the same range may be confused with Hine's Emerald Dragonfly, include *S. linearis*, *S. tenebrosa*, *S ensignera*, *S. elongata*, and S. *williamson*i. However, distinctive shapes of terminal appendages and ovipositors separate adults of this species from all others. Two characteristics change with the ages of the Hine's Emerald Dragonfly. After emerging as an adult, the eyes are initially brown and turn emerald green within 1 to 3 days. Toward the end of the adult life span, the wings may turn from clear to a slightly opaque, smokey color. No one character has been found that will easily and reliably differentiate larvae of Hine's Emerald Dragonfly from the similar species listed above (USFWS, 2001). The larva (nymph, naiad) is approximately 25mm in length and is light to dark brown when mature. The body is densely clothed with coarse setae (hair) (Illinois State Museum, 2012).

Species Distribution
Hine's Emerald Dragonfly lives in wetlands dominated by grass (graminoid) or grass-like plants and fed primarily by water from a mineral source, or fens. Two important characteristics common to wetlands inhabited by Hine's Emerald Dragonfly appear to be groundwater fed, shallow water slowly flowing through vegetation, and underlying dolomitic bedrock or calcareous limestone. The flowing water can range from barely detectable sheet flow to deeper, well-defined streamlet channels. Parts of the streamlet channels are usually covered by vegetation such as cattails or sedges. These slow-moving aquatic systems provide appropriate habitat for larval development. Soil types of these aquatic systems can range from organic much to mineral soils like marl. Two other important components of these wetland complexes are open, vegetated areas and nearby or adjacent forest edge. Areas of open vegetation serve as places to forage. Forest, trees, or shrubs provide protected, shaded areas for Hine's Emerald Dragonfly to perch and roost. Larval habitat may be an important factor affecting the distribution and population size of this species. Hine's Emerald Dragonfly larvae are usually found in small flowing streamlets within cattail marshes, sedge meadows, and hummocks (USFWS, 2001).

Historically, the Hine's Emerald Dragonfly was found in Alabama, Indiana, and Ohio and probably has been extirpated in those states. Today the dragonfly can only be found in Illinois, Michigan, Missouri and Wisconsin (USFWS, 2006).

Distribution within Action Area

- Illinois: Nine sites in Will, Cook, and Du Page Counties (USFWS, 2001); two sites added during five-year review (USFWS, 2013) with two new site updates in subsequent review, including Winnebago County (USFWS, 2019)
- Wisconsin: Twenty sites in Door, Kewaunee and Ozaukee Counties (USFWS, 2001); two sites added during five-year review including sites in Iowa and Richland Counties (USFWS, 2013) with no new site updates in subsequent review (USFWS, 2019).
- Michigan: Ten sites in Mackinac, Presque Isle, and Alpena Counties (USFWS, 2001); eight sites added during five-year review including adding sites in Alcona, Menominee, and Charlevoix counties (USFWS, 2013) with no new site updates in subsequent review (USFWS, 2019).

Critical Habitat

Critical habitat totals approximately 26,531.8 acres (ac) (10,737 hectares (ha)) in 37 units. The critical habitat units are located in Cook, DuPage, and Will Counties in Illinois; Alpena, Mackinac, and Presque Isle Counties in Michigan; Crawford, Dent, Iron, Phelps, Reynolds, Ripley, Washington, and Wayne Counties in Missouri; and Door and Ozaukee Counties in Wisconsin (75 FR 21394).

Life History

The life cycle of Hine's Emerald Dragonfly is similar to most dragonflies in that it is comprised of the following stages: aquatic egg, aquatic larva, and terrestrial/aerial adult. A Hine's Emerald Dragonfly female will most likely lay more than 500 eggs during her life. After an egg is hatched, the larvae may spend 2 to 4 years in small streamlets, foraging and molting as they grow. Upon completion of larval development, the larvae begin to emerge as adults, possibly as early as late May in Illinois and late June in Wisconsin and continue to emerge throughout the summer. The first emergence date can be estimated using temperature and precipitation data. The Hine's Emerald Dragonfly's know flight season lasts up to early October in Illinois and to late August in Wisconsin. Fully adult Hine's Emerald Dragonflies can live at least 14 days and may live 4 to 6 weeks. As with most dragonflies adult Hine's Emerald Dragonflies feed, establish territories, mate, and oviposit (lay eggs). Most dragonfly adults are general predators through their entire life cycle, feeding primarily on insects they can capture while flying (USFWS, 2001).

Current Stressors and Threats

The significant threats to the existence of this species have been identified as (USFWS, 2001):

- Habitat destruction/alteration, including changes in surface and sub-surface hydrology
- Contamination

Most of the wetland habitat that this dragonfly depends on for survival has been drained and filled to make way for urban and industrial development. Development that decreases the amount or quality of ground water flowing to the dragonfly's habitat threatens its survival because it depends on spring-fed shallow water to breed. Contamination of wetlands by pesticides or other pollutants also poses a threat. The dragonfly depends on pristine wetland or stream areas, with good water quality, for growth and development (USFWS, 2006).

Potential additional concerns include (USFWS, 2001):

- Environmental extremes (i.e. flood, drought, severe freezing)
- Transpiration (direct impact)
- Demographic and genetic stochasticity
- Disease or predation
- Overutilization for commercial, recreational, scientific, or educational purposes.

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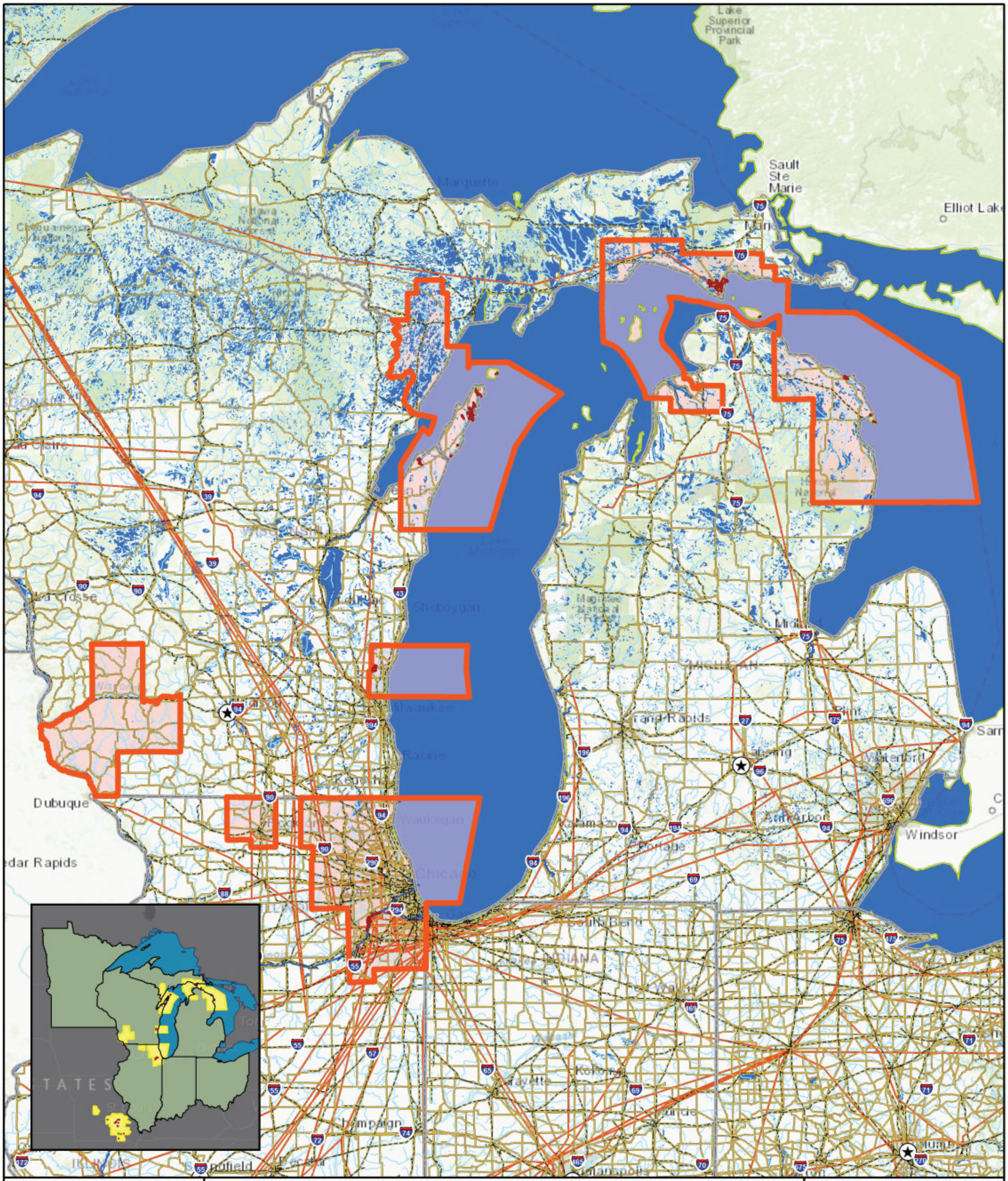

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0 15 30 60 90 120
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HINE'S EMERALD DRAGONFLY (*HESPERIA DACOTAE*) ACTION AREA OVERVIEW MAP

SCALE 1:5,500,000

- Petroleum Pipeline
- Major Road
- Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- Lakes & Ponds
- 1-Mile Coastal Inland Buffer
- Action
- Hine's Emerald Dragonfly (*Somatochlora hineana*) Critical Habitat
- Hine's Emerald Dragonfly (*Somatochlora hineana*) Counties of Occurrence

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Basemap courtesy of Esri. Date: 5/24/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS Projection: WGS 1984 Web Mercator

Hungerford’s Crawling Water Beetle (*Brychius hungerfordi*)

Federal Listing: Endangered
State Listing within the AA: Endangered in Michigan

Species Description

In addition to its geographic distinction, HCWB can be identified from other members of the genus by denser punctation of the head, the presence of a transverse infuscation at the base of the head between the eyes, coarser punctuation on the pronotum (the plate at the base of the head), and larger average size. In addition, median lobe of the aedeagus (part of the male genitalia) of each *Brychius* species has a unique shape and can be used for identification. Adult HCWB are small and torpedo-shaped, with an average body length of 3.8 to 4.3mm (0.15 to 0.17in). They are yellowish-brown in color with irregular dark markings and longitudinal stripes on the elytra, each of which is comprised of a series of fine, closely spaced and darkly pigmented indentations. Males are characterized by thickened tarsal segments of the front legs with small tufts of hair on the first three segments. The females tend to be larger than the males. HCWB larvae are light yellowish brown with cylindrical bodies that taper to a hooked tail. They are stiff-bodied and possess short legs with five segments and single tarsal hook. The larvae have modified forelegs which could be an adaptation for feeding on filamentous algae and can be distinguished from other described haliplids by having the third antennal segment shorter than the second segment. Final instar larvae are approximately 13mm in length. Strand and Spangler (1994) provide a more thorough description of HCWB larvae.

Species Distribution

HCWB inhabits relatively cool (15 to 25°C), fast flowing (1st, 2nd, 3rd order) alkaline streams with sand and gravel substrates, often occurring in reaches with an open to partially open canopy just below beaver dams or similar human-made structures. Adults prefer gravel and cobble riffles while larvae occupy areas with slower current and dense growth of microalgae, especially Chara. Specifically, they occur in riffles in floodplain forest, northern shrub thicket, northern wet meadow and rich conifer swamp habitats (MNFI, 2021). The hydrology of a site appears to be important for this species. HCWB seems to prefer seasonal streams that have some groundwater input. These streams do not dry up completely, but the water level can drop considerably. However, habitat requirements of the species are not fully understood. It is uncertain what habitat characteristics are important for all life stages of this species. In general, the types of streams inhabited by this species do not appear to be rare. The species appears to prefer environmental conditions found downstream of culverts, beaver dams, and similar structures. However, the species may also have a broader range of suitable habitat (USFWS, 2006).

There are 13 streams range-wide (Michigan and Canada) with known populations of HCWB. In Michigan, HCWB is known to occur in the East Branch of Maple River and Carp Lake River in Emmet County; East Branch of Black River, Van Hetton Creek (also known as Van Hellon and Van Helen Creek), and Stuart Creek in Montmorency County; Canada Creek in Montmorency and Presque Isle Counties; Mullet Creek in Cheboygan County; North Branch of Boyne River in Charlevoix County; Middle Branch of Big Creek in Oscoda County; and Portage Creek in Kalkaska County. In Ontario, Canada, HCWB is known to occur in the North Saugeen River, Rankin River, and Saugeen River (USFWS, 2021).

Distribution within Action Area

Records of HCWB occurrence in Michigan include (MNFI, 2021):

- Charlevoix County (one occurrence; last observed in 2011)
- Crawford County (one occurrence; last observed in 2019)
- Emmet County (four occurrences; last observed in 2017)
- Kalkaska County (two occurrences; last observed in 2020)
- Montmorency County (three occurrences; last observed in 2013)
- Oscoda County (one occurrence; last observed in 2011)

- Presque Isle County (one occurrence; last observed in 2005)

Critical Habitat
No critical habitat has been designated for Hungerford's Crawling Water Beetle.

Life History
Very little is known about the life history of HCWB; however, there are observations and life history information reported for other haliplids, including *B. hornii*. Although differences occur among species, life history information for closely related species may give us a reasonable estimate of the likely life history of HCWB. Like all beetle species, HCWB undergoes complete metamorphosis with a life cycle that consists of four distinct stages. In general, the period of egg laying for haliplids extends from May through July, although this may extend later in the summer in HCWB, and there may be another generation in the fall for some species. Oviposition (egg-laying) has not been observed for any species of *Brychius*, nor has the egg stage been described. See recovery plan for discussion of eggs of *Peltodytes* and *Haliplus* which may be similar to *Brychius* suggesting eggs are deposited on or into leaves and stems of aquatic plants. Haliplid larvae pass through three instars and are herbivorous. In *B. hornii*, the first two instars occur in July, and the third instar stage lasts from August to April. HCWB larvae have been found in or near direct current in association with algae in the genus *Chara*, which is thought to be a possible food source. When mature, larvae leave the water in search of a place in damp soil to pupate. In the lab, larvae of *B. hornii* emerged from the water in November and remained throughout the winter months half-buried in moist earth and sand. In the fall, larvae of HCWB were found away from the current, buried in an island of damp sand and Chara up to 15 cm above the water line. Like other haliplids, they likely overwinter in the larval stage in position for spring pupation. The pupal stage is the only one spent in a terrestrial setting. This stage lasts two to three weeks, during which time the transformation to adult takes place. It requires several days before the adult beetle is ready to leave the pupal chamber and reenter the water. The pupal stage of HCWB has not been observed. The young adults of some haliplids do not reproduce until the following year. Reproduction in haliplids usually occurs in the spring and early summer. Mating has been observed in HCWB in June. Mating in *B. hornii* also occurs in June. Adults of HCWB have been found year-round, suggesting that some adults survive the winter, even beneath ice cover Studies have shown that some haliplids can even survive being frozen solid. Other species in the family Haliplidae have at least one generation in the summer and likely another in the late summer or fall. Observations of HCWB suggest that they may have two generations per year, with a second brood of adults emerging late in the season (USFWS, 2006). The recovery plan (2006) provides additional details on food habits, respiration, general behavior, and locomotion and dispersal.

Current Stressors and Threats
Specific threats were unknown during listing (1994), but the listing rule hypothesized that human activities such as fish management, logging, beaver control management, dredging, stream pollution, and general stream degradation had contributed to the reduction of HCWB habitat. In general, it is likely that threats to the species include any activities that degrade water quality or remove or disrupt the pools and riffle environment of streams in which this species lives (USFWS, 2006). The primary threat to HCWB is modification of its habitat. Actions that are potentially harmful include dredging, channelization, bank stabilization and impoundment (USFWS, 2004).

- Stream modification
  The primary threat to Hungerford's Crawling Water Beetle is modification of its habitat. Actions that are potentially harmful include dredging, channelization, bank stabilization, and impoundment.
- Fish management
  Fish introductions or removals may pose a threat to HCWB. The introduction of brown trout, for example, can result in increased predation of the beetle. Other management practices, such as the use of chemical treatments, may also be harmful to this rare species.
- Degradation of water quality

- Geographic isolation

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0 3.25 6.5 13 19.5
Miles
0 3.25 6.5 13 19.5 26
Kilometers

HUNGERFORD'S CRAWLING WATER BEETLE (*BRYCHIUS HUNGERFORDI*) ACTION AREA OVERVIEW MAP

SCALE 1:1,000,000

- Petroleum Pipeline
- Major Road
- Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- Lakes & Ponds
- 1-Mile Coastal Inland Buffer
- Action Area
- Hungerford's Crawling Water Beetle (*Brychius hungerfordi*) Counties of Occurrence

N

Basemap courtesy of Esri. Date: 5/25/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS Projection: WGS 1984 Web Mercator

Karner Blue Butterfly (*Lycaeides [Plebejus] melissa samuelis*)

Federal Listing: Endangered
State Listing within the AA: Endangered in Illinois, Indiana, Minnesota, and Ohio; Threatened in Michigan; Special Concern in Wisconsin

Species Description

Karner Blue Butterflies are small with a wingspan of about 2.5cm (1in). The forewing length of adult KBBs is 1.2 to 1.4cm for males and 1.4 to 1.6cm for females. The wing shape is rounded and less pointed than *L. m. melissa*, especially in the female hind wing. The upper (dorsal) side of the male wing is a violet blue with a black margin and white fringed edge. The female upper side ranges from dull violet to bright purplish blue near the body and central portions of the wings, and the remainder of the wing is a light or dark gray-brown, with marginal orange crescents typically restricted to the hind wing. Both sexes are a grayish fawn color on the ventral side. Near the margins of the underside of both wings are orange crescents and metallic spots. The black terminal line along the margin of the hind wing is usually continuous. The eggs of Karner Blue are tiny and radially symmetric, about 0.7mm in diameter, somewhat flattened, and pale greenish-white in color. The surface is deeply reticulated with a fine geometric pattern. Larvae are a pea-green color, pubescent and dorsally flattened, with a brown-black to black head capsule. The head is often not visible as it is tucked under the body. Older larvae have pale green (to white) lateral stripes, and a dark-green longitudinal stripe dorsally. In pre-pupal larvae, the lateral stripes become less distinct and the color becomes a duller green. Larvae have four instars (larval development stages), and three glandular structures that are known to mediate interactions with ants in other species of *Lycaenidae*. Pupae are bright green and smooth, changing to a light tan with hints of purple shortly before emergence when the adult cuticle separates from the cuticle of the pupal case. In the Midwest, Karner Blue Butterflies can be confused with Nabokov's Blue (*L. idas nabokovi*), Melissa Blue (*L. melissa melissa*), Eastern- and Western-Tailed Blues (*Everes comyntas* and *E. amyntula*), Reakirt's Blue (*Hemiargus isola*), Greenish Blue (*Plebius saepiolus*), Marine Blue (*Leptotes marina*), Acmon Blue (*Icaricia acmon*), Spring Azure (*Celastrina argiolus*) complex, and Silvery Blue (*Glaucopsyche lygdamus)* (USFWS, 2003).

Species Distribution

Almost all known extant KBB populations occur on sandy soils associated with glacial outwash plains and terraces, glacial moraines, the shores and bottoms of glacial lakes, the glacial shores of existing lakes, and dissected sandstone outwashes (USFWS, 2003).

Changes in the distribution of the KBB within its historical range have occurred since the 2012 5-year review and the number of KBB populations has decreased since listing. Of the eight states with KBBs at the time of listing in 1992 (Illinois, New Hampshire, New York, Indiana, Ohio, Michigan, Wisconsin, and Minnesota), KBBs are likely no longer present in Illinois, Minnesota, and Indiana. Wisconsin and Michigan have the largest number of local populations with the greatest numbers of individuals; New York has one large population. The historic northern, eastern, and western limits of the butterfly correspond roughly with the distributional limits of lupine. In all three regions, the present distribution of the butterfly has contracted away from these limits, with extirpations of populations occurring in all three geographic directions. The northernmost population of the Karner Blue occurs in the Superior Outwash Recovery Unit (RU) in Wisconsin, the westernmost population in the Paleozoic Plateau RU in Minnesota, and the easternmost population in the Merrimac/Nashua River System RU in New Hampshire (USFWS, 2003).

Distribution within Action Area

- Illinois: Lake County
- Indiana: Lake and Porter Counties
- Michigan: Allegan, Ionia, Kent, Lake, Mason, Mecosta, Monroe, Montcalm, Muskegon, Newaygo, and Oceana Counties
- Minnesota: Winona County

- Ohio: Lucas County
- Wisconsin: 25 counties

Critical Habitat

Despite 1978 proposal (43 FR 28941), no critical habitat has been designated for Karner Blue Butterfly.

Life History

The Karner Blue Butterfly is bivoltine, which means that it completes two generations per year. In typical years, first brood larvae (caterpillars) hatch from overwintered eggs in mid- to late April and begin feeding on wild lupine (*Lupinus perennis*), the only known larval food source. Larvae pass through four instars (developmental stages), between which the relatively soft larval exoskeleton is shed. Feeding by first and second instar larvae results in tiny circular holes in the lupine leaves while older larvae eat all but the upper or lower epidermis, creating a characteristic window-pane appearance. Larvae feed for about three to four weeks and pupate (transform from larvae to adult) in late May to early June. Ants commonly tend larvae which collect a sugary solution secreted by the larvae, and in turn may protect the larvae from predation and/or parasitism. Mature larvae enter a wandering phase, after which the pre-pupal larvae attach themselves to various substrates with a silk thread. Karner Blues are known to pupate in the leaf litter, on stems and twigs, and occasionally on lupine leaves. First flight adults begin emerging in late May with the flight extending through late June. Adults are believed to live an average of four to five days but can live as long as two to three weeks. First flight adult females lay their eggs primarily on lupine plants, often singly on leaves, petioles, or stems, or occasionally on other plants or leaf litter close to lupine plants. Second brood eggs hatch in five to ten days, and larvae can be found feeding on wild lupine leaves and flowers from early June through late July. Typically, a larva can survive on one large lupine stem; however, the larva moves from leaf to leaf on the lupine stem, often returning to leaves fed on during earlier instars, and it may even move to other lupine stems. Larvae are found often on the lower parts of the stems and petioles. Ants also typically tend second brood larvae, but during midday on hot days tending may be reduced. Pupae are also frequently tended by ants. Second brood adults begin to appear in early to mid-July and fly until mid to late August, and in some years into early September. Flight phenology may be delayed because of cool wet summers and result in an adult flight period lasting through late August. The peak flight period usually lasts one to two weeks. Generally, there are about three to four times as many adults in the second brood compared with the first brood. The first brood is usually smaller most likely due to high overwintering mortality of eggs, the inability of larvae to find lupine in the spring, or greater oviposition success of first-flight females. It is important to note that there is a significant amount of annual variation in adult abundance relative to peak flight date and in brood timing and length among years (USFWS, 2003).

Current Stressors and Threats

As reported in the 5-year review (USFWS, 2012), spatial distribution at the metapopulation level has improved at some KBB recovery sites as a result of habitat restoration and management activities, but habitat degradation and loss from plant community succession and the presence of invasive plants continue to be a stressor to the species at many or all recovery sites. The most important threats to the Karner Blue range wide are habitat loss, which has been accompanied by increased fragmentation of the remaining suitable habitat, and habitat alteration primarily resulting from vegetational succession. Related to these is the threat of incompatible management stemming from conflicting and potentially conflicting management objectives. Large-scale disturbances, such as large wildfire and unusual weather, are also threats to Karner Blue populations (USFWS, 2003).

- Loss and alteration of native habitat (reduction and hybridization of native lupine)
- Loss and alteration of other contemporary habitats
- Incompatible management (pesticide use, mowing, prescribed fire, deer grouse management)
- Overutilization for commercial, recreations, scientific, or educational purposes
- Disease or predation
- Stochastic events

- Invasion and hybridization with other species that use introduced legumes (MNDNR, 2021)

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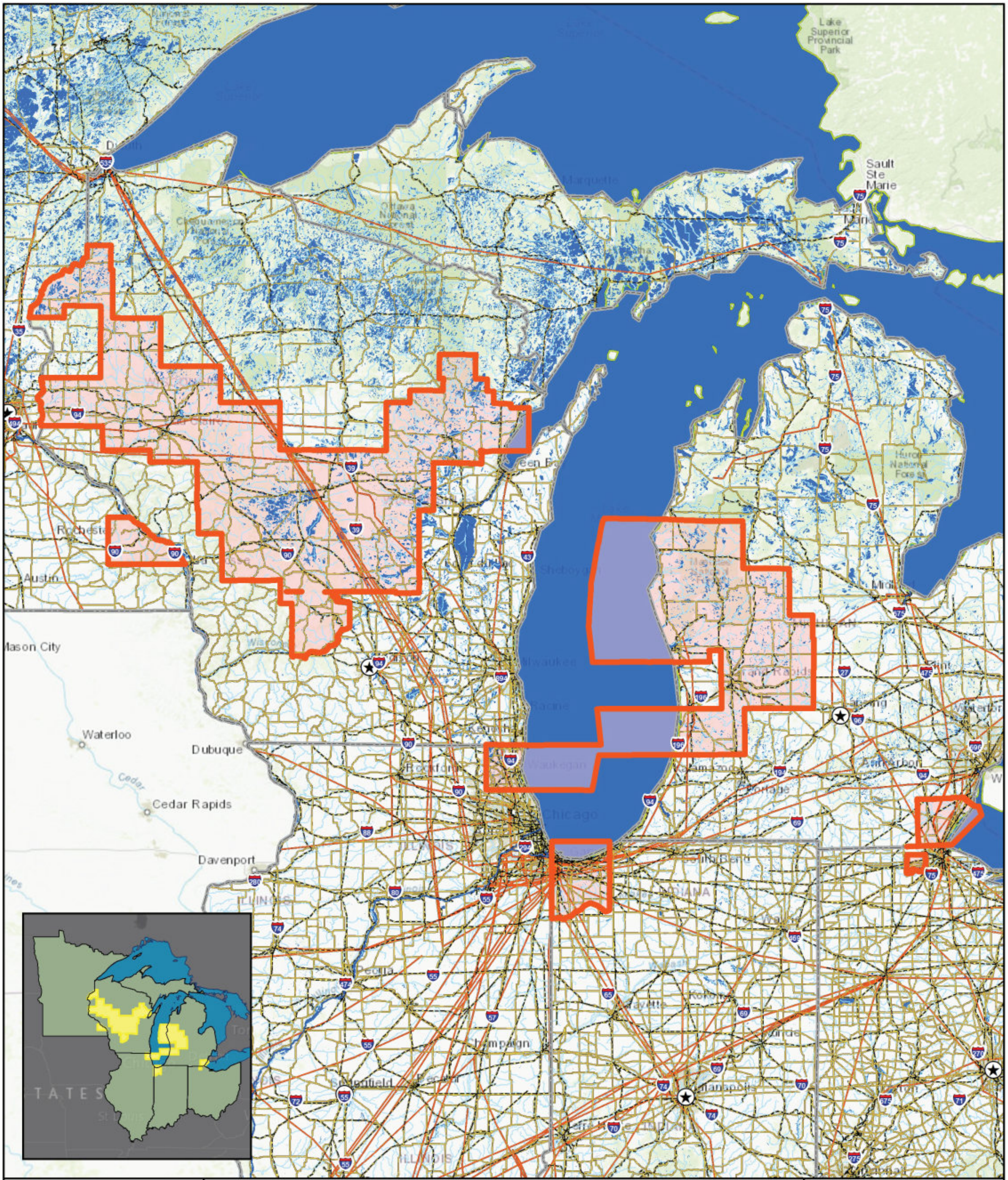

0	20	40	80	120

Miles

0	20	40	80	120	160

Kilometers

KARNER BLUE BUTTERFLY (*LYCAEIDES MELISSA SAMUELIS*) ACTION AREA OVERVIEW MAP

SCALE 1:6,000,000

—	Petroleum Pipeline
—	Major Road
- - - - - -	Railroad
—	Commercial Navigable Waterway
—	Rivers & Streams
▇	Lakes & Ponds
🟩	1-Mile Coastal Inland Buffer
🟨	Action Area
▭	Karner Blue Butterfly (*Lycaeides melissa samuelis*) Counties of Occurrence

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Basemap courtesy of Esri. Date: 5/25/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS Projection: WGS 1984 Web Mercator

Linda's Roadside-Skipper (*Amblyscirtes linda*)

Federal Listing: Under Review. This species was petitioned for Federal listing under the Endangered Species Act in 2010, and a 90-day finding was issued in 2011 (76 FR 59836).
State Listing within the AA: Not Listed

Species Description

Upperside primaries are dark brown with some fulvous overscaling toward the base and inner margin; the number of subapical spots variable, from three well defined to no spots at all. A few specimens show two poorly defined spots in the vicinity of the stigma. The stigma is well developed. Secondaries are dark brown with the basal and discal areas of the wings overscaled with fulvous scales and hairs. Underside primaries are grayish-brown, lighter than above. The cell area is occupied with reddish-fulvous scales. The spots reappear and are better defined, the subapical spots are clear white and the two spots near the stigma are fulvous. Secondaries are ground color dark brown, evenly suffused with grayish-white scales; an irregular curved discal band of five or six grayish-white spots, two above the cell and a faintly lighter area near the base. The overscaling almost obliterates the discal band and basal spots in some of the specimens. Fringes of both wings checkered. Body, above brown; beneath grayish-white; palpi, grayish-white; antennae, dark brown, ringed with gray; club, black above, beneath grayish-white. Females similar to the males except some of them have the discal band and basal spots on the under surface of the secondaries clear snow white. Males average 26mm (24 to 27mm) and females average 28mm (24 to 29mm) (Freeman, 1943).

Species Distribution

This species is endemic to a small area of the lower Midwest, U.S.A., centered in and near the Ozarks. It is found in the southern two-thirds of Missouri and immediately adjacent parts of Illinois, Kentucky, Tennessee, Arkansas and Oklahoma. It is known from Shawnee National Forest in Illinois. Other unprotected occurrences may have good viability but have not been assessed. (Nature Serve, 2021).

Critical Habitat

No critical habitat has been designated for Linda's Roadside Skipper.

Life History

There is debate on whether there are three broods from mid-April to early September or only two in late April-early May and late June-early July. Perhaps the third brood is partial. The egg and pupal stages are brief and most of the year is spent as larvae on the foodplant, perhaps among the litter over winter. Hibernation probably takes place as a late instar larva, possibly pupa. Larval diet probably restricted to the grass Indian Woodoats (*Chasmanthium latifolia)*. Feeding habits of adults are not well documented except that they do visit flowers and mud puddles (NatureServe, 2021).

Current Stressors and Threats

- Habitat loss and fragmentation
  This species is threatened by loss and fragmentation of streamside habitat from development and forestry activities (logging, prescribed fire).
- Pesticides
  This species is likely to be threatened by fumigation to control gypsy moths and agricultural pests.
- Natural disturbances
  Natural disturbances, such as some floods, may also pose a threat to some subpopulations, although larvae of many skippers seem to tolerate some flooding. Concerted efforts to survey for this species are needed to determine the full extent of the species' distribution and delineate critical habitat. Studies into the natural history are needed to better understand habitat requirements and limiting factors on life history (NatureServe, 2021).

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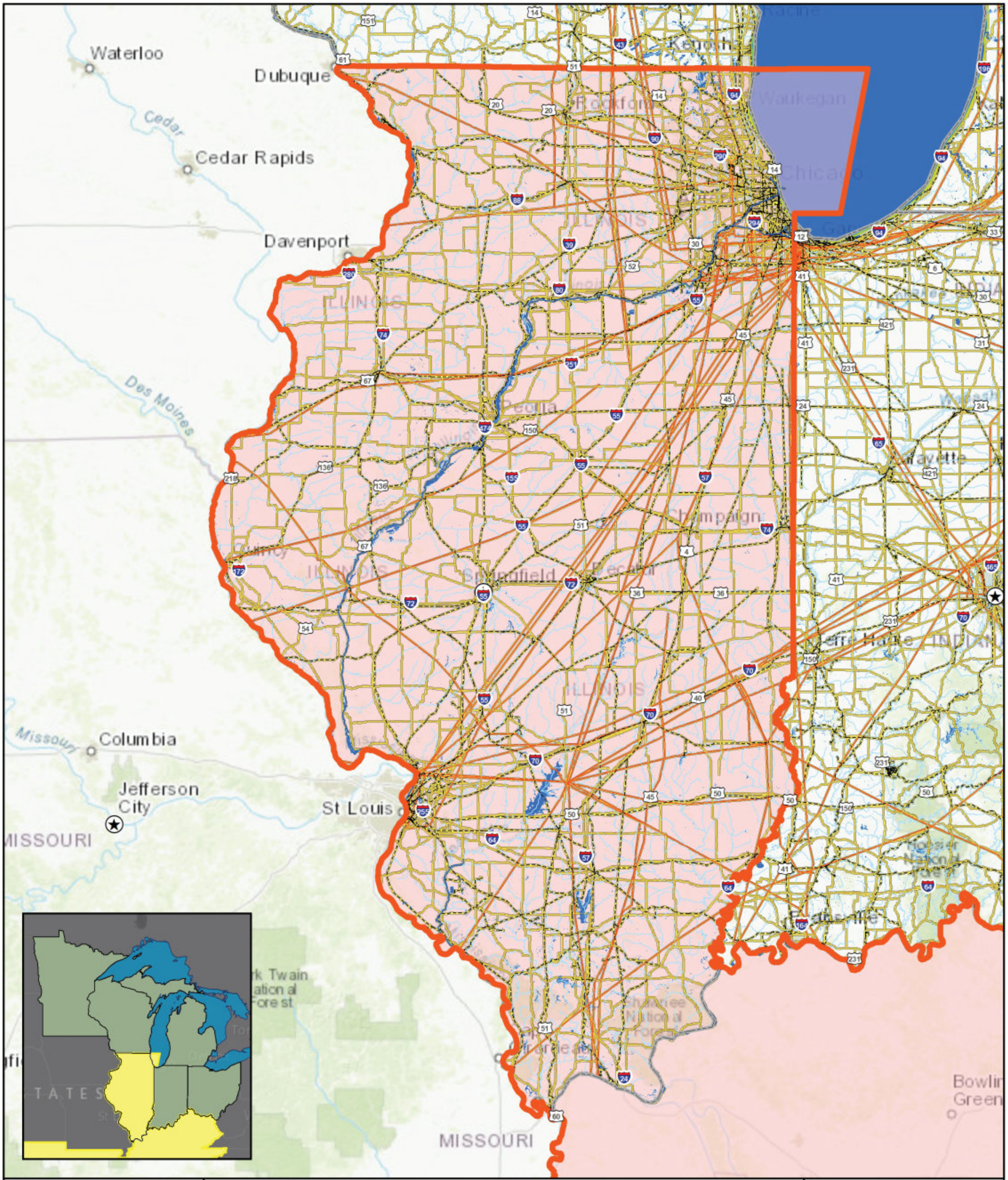

0 12.5 25 50 75
Miles
0 12.5 25 50 75 100
Kilometers

LINDA'S ROADSIDE SKIPPER (*AMBLYSCIRTES LINDA*)
ACTION AREA OVERVIEW MAP

SCALE 1:4,000,000

- Petroleum Pipeline
- Major Road
- Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- 🟦 Lakes & Ponds
- 🟩 1-Mile Coastal Inland Buffer
- 🟨 Action Area
- ▭ Linda's Roadside Skipper (*Amblyscirtes linda*) Counties of Occurrence

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Basemap courtesy of Esri.
Date: 5/25/2021
Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS
Projection: WGS 1984 Web Mercator

Mitchell’s Satyr Butterfly (*Neonympha mitchellii mitchellii*)

Federal Listing: Endangered
State Listing within the AA: Endangered in Michigan and Ohio

Species Description
MSB is a medium-sized butterfly and is a typical member of the Satyrinae, a subfamily of Nymphalidae, which includes about 43 species of pearly eyes, satyrs, and wood nymphs in North America. Male forewing length ranges between 1.6 to 1.8cm (0.6 to 0.7in), females between 1.8 to 2.1cm (0.7 to 0.8in). Although the dorsal (upper) wings are essentially unmarked and dark warm-brown in color, the ventral (lower) wing pattern may show through the thinly scaled dorsal wing surfaces. The ventral wing ground color is also dark warm-brown. Two conspicuous pattern elements characterize the ventral wing surfaces. The first is a linear series of four to five sub-marginal ocelli (eye-spots) on both the forewings and hindwings. The second is a pair of orange lines which encircle the ocelli rows on both wings. As with most satyrines, the expression of the ocelli is variable, and they tend to be larger and more conspicuous in females. MSB is superficially similar to several species with which it occurs in Indiana, Michigan and Ohio. Two species of Satyrodes, the Appalachian Eyed Brown (*Satvrodes appalachia*) and the Eyed Brown (*S. eurydice*), both have a similar series of ventral ocelli. However, both these species can be separated by their larger size, which averages 50 percent greater, and their much lighter ground color (almost tan). The Little Wood Satyr (*Megisto cymela*) is also frequently encountered along the edges of wetlands which support MSB. The Little Wood Satyr is approximately the same size as MSB, but has ocelli on both the ventral and dorsal wing surfaces, and the ventral ground color is lighter, tending to warm-tan. Older, worn specimens of MSB found late in the season may be lighter in color than fresh ones, making it more likely to confuse with other species. Researchers may want to use other characteristics to confirm their identifications (USFWS, 1998).

Species Distribution
In Michigan and Indiana, the MSB is found exclusively in fens and open parts of rich tamarack swamps. MSB are not found in all fens and are not distributed throughout any one fen. MSB typically occur near (usually within 3m) woody vegetation within a fen. In more open fens, MSB occur along the shrubby edge of the fen. In fens with more tamarack or other woody vegetation, MSB are found in open, grassy lanes between trees and shrubs. In other fens, MSB are found among openings in rich tamarack swamps. MSB are rarely found in open fens without trees or tamarack swamps without openings. Similar to the federally endangered Karner Blue butterfly (*Lycaeides melissa samuelis*), the ideal MSB habitat appears to be an intermediate between a grass or sedge dominated prairie and a closed canopy forest. The MSB is found primarily in fen savanna, usually dominated by tamarack (MIDNR, 2018).

Currently, there are nine MSB populations in Michigan (six viable), which is a decline from 16 since the previous 5-year review (2014). Population trends have been stable or declining in recent years. None of these sites occur on state or federal land and many Michigan populations occur on lands not formally committed to conservation into perpetuity. There is one population in Indiana that is not considered viable and recently acquired by local government. Populations in Virginia (11) are confined to 1 county, despite wide ranging surveys. Only three of these populations are considered to be good to fair viability, with one partially owned by the state and three under a conservation easement. Mississippi has 15 populations across five counties, an increase from the 11 populations noted in the 2014 review; however, viability is unknown. While some of these populations occur on state and federal lands, status of monitoring or management are not known. Alabama has populations within the Oakmulgee Ranger District of the Talladega National Forest, ranging across six counties. Captive propagation, reintroduction, and augmentation are concentrated in Michigan and Indiana because of long-term trends of population declines and ongoing threats in the northern part of the species range. In 2016, the Service developed a Safe Harbor Agreement with the purpose to reintroduce butterflies to historic sites and/or to suitable fens that occur within its historic range. Limited introductions began in 2016 at a TNC property in Indiana; however, the number of individuals available for release have been relatively small and no individuals were found during surveys in recent years. An HCP was developed for Michigan and Indiana in 2018 and signed in 2020 to maintain and expand current populations through management, restoration, and protection of suitable habitat while minimizing take and restore unoccupied habitat for reintroduction to increase the number of extant populations (USFWS, 2021a).

Distribution within Action Area

Records of MSB occurrence in Michigan include (MNFI, 2021):

- Barry County (three occurrences; last observed in 2012)
- Berrien County (three occurrences; last observed in 2020)
- Branch County (one occurrence; last observed in 2020)
- Cass County (five occurrences; last observed in 2020)
- Jackson County (four occurrences; last observed in 2020)
- Kalamazoo County (four occurrences; last observed in 2009)
- Lenawee County (one occurrence; last observed in 1980)
- St. Joseph County (two occurrences; last observed in 2008)
- Van Buren County (three occurrences; last observed in 2020)
- Washtenaw County (two occurrences; last observed in 2019)
- Wayne County (one occurrence; last observed in 1931)

The populations in Barry, Kalamazoo, and St. Joseph County are now considered extirpated; however, it is hoped that MSB may be returned to these counties in the future (USFWS, pers. comm., 2022).

Although the Indiana population of MSB is not considered viable, the species may occur in LaGrange County, Indiana.

MSB was known from a single Ohio county at the time of listing (57 FR 21564). According to intensive MSB searches conducted from 1985 to 1990, no extant populations were found in Ohio. The recovery plan (USFWS, 1998) lists Portage and possibly Seneca counties as supporting historical populations of Mitchell's Satyr. As of 2013, the species is considered extirpated from the state. However, ECOS still lists Portage County, Ohio as potentially harboring MSB, and there may be opportunities to reintroduce this species into Portage County in the future.

Critical Habitat

No critical habitat has been designated for Mitchell's Satyr Butterfly.

Life History

The MSB exists for 95% of its life cycle as a caterpillar or larva. Larvae hatch from eggs after 7 to 11 days, in July. They immediately move to a nearby food plant. First instar larvae are initially white, with dark velvet-brown heads, but their bodies change to a lime green color after they begin feeding. The second through sixth instars are cryptically colored (green or tan, depending on the time of year). The MSB overwinters as a fourth instar larva on the leaves of tussock sedge. In the spring, the larvae continue eating and growing. In late-May to late-June, the larvae form a chrysalis about 40cm (5 to 68cm) or 15in (2 to 27in) from the base of the plant. MSB larvae feed on a variety of sedges and grasses found in fens, sedge meadows, tamarack swamps, and other wetlands. The chrysalis persists for 10 to 15 days. Adult butterflies in the northern portion of its range emerge from mid-June to late July. The populations are bivoltine in Alabama and Mississippi; the first flight begins in late May to early June and the second generation has flight in August to mid-September (USFWS, pers. comm., 2022). Males emerge earlier than females (USFWS, 1998). Adults are short-lived, do not usually feed, and exist primarily to mate, disperse, and lay eggs. Eggs are not usually laid on food plants. Instead, eggs are most often laid on forbs and short statured wildflowers. In captivity, eggs are most often laid on clearweed *Pilea pumila*.

Current Stressors and Threats

- Habitat loss and degradation
  The greatest threat to the Mitchell's Satyr is habitat destruction. Most of the wetland habitat that this butterfly depends on for survival has been drained and filled to make way for urban and agricultural development. Also, invasion from exotic weeds threaten the fens on which the butterflies depend.
- Pesticides and other pollutants
  Contamination of fen wetlands by pesticides, fertilizer, and nutrient runoff from adjacent agriculture, including livestock production, poses a threat to the butterfly's habitat.
- Butterfly collectors
  It is believed that some populations of the Mitchell's Satyr were eliminated by butterfly collectors. Because butterfly numbers are so low, the collection of even a few individuals could harm the butterfly population. Collection is illegal without a permit from the U.S. Fish and Wildlife Service (USFWS, 2021b).
- Hydrology alteration
- Inbreeding depression associated with small, isolated populations

Human-induced habitat loss, degradation, and fragmentation are the primary threats affecting MSB. These result from nutrients entering groundwater from surrounding agricultural and other lands; continued groundwater withdrawal and other changes to hydrology due to roads, wells, ditches, etc.; use of pesticides and other chemicals that drift from surrounding areas; loss of habitat due to residential development; invasive species; and natural succession resulting in woody shrub encroachment. These habitat stressors are expected to continue into the future and likely increase as the human population increases and expands. Wolbachia is present across the range, though more often found in the northern populations. The captive propagation program must continue to carefully avoid inadvertent introduction of Wolbachia into uninfected populations or introduction of a new strain into wild populations. Climate change will impact Mitchell’s Satyr across its disjunct range, but the level of impact may vary from state-to-state. Drier conditions in the northern part of its range could further limit populations that are already small and isolated. Lack of commitment to Mitchell’s Satyr habitat management and conservation is a long-term concern (USFWS, 2021a).

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0 12.5 25 50 75
Miles
0 12.5 25 50 75 100
Kilometers

MITCHELL'S SATYR BUTTERFLY (*NEONYMPHA MITCHELLII*) ACTION AREA OVERVIEW MAP

SCALE 1:4,000,000

— Petroleum Pipeline
— Major Road
------ Railroad
— Commercial Navigable Waterway
— Rivers & Streams
▬ Lakes & Ponds
▬ 1-Mile Coastal Inland Buffer
▬ Action Area
▭ Mitchell's Satyr Butterfly (*Neonympha mitchellii*) Counties of Occurrence

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Basemap courtesy of Esri. Date: 5/25/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS Projection: WGS 1984 Web Mercator

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Monarch Butterfly (*Danaus plexippus*)

Federal Listing: Candidate. The Monarch is a candidate species and is not yet listed or proposed for listing.
State Listing within the AA: Not Listed. State insect of Illinois.

Species Description

The Monarch, *Danaus plexippus* (Linneaus, 1758), is a species of butterfly in the order Lepidoptera (family Nymphalidae). Adult Monarch 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. Adult Monarchs are sexually dimorphic, with males having narrower wing venation and scent patches. The bright coloring of a Monarch is aposematic, as it serves as a warning to predators that eating them can be toxic (USFWS, 2020).

Species Distribution

The Monarch occurs in North, Central, and South America; Australia; New Zealand; islands of the Pacific and Caribbean, and elsewhere (USFWS, 2020). States/US Territories in which this population is known to or is believed to occur: Alabama, Arizona, Arkansas, California, Colorado, Connecticut, Delaware, District of Columbia, Florida, Georgia, Hawaii, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin, Wyoming (USFWS, 2021).

Distribution within Action Area

The Monarch Butterfly is known or believed to occur statewide in Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin (USFWS, 2021).

Critical Habitat

No critical habitat has been designated for the Monarch Butterfly.

Life History

During the breeding season, Monarchs lay their eggs on their obligate milkweed host plant (primarily *Asclepias* spp.), and larvae emerge after two to five days. Larvae develop through five larval instars (intervals between molts) over a period of 9 to 18 days, feeding on milkweed and sequestering toxic cardenolides as a defense against predators. The larva then pupate into chrysalis before eclosing 6 to 14 days later as an adult butterfly. There are multiple generations of Monarchs produced during the breeding season, with most adult butterflies living approximately two to five weeks; overwintering adults enter into reproductive diapause (suspended reproduction) and live six to nine months (USFWS, 2020).

The Monarch life cycle varies by geographic location. In many regions where Monarchs are present, Monarchs breed year-round, repeatedly following the above-referenced life cycle throughout the year. Individual Monarchs in temperate climates, such as eastern and western North America, undergo long-distance migration, where the migratory generation of adults is in reproductive diapause and lives for an extended period of time. In the fall, in both eastern and western North America, Monarchs begin migrating to their respective overwintering sites. This migration can take Monarchs distances of over 3,000 km and last for over two months. Migratory individuals in eastern North America predominantly fly south or southwest to mountainous overwintering grounds in central Mexico, and migratory individuals in western North America generally fly shorter distances south and west to overwintering groves along the California coast into northern Baja California. Data from Monarchs tagged in the southwestern states in the fall suggest that those in Nevada migrate to California, those in New Mexico migrate to Mexico, and those in Arizona migrate to either Mexico or California. In early spring (February-March), surviving Monarchs break diapause and mate at the overwintering sites before dispersing. The same individuals that undertook the initial southward migration begin flying back through the breeding grounds and their offspring start the cycle of generational migration over again (USFWS, 2020).

In eastern North America, Monarchs travel north in the spring, from Mexico to Canada, over two to three successive generations, breeding along the way. Individual Monarchs disperse as far north as they can physiologically tolerate based on climatic conditions and available vegetation; the most specific predictors of the northern distribution of individual Monarchs are monthly mean temperature and precipitation. The number of generations of Monarchs produced in a given year can vary between three and five and is dependent upon environmental conditions. While a majority of the eastern Monarchs shift to the more northern reaches of their range, western Monarchs continue to occupy and breed in warmer climates throughout the summer, while also expanding to include the farther reaches of their range. In the spring in western North America, Monarchs migrate north and east over multiple generations from coastal California toward the Rockies and to the Pacific Northwest. In the southwestern states, migrating Monarchs tend to occur more frequently near water sources such as rivers, creeks, roadside ditches, and irrigated gardens (USFWS, 2020).

Adult Monarch Butterflies during breeding and migration require a diversity of blooming nectar resources, which they feed on throughout their migration routes and breeding grounds (spring through fall). Monarchs also need milkweed (for both oviposition and larval feeding) embedded within this diverse nectaring habitat. The correct phenology, or timing, of both Monarchs and nectar plants and milkweed is important for Monarch survival. The position of these resources on the landscape is important as well. In western North America, nectar and milkweed resources are often associated with riparian corridors, and milkweed may function as the principal nectar source for Monarchs in more arid regions. Individuals need nectar and milkweed resources year-round in nonmigratory populations. Additionally, many Monarchs use a variety of roosting trees along the fall migration route (USFWS, 2020).

Migratory individuals of eastern and western North America require a very specific microclimate at overwintering sites. The eastern population of Monarchs overwinter in Mexico, where this microclimate is provided by forests primarily composed of oyamel fir trees (*Abies religiosa*), on which the Monarchs form dense clusters. The sites used for overwintering occur in mountainous areas west of Mexico City located between elevations of 2,900 and 3,300m. The temperature must remain cool enough to prevent excessive lipid depletion, while at the same time staying warm enough to prevent freezing. Exposure to these cooler temperatures also helps orient the Monarchs northward in the spring. The oyamel fir forest provides essential protection from the elements, including rain, snow, wind, hail, and excessive solar radiation. Many sites also provide a source of hydration via nectar plants or a water source. Most of the observed overwintering sites are located within the Monarch Butterfly Biosphere Reserve, which covers over 56,000 ha. Migratory information for the western population available in (USFWS, 2020).

Current Stressors and Threats

There are a myriad of influences operating on the North American populations. The primary drivers affecting the health of the two North American migratory populations are changes in breeding, migratory, and overwintering habitat (due to conversion of grasslands to agriculture, urban development, widespread use of herbicides, logging/thinning at overwintering sites, unsuitable management of overwintering groves, and drought), continued exposure to insecticides, and effects of climate change. Expert-elicited rank and extent of impact (% contribution to the decline from the historical period) of the influences on the eastern North American population:

1) Availability, spatial distribution, and quality of milkweed (25%)
2) Availability and quality of overwintering habitat (20%)
3) Climate (storms, drought, temperatures) (12.5%)
4) Availability, quality, and spatial distribution of migration resources (12%)
5) Disease and natural enemies (9.5%)
6) Insecticides (8%)

7) Availability, spatial distribution, and quality of nectar resources (breeding) (5%)
8) Road mortality and pollutants (3%)
9) Biogeographical scrambling of milkweed spp. (includes non-native spp.) (2%)
10) Other (2%)
11) Monarch releases, captive breeding, and translocation (1.5%)

Each of these impacts is discussed in detail in the Species Status Assessment (USFWS, 2020).

List of References

U.S. Fish and Wildlife Service (USFWS). (2020). Monarch (*Danaus plexippus*) species status assessment report, version 2.1. 96pp.

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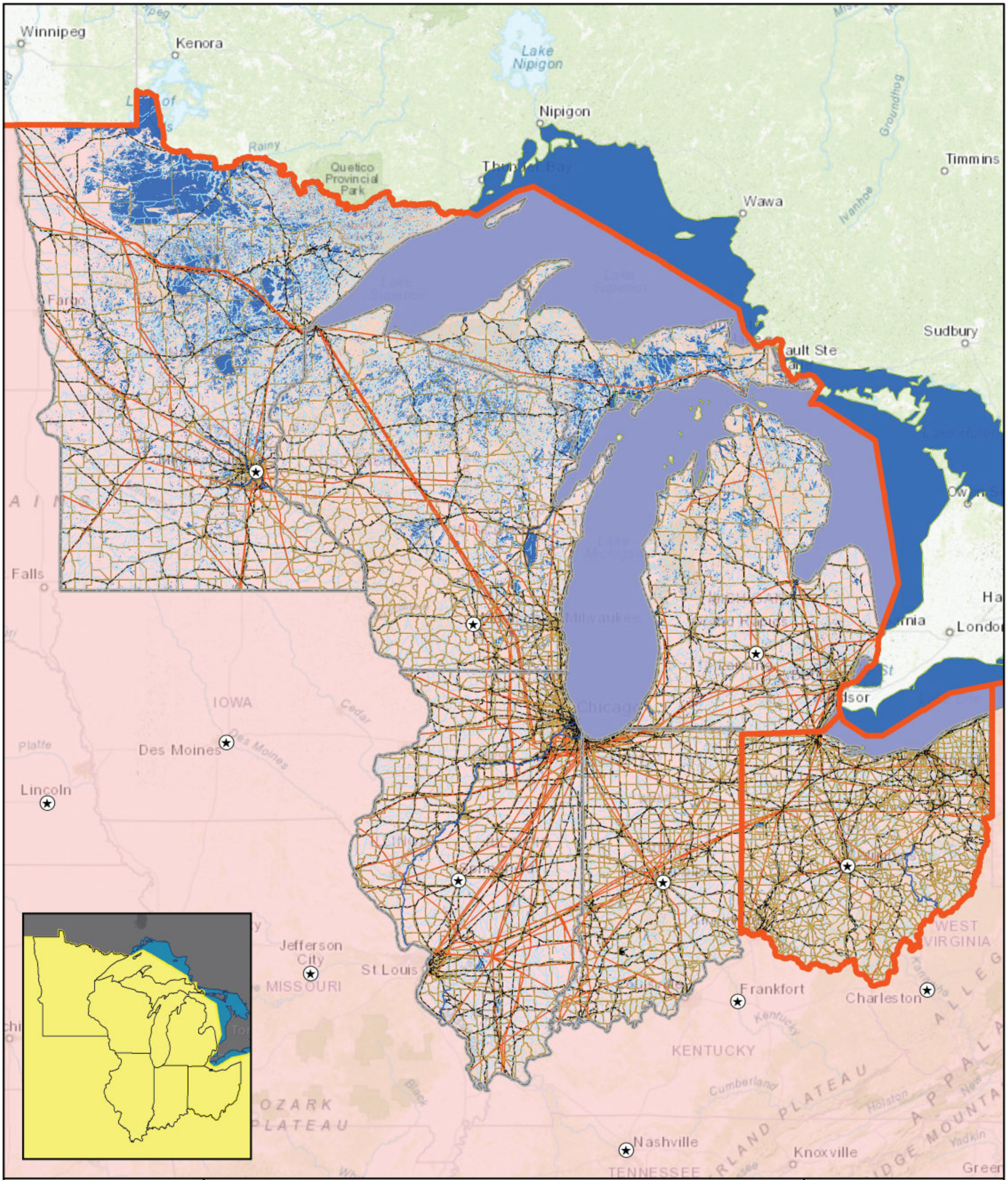

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Miles
0 30 60 120 180 240
Kilometers

MONARCH BUTTERFLY (*DANAUS PLEXIPPUS*) ACTION AREA OVERVIEW MAP

SCALE 1:10,000,000

- Petroleum Pipeline
- Major Road
- Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- Lakes & Ponds
- 1-Mile Coastal Inland Buffer
- Action Area
- Monarch Butterfly (*Danaus plexippus*) Counties of Occurrence

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Basemap courtesy of Esri.

Date: 5/25/2021

Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS

Projection: WGS 1984 Web Mercator

Poweshiek Skipperling (*Oarisma poweshiek*)

Federal Listing: Endangered
State Listing within the AA: Endangered in Michigan, Minnesota, and Wisconsin

Species Description

The Poweshiek Skipperling is a small butterfly, more delicate looking than most "grass" skippers (subfamily Hesperiinae). The forewing length (base to apex) is 1.4 to 1.6cm (0.55 to 0.63in) in both sexes. Antennae are short and relatively stout and have blunt-tipped clubs. Although capable of rapid flight, this skipper more typically flies erratically just above the grasses at a speed that is relatively easy to follow with the eye. Its flight rarely exhibits the "skipping" quality that gives the family its name. Males and females are very similar in appearance apart from the thicker, heavier abdomen females have for a few days after eclosing. The upper surface of the wings is a uniform dark brown with a purplish gloss in fresh individuals, except for a splash of glossy orange along the leading edge of each forewing. Males do not have a brand on the forewing as most grass skippers do. The under surface of the hind wings is distinctive, having a pale finely pinstriped look created by white veins on a hoary gray-brown ground color. There are a couple of surface features that differ between the sexes but these are difficult to assess in the field. The forewing fringe of females is slightly paler on the upper side than that of males. Most reliably diagnostic, the antennae of females have alternating pale and brown annulations along their upper side while in males this surface is a smooth even golden color, but magnification is required for determination (MNDNR, 2018).

Species Distribution

Habitats utilized by the Poweshiek Skipperling in Minnesota include wet to dry native prairie but not sand prairie. The same is reported for the Dakotas, though moist prairie seems to be favored there. A reported preference for wet prairie in Wisconsin has been interpreted as an artifact of greater fire-mortality in upland prairie habitat. The habitat in Michigan is a type of open wetland known as prairie fen.These are plant communities on peaty soils saturated by upwelling calcareous groundwater; wetland-obligate sedges dominate, but several grasses characteristic of prairie communities are present as well. Interestingly, the Poweshiek Skipperling has never been reported from sedge-dominated wet meadow or fen in Minnesota. Habitats dominated by nonnative grasses such as Kentucky bluegrass (*Poa pratensis*), smooth brome (*Bromus inermis*), and redtop (*Agrostis gigantea*) do not appear to be suitable for this skipper (MNDNR, 2018).

In the United States, there are historic records for the Poweshiek Skipperling from eight states (Illinois, Indiana, Iowa, Michigan, Minnesota, North Dakota, South Dakota, and Wisconsin) and one Canadian province (Manitoba). The only confirmed records for Illinois and Indiana are very old and it is presumed extirpated in both of those states. Poweshiek Skipperlings have been recently extant (e.g. since 2000) in each of the other states (Selby, 2010). Currently in the US, the species is known to or is believed to occur in Iowa, Michigan, Minnesota, North Dakota, South Dakota, and Wisconsin (USFWS, 2021)

Distribution within Action Area

- Michigan: Hillsdale, Jackson, Lenawee, Livingston, Oakland, and Washtenaw Counties
- Minnesota: Only known or believed to occur in Polk County, although critical habitat is designated in additional counties (see below)
- Wisconsin: only known or believed to occur in Green Lake and Waukesha Counties

Critical Habitat

In total, approximately 25,888 acres (10,477 hectares) in Cerro Gordo, Dickinson, Emmet, Howard, Kossuth, and Osceola Counties, Iowa; Hilsdale, Jackson, Lenawee, Livingston, Oakland, and Washtenaw Counties, Michigan; Chippewa, Clay, Cottonwood, Douglas, Kittson, Lac Qui Parle, Lincoln, Lyon, Mahnomen, Murray, Norman, Pipestone, Polk, Pope, Swift, and Wilkin Counties, Minnesota; Richland County, North Dakota; Brookings, Day, Deuel, Grant, Marshall, Moody, and Roberts Counties, South

Dakota; and Green Lake and Waukesha Counties, Wisconsin, fall within the boundaries of the critical habitat designation for Poweshiek Skipperling (80 FR 59248).

Life History

The Poweshiek Skipperling has a single annual generation. Adults have been recorded from the last week of June into the first week of August (in Minnesota), but in a typical year most adults fly between the end of June and the middle of July. Eggs hatch in about ten days, and the partly grown larvae overwinter and complete development the following spring. The grass skippers are so called because their larval food plants are restricted to grasses or sedges. A spike-rush (*Eleocharis elliptica*) has frequently been cited as the larval food plant of the Poweshiek Skipperling based on an early report of egg-laying on this member of the sedge family (Cyperaceae) in Michigan. However, observations in Minnesota and Wisconsin indicate that prairie grasses, especially prairie dropseed (*Sporobolus heterolepis*) and little bluestem (*Schizachyrium scoparium* var. *scoparium*), are probably the most important larval hosts. Apparently, females do not restrict egg-laying to suitable host plants but leave it to larvae to find them. Unlike most skippers, Poweshiek larvae do not construct shelters but rest head down on grass blades or stems when not feeding. Larvae overwinter in a similar position on stems. Males seek mating opportunities through meandering search flights above and among the tops of grasses. This mate-seeking behavior is known as "patrolling" and is different from the perch-chase behavior of many grass skippers. Females probably mate soon after they become capable of flight, but whether they mate with more than one male is unknown. Research in Canada has found that adults may live up to 10 to 12 days in the wild, but the average is probably about a week. Nothing is known about the dispersal behavior of mated females.

Current Stressors and Threats

The most comprehensive discussion of threats and stressors comes from COSEWIC (2013) and is summarized here:

- Conversion of habitat to non-grassland
  Since the 1850s, over 99% of the native North American prairie habitat has been converted to agricultural row crops or plowed and then converted to hay fields. Agricultural habitats are completely unsuitable for Poweshiek Skipperling. Remnant prairies where Poweshiek Skipperling now occurs are generally unsuitable for row-crop agriculture because of the shallow, rocky, highly calcareous soils.
- Grazing
  Tall-grass prairies appear to be very susceptible to the effects of overgrazing, which reduces or eliminates critical adult nectar sources for Poweshiek Skipperling and removes forage for larvae, thereby making the habitat unsuitable for the skipper.
- Haying
  Haying may either be detrimental or beneficial to Poweshiek Skipperling populations, depending on when in the season it is done. Mowing prairies and removing the cuttings helps to maintain the prairie flora and vegetation structure by preventing or delaying succession to woody plants and reducing the accumulation of litter on the soil. However, if mowing is done before or during the flight period, the critical nectar sources are eliminated and exotic grasses such as *P. pratensis* are favored. These changes can eliminate Poweshiek Skipperling and other specialist prairie skippers from the prairie.
- Controlled burning
  Wildfires were an important element for sustaining the flora and fauna of native prairies prior to their destruction. Now, prescribed or controlled burns are often used by managers to maintain the native grassland structure and floral complexes. These burns differ from wildfires in that remnant prairies are often burned far more frequently, more thoroughly, and at times during the season when natural wildfires would not normally occur. Although prescribed burns may be beneficial for maintaining the prairie flora, they may be devastating to certain insect species. Prescribed burning of isolated prairies can cause local extirpation of certain species of insects, especially habitat specialists like Poweshiek Skipperling. Prior to the destruction of the prairies, burns were patchy, which allowed recolonization of these sites by skippers from adjacent unburned areas.

- Succession
  Prairies that are protected from all activities, such as grazing, mowing or prescribed burns, will eventually become unsuitable for many prairie species of plants and insects because of the growth of woody shrubs and taller grasses, accumulation of litter, reduction of nectar sources, and invasion by such exotic plants as *B. inermis*. It appears that some form of disturbance is required for the long-term persistence of prairie habitat suitable for Poweshiek Skipperling.
- Exotic species
  Exotic plants, such as Leafy Spurge, Kentucky Blue Grass, and Smooth Brome, are significant threats to native prairie habitats in North America. Purple Loosestrife is a potential major threat to the wet tall-grass prairie habitats. Aggressive invaders can completely out-compete much of the native flora in wetlands and other seasonally flooded habitats. Once weeds invade a site, they can outcompete and replace the native plants required by Poweshiek Skipperling., making the habitat unsuitable for this insect.
- Habitat fragmentation
  Poweshiek Skipperling probably formerly existed as essentially a single population throughout much of the almost continuous tall-grass prairie in the north central plains of North America. Now, it occurs as a series of isolated populations throughout much of its range. Long-distance dispersal over more than a few kilometres is unlikely in this species. Unless source populations exist within a few kilometres, it is unlikely that a population eliminated by fire, overgrazing or other causes will be re-founded by immigrants.

List of References

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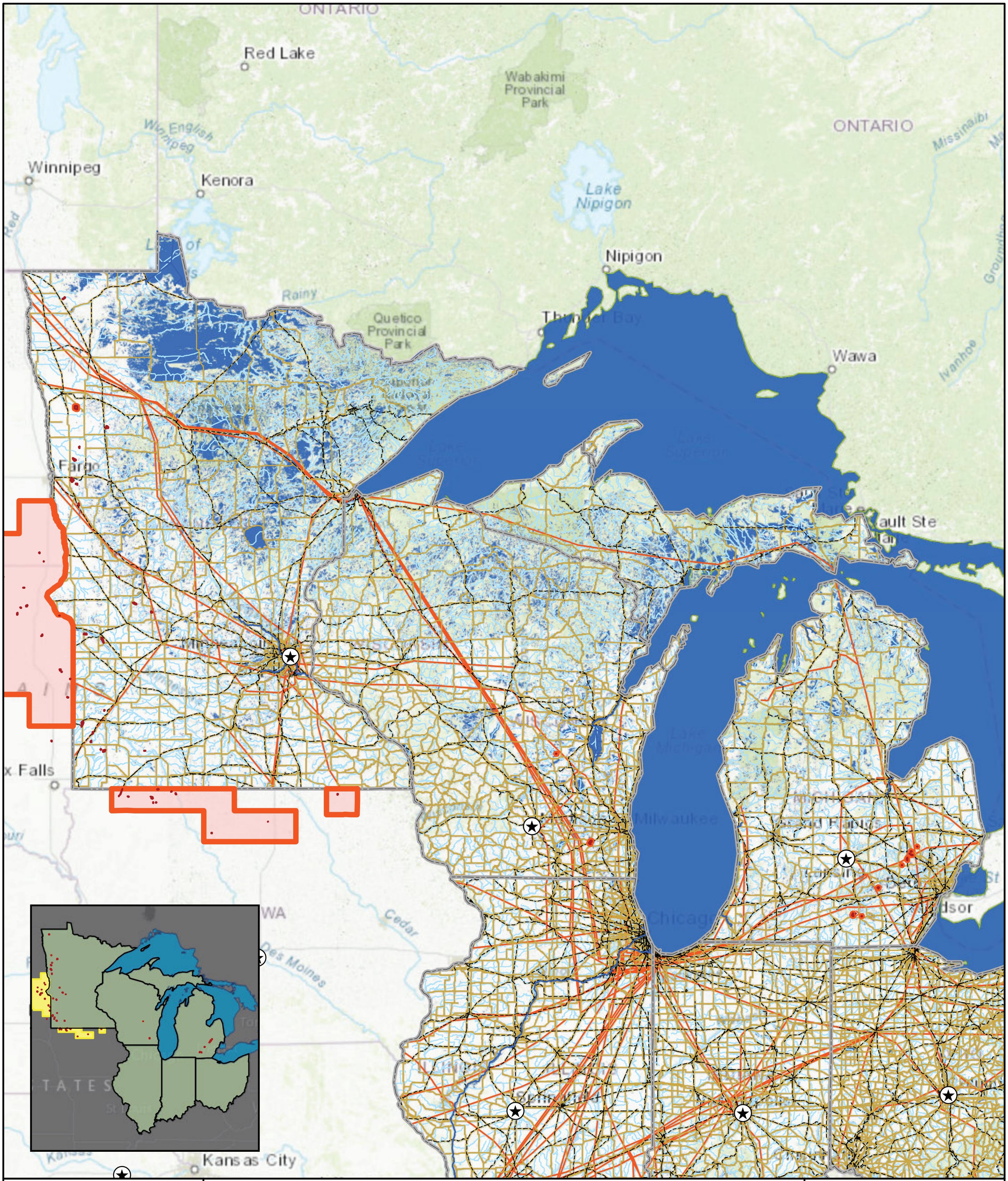

0 30 60 120 180
Miles
0 30 60 120 180 240
Kilometers

POWESHIEK SKIPPERLING (*OARISMA POWESHIEK*) ACTION AREA OVERVIEW MAP

SCALE 1:9,000,000

- Petroleum Pipeline
- Major Road
- Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- Lakes & Ponds
- 1-Mile Coastal Inland Buffer
- Action
- Poweshiek Skipperling (*Oarisma poweshiek*) Critical Habitat
- Poweshiek Skipperling (*Oarisma poweshiek*) Counties of Occurrence

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Basemap courtesy of Esri.
Date: 6/14/2021
Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS, EIA
Projection: WGS 1984 Web Mercator

Rattlesnake-Master Borer Moth [Eryngium Stem Borer] (*Papaipema eryngii*)

Federal Listing: Not Listed. The U.S. Fish & Wildlife Service announced in 2020 findings that the Rattlesnake-Master Borer Moth (RMBM) did not warrant listing as Endangered or Threatened under the Endangered Species Act (85 FR 44478).
State Listing within the AA: Endangered in Illinois

Species Description

The adult RMBM measures 3.5 to 4.8cm (1.4 to 1.9in) in wingspan. Both sexes are purple-brown with small, scattered yellow and white spots. Flight-worn moths appear lighter in color after darker scales have fallen away after a few nights of flying and crawling through vegetation, although the large white spots typically remain distinctive. Males have distinctive genitalia that allow distinction from other *Papaipema*. RMBM larvae appear similar to other *Papaipema* larvae but retain longitudinal white and purplish-striped markings until the last instar, when the purple fades and the larvae become mostly dull yellowish-white with scattered, raised, dark-brown spots (USFWS, 2020).

Species Distribution

RMBMs are obligate residents of undisturbed prairie, barrens, savanna, and woodland openings that contain rattlesnake-master, the sole larval food plant. RMBM was thought not to occur outside of a true prairie or prairie remnant; however, populations in Missouri and Arkansas were found in roadsides, savannahs, glades, and woodland openings with moist, well-drained soils (USFWS, 2020).

The historically occupied range and species condition of Rattlesnake-Master Borer Moth is not known. The species was described in 1917, and only occasional collection records exist until the 1990s. At the time of the original 12-month finding in 2013 (78 FR 49422), 16 known extant populations had been discovered since 1993. Additional surveys between 2013 and 2018 brought the total number of extant populations to 55. With more than a 98 percent decline of prairie landscapes across the U.S., it may be assumed that the currently occupied range is less than the historically occupied range. Conversion of grasslands began in the 1800s; it is feasible the species may have been lost from large parts of its historical range before the limits of its former distribution were recorded (USFWS, 2020). Currently RMBM is thought to occur in Arkansas, Illinois, Kansas, Kentucky, North Carolina, and Oklahoma (USFWS, 2021).

Distribution within Action Area

The State of Illinois has the most Rattlesnake-Master Borer Moth sites (USFWS, 2013). In Illinois, the species is historically recorded only from locations in Cook County, with multiple collections made from 1915 – 1938 across a localized area that retained larger prairie remnants containing rattlesnake master. As of 2014 there were a total of 10 element occurrences across 7 counties (Cook, Effingham, Fayette, Grundy Livingston, Marion, Will) in the Database for RMBM (Mankowski et al., 2014).

Critical Habitat

No critical habitat has been designated for the Rattlesnake-Master Borer Moth.

Life History

RMBM has a single flight per year (univoltine), with adults emerging from mid-September to early October and flying through mid-October or until killing. Larvae in southern populations emerge in mid-April to early May, up to a month before those in Illinois, but adults emerge from their pupae about a month later than northern populations, likely reflective of local temperature regimes and length of growing season. The adult flight period and breeding period is approximately 10 days of peak flight, with the greatest concentration of adults noted the last week of September. *Papaipema* females seldom fly before breeding, and Rattlesnake-Master Borer Moth is expected to follow this pattern. Adult moths live 10-14 days. Milder weather conditions in the southern 4 part of the species' range may allow the flight period to extend into November. Adult

RMBM feeding habits are largely unknown. Based on their short flight period, general scarcity of seasonal nectar sources in the fall, and large fat stores in adults, researchers postulate that adult moths likely do not feed much from nectar sources and likely use dew, puddles, aphid residue, or oozing sap for moisture and nutrients. Adults will drink from sugar water when held in captivity, extending the adult moth lifespan by several days. Based on their coloring, adult moths likely spend their days camouflaged and attached to plants or on the bottoms of leaves. Mating occurs during the flight period after which females lay eggs increases or folds on dead, dying, or green leaves of rattlesnake-master (*Eryngium yuccifolium*), where the eggs overwinter. Eggs darken a few days before larvae emerge between early May (southern portion of range) and early June. Rattlesnake-master is the only food source for the larvae, which are internal plant feeders, boring into stems and root of the host plant. The first larval instar often feeds behind new growth of a leaf or stem until capable of chewing into the harder growth and then enters the stem. Subsequent instars bore into the leaf whorl and burrow down to the root. Larvae generally finish feeding by mid- to late July after reaching the root crown and then begin to burrow into the bulb or root. The fifth instar will then stay in the root chamber and aestivate for several weeks before triggered to pupate in mid-August to mid-September. Pupation appears to take place either inside the feeding chamber in the root or in the soil next to the root and lasts 3-4 weeks. Before pupation, larvae may construct a short silken tube to the soil surface to allow the emerging moth to reach the surface. During the time of actively boring into the host plant, some larvae exhibit competitive behavior by moving into already occupied bore holes, killing the occupant and consuming it or pushing it back out. Multiple larvae may occur in a single stem early in the season, but by early June, only one larva remains. Those not killed and eaten by cannibalistic larvae move to another plant. When an older larva is located in a host plant insufficient for its needs, the larva can move to a different host plant on which it continues to develop normally, although this plant-to-plant movement is uncommon. One rattlesnake-master clump may contain multiple stems and multiple larvae. Although there are no specific data on their home range, RMBMs are not thought to disperse widely and have been described as “relatively sedentary”. RMBM appear to be capable of dispersal of up to 2 miles (3.2km) if the number of host plants is limiting. Recolonization of sites after prescribed fires in Missouri show that adult moths are able to fly at least two miles to seek out new breeding habitat. Farther dispersal may be aided by wind or severe weather events, and some females appear to disperse more widely just before death (USFWS, 2020).

Current Stressors and Threats

Management of the vegetation in an area occupied by Rattlesnake-Master Borer Moth can positively or negatively affect the species. Timing, intensity, type, frequency, and spatial rotation through a site are components of a land management strategy that have the potential to affect the species’ persistence and viability on a site through the effects on the rattlesnake-master host plant. Types of management actions that may affect the species are listed below (USFWS, 2020). See USFWS, 2020 and 78 FR 49422 for discussion of these stressors/threats.

- Habitat loss or fragmentation (native prairie and host plant decline)
- Grazing/mowing
- Lack of habitat management (succession)
- Fire

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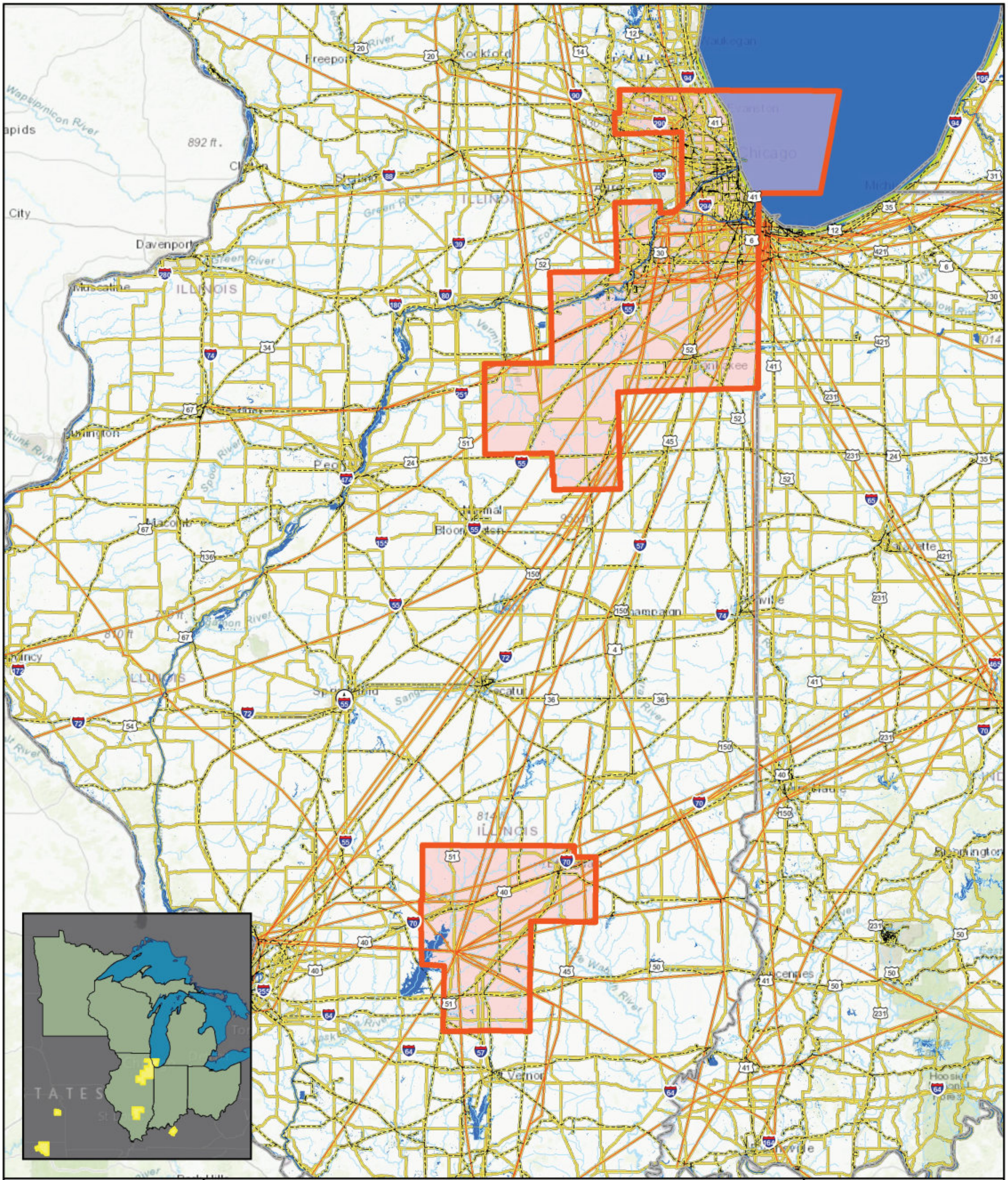

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Miles
0 10 20 40 60 80
Kilometers

RATTLESNAKE MASTER BORER MOTH (*PAPAIPEMA ERYNGII*) ACTION AREA OVERVIEW MAP

SCALE 1:3,000,000

Petroleum Pipeline
Major Road
Railroad
Commercial Navigable Waterway
Rivers & Streams
Lakes & Ponds
1-Mile Coastal Inland Buffer
Action Area
Rattlesnake Master Borer Moth (*Papaipema eryngii*) Counties of Occurrence

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Basemap courtesy of Esri.
Date: 5/25/2021
Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS
Projection: WGS 1984 Web Mercator

Regal Fritillary (*Speyeria idalia*)

Federal Listing: Under Review. This species was petitioned for Federal listing under the Endangered Species Act in 2013, and a 90-day finding was issued in 2015 (80 FR 56429).
State Listing within the AA: Endangered in Indiana, Ohio, Michigan, and Wisconsin; Threatened in Illinois; Special Concern in Minnesota

Species Description

The Regal Fritillary is a large, brushfooted butterfly with a wingspan of 67 to 105mm (2⅝ to 4⅛ in). It is similar in size to the Monarch butterfly (*Danaus plexippus*). Females are slightly larger than males. The upperside of the forewing is bright red-orange with black markings. On females the forewing is edged with a black marginal band with a postmedian row of white spots. The upperside of the hindwing is black with a postmedian row of white spots. There is also a submarginal row of spots that is orange on males and white on females. The underside of the forewing is orange with a marginal band of white spots and a black fringe. The hindwing is dark greenish brown with elongate white spots. Regal Fritillary eggs are initially "white or cream colored" and then darken to a frost gray. Larvae can be ochre-yellow to orangish, yellow on the rear with yellow lines and black spots. Larvae are about 2.03mm (0.08in) long when they hatch, and they reach a length of 44.45mm (1.75in) when fully developed. Pupae are light mottled brown tinged with pink, with small black spots on the wings and thorax, short dorsal cones, and yellow transverse bands on the abdomen and reach a size of about 27.94mm (1.10in) in length. No butterfly anywhere in the world resembles the Regal Fritillary. The species' hindwings are unique, being a velvety, blue-black with two bands of spots. Because of size, females could be mistaken for a Monarch at great distances (WildEarth Guardians, 2013).

Species Distribution

Regal Fritillary butterflies live in tall-grass prairie and other open and sunny locations such as damp meadows, marshes, wet fields, and mountain pastures. In Michigan, regal fritillaries inhabit prairie or open environments frequently in sandy regions, including meadows, old fields, and floodplain forest openings and edges (MNFI, 2021). Wisconsin has identified Regal Fritillary habitat in the state as large grassland areas with prairie remnants or lightly grazed pasture lands containing prairie vegetation where topography often includes hills and valleys (WIDNR, 2020). The Regal Fritillary is strongly associated with native prairie habitat. Adults are encountered in both upland prairies and in wet prairies, although larval development may be restricted to upland prairie in Minnesota (MNDNR, 2021). In Illinois it lives in sand prairies, tallgrass prairies, savannas, dunes and other wet areas associated with sand (IDNR, 2021).

Historically the Regal Fritillary's range covered more than a million square miles; today the species' range is less than half that size. Its historical range extended from Nova Scotia, south to northern Georgia, west to the Dakotas and eastward to the Atlantic coast. The Regal Fritillary is currently restricted to tall-grass prairie remnants. Its core range is in Kansas, Missouri, and Nebraska. It is very rare or at best locally frequent in its entire range and has almost disappeared from its range east of the Mississippi. There has been a drastic loss of range since 1980, probably especially since 1987. The southwestern limit still is extreme eastern Colorado, Kansas and extreme northeastern Oklahoma but it has disappeared from western North Dakota while persisting in the eastern part. Regals are historic or extirpated in all six New England states; Canada (if ever really established), New York, New Jersey, Maryland, Delaware, probably West Virginia, Ohio, probably Indiana, and Michigan. By the late 1990s, a large population in central Pennsylvania (still extant in 2006) and another in Virginia were the only actually located extant occurrences east of the Illinois-Indiana border region, although there was one apparently reliable observation in western North Carolina in 1994. The Regal Fritillary is rapidly declining in the prairie states of Illinois, Iowa and Wisconsin. While it has been recorded in southern Ontario and Manitoba, it probably does not have permanent colonies in Canada (WildEarth Guardians, 2013).

Distribution within Action Area
Specific county listings are not provided in ECOS. However, the species is known or believed to occur in Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin.

Critical Habitat
No critical habitat has been designated for the Regal Fritillary.

Life History
Adult regal fritillaries are nectarivores, while juveniles are herbivores. Adults feed on nectar from various flowers such as milkweeds, thistles, red clover, and mountain mint. However, no single nectar genus is crucial and nectar resources nearly always change over the lifetime of at least females. If a reliable source of nectar is not available, adult regal fritillaries will emigrate from an area quickly. The Regal Fritillary has demanding nutritional requirements due to its extended adult lifespan. Most butterflies use nectar resources primarily to meet energy needs, but many long-lived butterflies also use food resources for egg production. Adult food limitations may lead to decreased fecundity and fertility. Violets are the sole larval food source. The violet leaves must be from young or intermediately aged plants (WildEarth Guardians, 2013).

The Regal Fritillary's single flight period takes place between mid-June and mid-September (the timing of the flight period varies across the range and can vary significantly from year to year due to weather). Females emerge one to two weeks after the males and generally mate upon emergence. However, they do not lay eggs until at least three weeks after mating, between late August and early September. This extended period of time between mating and oviposition is known as "reproductive diapause" and is rare in other North American Lepidoptera. This appears to be an adaptation to the lifecycle of the larval food source—violets. The extended time period between mating and oviposition during the heat of the summer and the overwintering of larvae allow the caterpillars to emerge in the spring when violet hostplants are young. The Regal Fritillary females may lay more than 2,000 eggs. Females lay single eggs throughout their habitat even if the host violets are not present. Eggs are laid on vegetation, dead leaves, and pebbles and hatch in about 3-4 weeks. Once the caterpillars hatch, they enter diapause immediately and overwinter unfed. After becoming active in the spring, they eat the leaves of young violets. The pupal stage lasts two and a half to four weeks. June is typically the beginning of adult male emergence, although emergence may start as early as late May in the warmest part of the specie's range. Not much is known about the dispersal behavior of the Regal Fritillary. While some disperse for miles, adults usually stay in their natal area, at least for several weeks. The Minnesota Department of Natural Resources (MNDNR, 2021) describes regal fritillaries as powerful fliers, capable of ranging widely across the landscape, and further describes dispersal behavior: Adults are rarely encountered away from native prairie remnants, and they appear to have a strong tendency to remain within the boundaries of these. However, adults are frequently observed in remnants too small to produce self-sustaining populations, suggesting that dispersal among remnants is common. Regals are strong flyers and sometimes disperse over tens of kilometers or more, though it is their tendency to remain within the bounds of their natal prairie, especially if it is surrounded by trees, croplands, or roads. Adult Regal Fritillary males live about a month, dying about 2 weeks after mating. Females probably live approximately two months. Mortality for the Regal Fritillary is particularly high during the larval stage. The larva must survive winter and then locate a violet hostplant in spring, which it cannot detect from a distance of more than 1 to 2cm. Larvae are also extremely susceptible to disease, parasitoids, and direct and indirect mortality from fires that consume the vegetation where they are sheltered.
(WildEarth Guardians, 2013).

Current Stressors and Threats
- Grassland conversion
- Prescribed burning and wildfires
- Grazing effects
- Exotic species

- Pesticides
- Overutilization for commercial, recreational, scientific, or educational purposes
- Environmental factors

Historic loss, fragmentation, and degradation of the prairie landscape have been the primary factors contributing to the decline and current vulnerability of Regal Fritillary populations, and continued habitat loss, fragmentation, and degradation are the greatest threats to future populations. Activities that threaten further habitat loss and fragmentation include row crop agriculture, urban development and housing construction, road construction and maintenance, gravel mining, and wind generators. Threats to habitat quality and the availability of critical resources (e.g., nectar plants, larval food plants) include indiscriminate use of herbicides, invasive exotic species, and encroachment by woody vegetation (native and exotic). Fire, grazing, and haying can play important roles in maintaining and shaping prairie ecosystems, so the complete absence of these influences can constitute a threat to the extent and quality of prairie remnants. However, they can also pose direct and indirect threats to regal fritillaries depending on their timing and intensity. Larvae in the leaf litter are extremely vulnerable to direct mortality from fires and indirect mortality from increased exposure after the fires remove the protective litter layer. Improperly timed fires, grazing, and haying can all impact the availability of nectar and larval food resources at critical times. Other more direct threats to regal fritillaries can include extreme weather (e.g., harsh winters, late frosts, unusually cool and wet growing seasons, and severe storms), indiscriminate use of insecticides, disease, and predation. A reduction in fitness resulting from genetic isolation may also pose a long-term threat (Selby, 2007).

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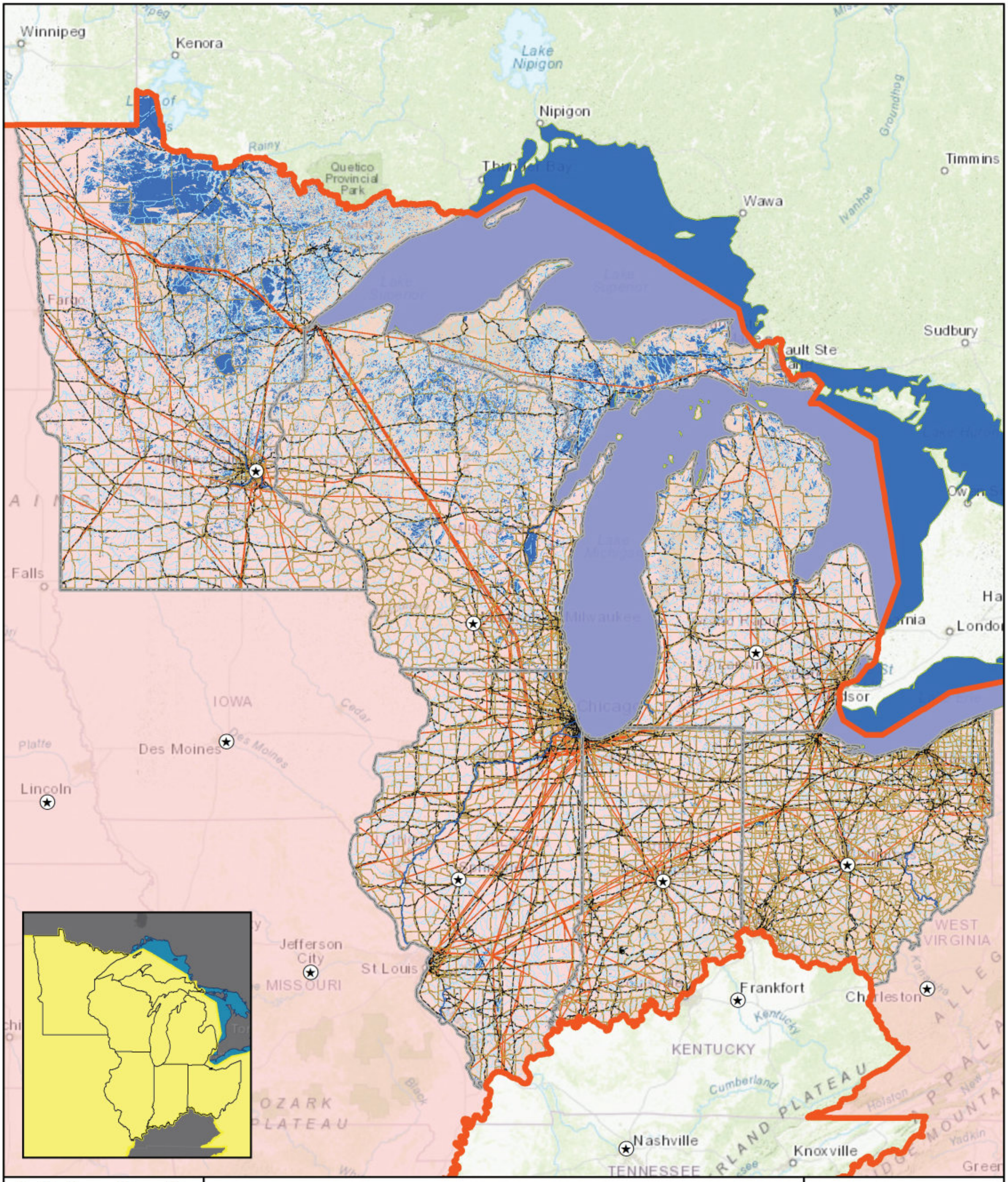

0 30 60 120 180
Miles
0 30 60 120 180 240
Kilometers

REGAL FRITILLARY (*SPEYERIA IDALIA*) ACTION AREA OVERVIEW MAP

SCALE 1:10,000,000

- — Petroleum Pipeline
- — Major Road
- ------ Railroad
- — Commercial Navigable Waterway
- — Rivers & Streams
- ■ Lakes & Ponds
- 🟩 1-Mile Coastal Inland Buffer
- 🟨 Action Area
- ▭ Regal Fritillary (*Speyeria idalia*) Counties of Occurrence

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Basemap courtesy of Esri.
Date: 5/25/2021
Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS
Projection: WGS 1984 Web Mercator

Rusty Patched Bumble Bee (*Bombus affinis*)

Federal Listing: Endangered
State Listing within the AA: Endangered in Michigan and Ohio

Species Description

The Rusty Patched Bumble Bee (RPBB) is a eusocial (highly social) organism forming colonies consisting of a single queen, female workers, and males. Colony sizes are considered large compared to other bumble bees, and healthy colonies may consist of up to 1,000 individual workers in a season. Queens and workers differ slightly in size and coloration; queens are larger than workers. All RPBB have entirely black heads, but only workers and males have a rusty reddish patch centrally located on the abdomen.

Species Distribution

The current range consists of Illinois, Indiana, Iowa, Maine, Massachusetts, Minnesota, Ohio, Virginia, West Virginia, Wisconsin, and Ontario, Canada. Detailed mapping, including potential zones for the species can be found at https://www.fws.gov/midwest/endangered/insects/rpbb/rpbbmap.html.

Historically, the species was widely distributed across areas of Quebec, North Dakota, South Dakota, Minnesota, Wisconsin, Iowa, Missouri, Illinois, Kentucky, Tennessee, Indiana, Michigan, Ontario, Ohio, Pennsylvania, New York, Vermont, Maine, Massachusetts, New Hampshire, Delaware, Rhode Island, Connecticut, New Jersey, Maryland, Virginia, District of Columbia, West Virginia, North Carolina, South Carolina, and Georgia.

Distribution within Action Area

- Illinois: 25 counties
- Indiana: Fountain, Hamilton, Lake, Marion, Montgomery, and Parke Counties
- Minnesota: 29 counties
- Ohio: Lucas and Wood Counties
- Wisconsin: 39 counties

Critical Habitat

No critical habitat has been designated for the Rusty Patched Bumble Bee.

Life History

RPBB annual cycle begins in early spring with colony initiation by solitary queens and progresses with the production of workers throughout the summer and ending with the production of reproductives, males and new queens, in mid to late summer and early fall. The males and new queens disperse to mate and the original founding queen, males, and workers die. The new queens go into diapause (a form of hibernation) over winter. The following spring, the queen, or foundress, searches for suitable nest sites and collects nectar and pollen from flowers to support the production of her eggs, which are fertilized by sperm she has stored since mating the previous fall. She is solely responsible for establishing the colony. As the workers hatch and the colony grows, they assume the responsibility of food collection, colony defense, and care of the young, while the foundress remains within the nest and continues to lay eggs. During later stages of colony development, in mid-July or August to September, the new queens and males hatch from eggs. At the end of the season the foundress dies and the new queens (gynes, or reproductive females) mate before hibernating. RPBB has been observed and collected in a variety of habitats, including prairies, woodlands, marshes, agricultural landscapes, and residential parks and gardens. RPBB requires areas that support sufficient food (nectar and pollen from diverse and abundant flowers), undisturbed nesting sites in proximity to floral resources, and overwintering sites for hibernating queens (USFWS, 2016).

Bumble bees are generalist foragers, meaning they gather pollen and nectar from a wide variety of flowering plants. RPBB is a short-tongued species, so they are not able to easily access the nectar in flowers with deep corollas (all of the petals of a flower). The species is one of the first to emerge early in the spring and the last to go into hibernation, so to meet its nutritional needs, RPBB requires a constant and diverse supply of flowers that bloom throughout the colony's long life cycle, from April through September. The nectar from flowers provides carbohydrates and the pollen provides RPBB with protein. The number of queens that a colony can produce is directly related to the amount of pollen that is available. It has been suggested that RPBB needs floral resources in close proximity to its nest sites, because studies of other *Bombus* species typically exhibit foraging distances of less than 1 km from their nesting sites. RPBB may also be dependent on woodland spring ephemeral flowers because of the species' early emergence in the spring and is often associated near woodland habitats. The availability of floral resources is dependent on the proper soil and precipitation conditions to sustain them. Extended periods of drought, for instance, may lessen the availability and diversity of flowering plants in a given area because plant phenology is primarily driven by temperature, precipitation, and the timing of snowmelt in the spring. RPBB nests are typically in abandoned rodent nests or other similar cavities, one to four feet below ground. RPBB nests have also been occasionally observed above ground. Little is known about the overwintering habitats of RPBB foundress queens, but other species of *Bombus* typically form a chamber in soft soil, a few centimeters deep and sometimes use compost or mole hills to overwinter. RPBB live in temperate climates and are not likely to sustain prolonged periods of high temperatures (over 35ºC [95ºF]). *Bombus* are able to fly in cool temperatures and low light levels, particularly in comparison to other bees, which can extend their daytime foraging times (USFWS, 2016).

Current Stressors and Threats

Prior to listing (in 2017), the species experienced a widespread and precipitous decline. The cause of the decline is unknown, but evidence suggests a synergistic interaction between an introduced pathogen and exposure to pesticides (specifically, insecticides and fungicides) (USFWS, 2020). The USFWS Fact Sheet (2019b) lists these factors leading to RPBB decline:

- Habitat loss and degradation
  Most of prairies and grasslands of the Upper Midwest and Northeast have been converted to monoculture farms or developed areas, such as cities and roads. Grasslands that remain tend to be small and isolated.
- Intensive farming
  Increases in farm size and technology advances improved the operating efficiency of farms but have led to practices that harm bumble bees, including increased use of pesticides, loss of crop diversity which results in flowering crops being available for only a short time, loss of hedgerows and the flowers that grew there, and loss of legume pastures.
- Disease
  Pathogens and parasites may pose a threat to the Rusty Patched Bumble Bee, although their prevalence and effects in North American bumble bees are not well understood.
- Pesticides
  The Rusty Patched Bumble Bee may be vulnerable to pesticides used across its range. Pesticides are used widely on farms and in cities and have both lethal and sublethal toxic effects. Bumble bees can absorb toxins directly through their exoskeleton and through contaminated nectar and pollen. Rusty Patched Bumble Bee nest in the ground and may be susceptible to pesticides that persist in agricultural soils, lawns and turf.
- Global climate change
  Climate changes that may harm bumble bees include increased temperature and precipitation extremes, increased drought, early snow melt and late frost events. These changes may lead to more exposure to or susceptibility to disease, fewer flowering plants, fewer places for queens to hibernate and nest, less time for foraging due to high temperatures, and asynchronous flowering plant and bumble bee spring emergence.

All of these factors are explored in detail with additional data in the SSA. The SSA additionally lists small populations dynamics and synergistic effect (multiple stressors) as threats (USFWS, 2016).

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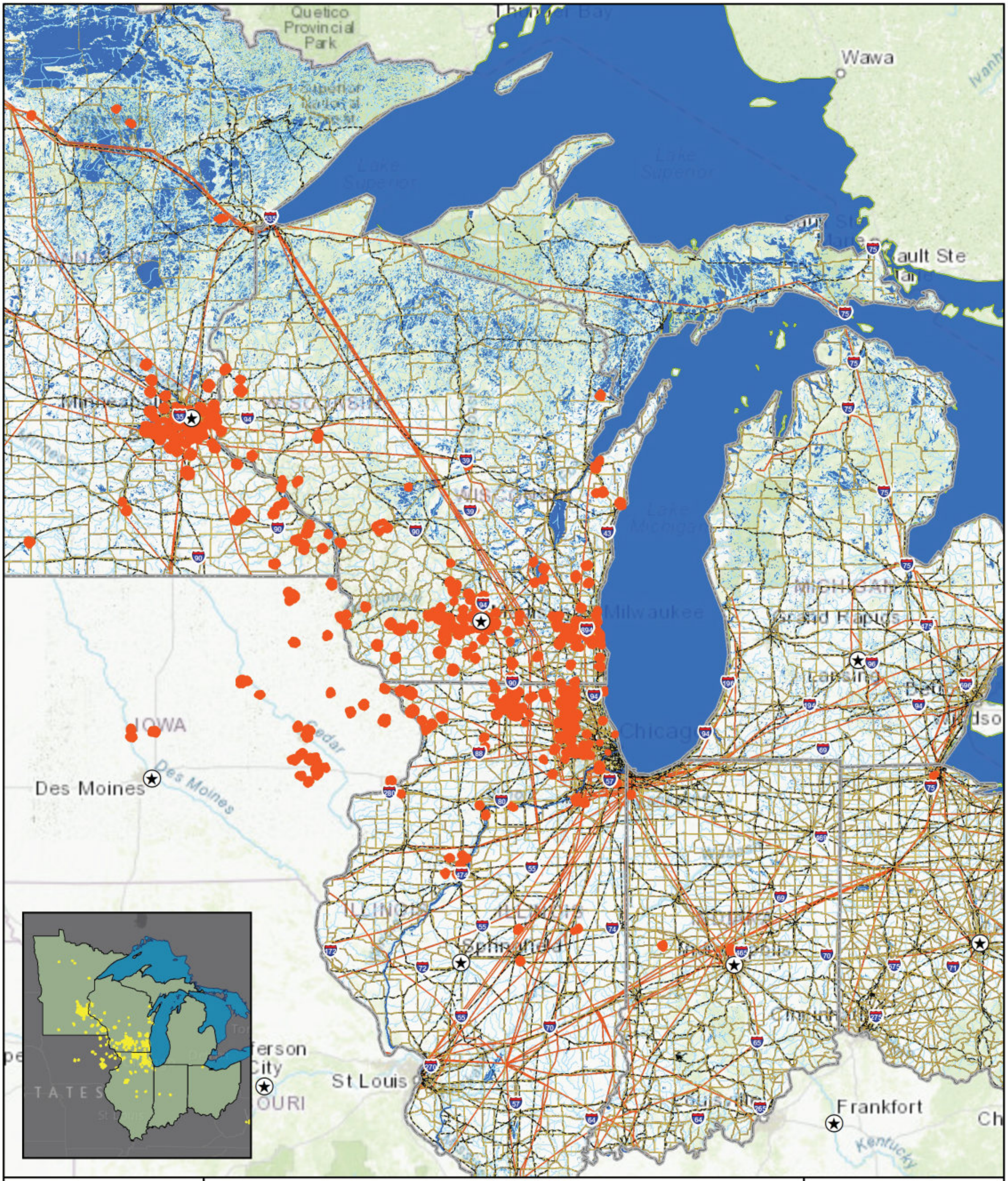

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Miles
0 25 50 100 150 200
Kilometers

RUSTY PATCHED BUMBLE BEE (*BOMBUS AFFINIS*) ACTION AREA OVERVIEW MAP

SCALE 1:7,500,000

Petroleum Pipeline
Major Road
Railroad
Commercial Navigable Waterway
Rivers & Streams
Lakes & Ponds
1-Mile Coastal Inland Buffer
Action Area
Rusty Patched Bumble Bee (*Bombus affinis*) Counties of Occurrence

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Basemap courtesy of Esri. Date: 5/25/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS Projection: WGS 1984 Web Mercator

Fishes

FISHES

Lake Sturgeon (*Acipenser fulvescens*)

Federal Listing: Under Review. The Lake Sturgeon was petitioned for Federal listing under the Endangered Species Act in 2018, and a 90-day finding was issued in 2019 (84 FR 41691).
State Listing within the AA: Endangered in Illinois, Indiana, and Ohio; Threatened in Michigan; Special Concern in Wisconsin and Minnesota

Species Description

The Lake Sturgeon is a primitive, heavy-bodied, torpedo-shaped fish, partially covered with bony plates rather than scales. The body is angular (5-sided) in young individuals, but more cylindrical in adults. The snout is short, rounded and conical and the tail is sharklike in profile (i.e. the upper lobe is longer than the lower lobe). The mouth is located on the underside of the head and the lower lip has a lobe at each corner. Four smooth barbels are located in front of the mouth. Young Lake Sturgeon are gray or brown dorsally with dusky dorsal and lateral blotches. Adults are gray to yellowish green dorsally and white ventrally. Adults can reach lengths of 8ft and weigh up to 310lbs, but this large size is rare, and more commonly, large specimens range in length over 60in. Although the male sturgeon's typical lifespan is 50 to 60 years, female sturgeon can live up to 150 years (USFWS, 2001).

As Lake Sturgeon grow older the five rows of spiny tipped, bony plates that run along the entire length of their body begin to smooth out. On older, larger individuals, the plates are barely visible, and the fish appears to be relatively smooth. The Lake Sturgeon has never evolved to the point of replacing the cumbersome plates with the smaller, thinner, flexible scales found on more modern species of fish (WIDNR, 2008).

Lake Sturgeon exhibit considerable color variation due to age and locality. Adult Lake Sturgeon in Wisconsin in generally slate-grey, olive-brown, or black over the body with a milky or yellow-white underside. Young Lake Sturgeon usually lighter in color than the adults and have dark blotches on their sides and snouts Young Lake Sturgeon caught in waters that drain to the Mississippi River are frequently confused with the smaller Shovelnose Sturgeon (*Scaphirhynchus platorynchus*). This distinct species differs from the Lake Sturgeon by their long, rounded, shovel-shaped snout; bony plates that cover the caudal fin; a long filament that extends from the upper lobe of the caudal fin; and the lack of spiracles present on the Lake Sturgeon (WIDNR, 2008).

Species Distribution

Lake Sturgeon are widely distributed in North America, being found in three major drainages: the Mississippi River, the Great Lakes, and the Hudson Bay. While they occur in the greatest abundance in the large lakes and rivers of the Great Lakes region of the United States and Canada, most of the Lake Sturgeon's natural range in the United States is in the Mississippi River Basin from the Upper Mississippi River and its major tributaries to the southern border of Arkansas. Formerly abundant throughout much of this area, the Lake Sturgeon has been drastically reduced or eliminated throughout most of its southern range (USFWS, 2001).

Distribution within Action Area

- In Illinois, Lake Sturgeon can be found in Lake Michigan where they spend most of their lives, and large and smaller rivers in early spring when they migrate to spawn as flows increase and water temperatures begin to warm.
- In Indiana, the Lake Sturgeon can primarily be found in the Wabash and White River drainages, and occasionally in other large rivers.
- In Ohio, Lake Sturgeon are probably extinct in Ohio River drainages and are likely only found in Lake Erie and associated drainages including the Maumee River and possibly the Cuyahoga River.
- In Michigan, Lake Sturgeon are found within Lake Erie (and two river drainages), Lake Huron (and five river drainages), Black Lake, Burt Lake, Mullett Lake, Otsego Lake, Lake Michigan (and eight

river drainages), Indian Lake, Big Manistique Lake, Millecoquins Lake, and Lake Superior (and two river drainages).

- In Wisconsin, Lake Sturgeon occur in Mississippi River drainages including the St. Croix, Chippewa, and Wisconsin Rivers (and major tributaries). It can also be found in Lake Michigan and Lake Superior drainages. In Minnesota, Lake Sturgeon are found in Lake of the Woods, Lake Superior, and many rivers including the Rainy, St. Croix, St. Louis, Kettle, and Red River of the North.

Critical Habitat
No critical habitat has been designated for Lake Sturgeon.

Life History
Lake Sturgeon migrate to their annual spawning grounds between late April and early June, preferring to spawn in shallow, rocky areas along riverbanks. Lake Sturgeon spawning is dependent on water temperature and flow. During seasons when water flow is high and water temperatures rise slowly spawning begins when the water temperature reaches 53ºF. In contrast, during seasons of low water flow and more rapid water temperature rise, spawning does not begin until water temperatures reach 58-59ºF (WIDNR, 2008).

Males arrive at the spawning sites ahead of the females, cruising in groups of eight or more, often so close to the surface that their tails, backs, or snouts are out of the water. Spawning begins as soon as a female enters the group. The males swim alongside the female, usually against the current, vigorously thrashing their tails as they release milt (sperm) while the female drops her eggs. The fertilized eggs, each about one-eighth inch in diameter, are sticky and cling to rocks and other solid materials in the water until they hatch. There is considerable variation in the number of eggs produced by the females of the same weight - the quantity can range from 50,000 to 700,000 eggs in one season (WIDNR, 2008).

The eggs hatch in five to eight days, depending on the water temperature. In 12 to 14 days, the fry (newly hatched fish) are 1in long and have fully developed mouths and barbels. A female sturgeon reaches sexual maturity when she is 24 to 26 years old and about 55 inches long, and will spawn once every four, five, or six years thereafter. Males mature at about 15 years, when they are about 45 inches long. Most males spawn every other year, while some do so every year. Lake Sturgeon grow larger and live longer than any other fish in its range (WIDNR, 2008).

Current Stressors and Threats

- Historic overharvesting
  Lake Sturgeon are long lived, late maturing, and sporadic spawners, and therefore are especially susceptible to overharvest. In the mid-1800's, commercial fishing operations for Lake Trout (*Salvelinus namaycush*) and Lake Whitefish (*Coregonus clupeaformis*) viewed Lake Sturgeon as a nuisance species. The sturgeon's bony scutes tore nets, and, as a result, the fish were often destroyed. By the 1880's, the value of the sturgeon for meat and roe and the production of isinglass resulted in increased harvest. Historic overharvest by commercial fishing operations is one of the major contributing factors in the demise of the Lake Sturgeon. In 1977, all commercial fishing for Lake Sturgeon in United States waters was discontinued (Galarowicz, 2003).
- Habitat degradation
- Water pollution
  Like many fish, Lake Sturgeon require stable, moderate levels of dissolved oxygen in the water to survive. Polluted waters have less available dissolved oxygen. In the winter and midsummer months, oxygen levels may drop too low to support Lake Sturgeons, resulting in mortality of the species and other fish species. Polychlorinated biphenyls (PCSs) a family of cancer-causing chemical products banned in 1972, are a special concern for Lake Sturgeon. The concentration of PCBs is greatest in sediments at the bottom of lakes and rivers where Lake Sturgeon feed. Fat-soluble PCBs are absorbed

easily by Lake Sturgeon due to their high percentage of body fat, and because the fish live for so many years, they may feed on contaminated food sources for a long time (WIDNR, 2008).

- Dams (spawning, habitat fragmentation)
  Preservation of habitat is the single most important factor in maintaining conditions for the survival of the Lake Sturgeon. Changes in habitat have seriously reduced the capacity of our waters to support the Lake Sturgeon. For example, most of the remaining Lake Sturgeon populations in the United States are restricted in movement resulting from construction of dams (the exceptions being Sturgeon River, Michigan, and the Bad River, Wisconsin). Lake Sturgeon are sometimes blocked from spawning sites or prevented from even entering a system. The construction of dams also increases siltation, which could potentially affect egg survival. In addition, hydroelectric facility operations may alter water temperature and flow regime affecting spawning habitat.

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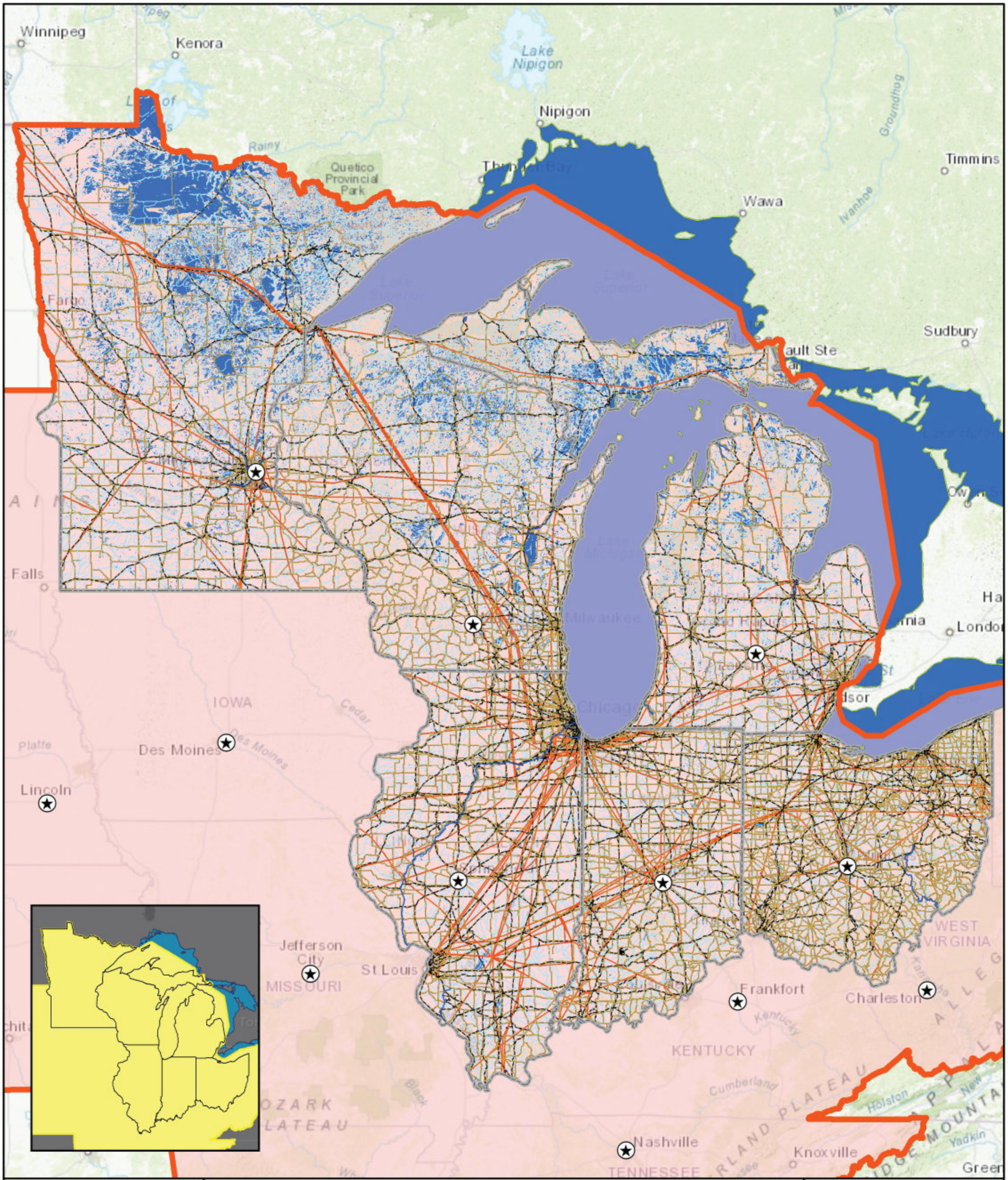

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Miles
0 25 50 100 150 200
Kilometers

LAKE STURGEON (*ACIPENSER FULVESCENS*) ACTION AREA OVERVIEW MAP

SCALE 1:10,000,000

— Petroleum Pipeline
— Major Road
------ Railroad
— Commercial Navigable Waterway
— Rivers & Streams
■ Lakes & Ponds
■ 1-Mile Coastal Inland Buffer
■ Action Area
▭ Lake Sturgeon (*Acipenser fulvescens*) Counties of Occurrence

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Basemap courtesy of Esri.
Date: 5/25/2021
Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS
Projection: WGS 1984 Web Mercator

Pallid Sturgeon (*Scaphirhynchus albus*)

Federal Listing: Endangered
State Listing within the AA: Endangered in Illinois

Species Description

Pallid Sturgeons have a unique dinosaur-like appearance. They have a flattened snout, long slender tail and are armored with lengthwise rows of bony plates instead of scales. Their mouth is toothless and positioned under the snout for sucking small fishes and invertebrates from the river bottom. The skeleton structure of a Pallid Sturgeon is primarily cartilaginous. Pallid Sturgeons can weigh up to 80lb and reach lengths of 6ft, whereas the closely related shovelnose sturgeon rarely weighs more than 8lb. The back and sides of Pallid Sturgeons are grayish-white versus the brown color of the shovelnose sturgeons (USFWS, 2019). Although in most instances Pallid Sturgeons are lighter in color than the shovelnose sturgeon, coloration cannot consistently be relied upon as a means of separating the two species (USFWS, 1993)

Pallid Sturgeon are similar in appearance to the more common Shovelnose Sturgeon. Both species inhabit overlapping portions of the Missouri and Mississippi river basins. A 1905 description of the species noted that Pallid Sturgeon differed from Shovelnose Sturgeon in size, color, head length, eye size, mouth width, barbel length ratios, ossification, gill raker morphology, number of ribs, and size of the air bladder. Bailey and Cross (1954) identified several additional differences between the two species, including barbel arrangement and position, barbel structure (i.e., diameter and papillae), and both dorsal and anal fin ray counts. They also developed a suite of diagnostic measurement ratios intended to eliminate the effects of size, age, and possibly geographic variation. In general, mature Pallid Sturgeon attain larger sizes than mature Shovelnose Sturgeon and they have longer outer barbels and shorter inner barbels with inner barbels originating anterior to outer barbels. Additionally, Pallid Sturgeon have wider mouths and naked bellies generally lack the mosaic of embedded scutes that armor the ventral surface of the Shovelnose Sturgeon (USFWS, 2014).

Several of these diagnostic characters and ratios change with age of the fish (allometric growth), making identification of juvenile and subadult fish difficult. Fishery biologists have found that in most cases morphometric ratios described in Bailey and Cross (1954) as well as subsequent indices developed by Wills et al. (2002) were not mutually exclusive when used to compare Pallid to Shovelnose sturgeon in the middle Mississippi River or when used to compare both species from different geographic reaches. Also, these indices do not work well on smaller-sized specimens. This lack of uniform applicability of morphometric indices may be attributable to greater morphological differences documented between upper Missouri River Pallid Sturgeon and Pallid Sturgeon samples in the middle and lower Mississippi and Atchafalaya rivers. Additionally, Pallid Sturgeon from the upper Missouri River live longer and grow larger than those found in the lower Missouri and Mississippi Rivers (USFWS, 2014).

Species Distribution

The historical distribution of the Pallid Sturgeon includes the Missouri and Yellowstone Rivers in Montana, downstream to the Missouri-Mississippi confluence, and the Mississippi River possibly from near Keokuk, Iowa downstream to New Orleans, Louisiana (USFWS, 2014).

Since listing in 1990, wild Pallid Sturgeon have been documented in the Missouri River between Fort Benton and the headwaters of Fort Peck Reservoir, Montana; downstream from Fort Peck Dam, Montana to the headwaters of Lake Sakakawea, North Dakota; downstream from Garrison Dam, North Dakota to the headwaters of Lake Oahe, South Dakota; from Oahe Dam downstream to within Lake Sharpe, South Dakota; between Fort Randall and Gavins Point Dams, South Dakota and Nebraska; downstream from Gavins Point Dam to St. Louis, Missouri (including Illinois); in the lower Milk and Yellowstone Rivers, Montana and North Dakota; the lower Big Sioux River, South Dakota; the lower Platte River, Nebraska; the lower Niobrara River, Nebraska; and the lower Kansas River, Kansas. Pallid Sturgeon observations and records have increased with sampling effort in the Mississippi River basin. The contemporary downstream extent of Pallid Sturgeon ends near New Orleans, Louisiana. Additionally, the species has been documented in the lower Arkansas River, the lower Obion River, Tennessee, as well as navigation pools 1 and 2, i.e., downstream from Lock and Dam 3, in the Red River, Louisiana (USFWS, 2014).

Distribution within Action Area

In Illinois, Pallid Sturgeon are very rare within the Upper Mississippi in Illinois (upstream of Lock and Dam 26 near Alton, Illinois) and are estimated at 1,600 – 4,900 individuals in the Middle Mississippi in Illinois (Mississippi River at confluence with Missouri River down to Mississippi River at confluence with Ohio River near Cairo, Illinois).

Critical Habitat

No critical habitat has been designated for Pallid Sturgeon.

Life History

Pallid Sturgeon can be long-lived, with females reaching sexual maturity later than males. Based on wild fish, estimated age at first reproduction was 15 to 20 years for females and approximately 5 years for males. Like most fish species, water temperatures influence growth and maturity. Female hatchery-reared Pallid Sturgeon maintained in an artificially controlled hatchery environment (i.e., near constant 16 to 20°C, 61 to 68°F temperatures) can attain sexual maturity at age 6, whereas female Pallid Sturgeon subject to colder winter water temperatures reached maturity around age 9. Hatchery-reared Pallid Sturgeon in the lower Missouri River reached sexual material at ages 9 and 7 for males and females, respectively. However, as of 2012, no 1997 year-class hatchery-reared Pallid Sturgeon, released in the upper Missouri River between Fort Peck Dam and Lake Sakakawea, have been found to be sexually mature. Thus, age at first reproduction can vary between hatchery-reared and wild fish and is dependent on local conditions (USFWS, 2014).

Females do not spawn each year. Observations of wild Pallid Sturgeon collected as part of the Pallid Sturgeon Conservation Augmentation Program (PSCAP) in the northern part of the range indicates that female spawning periodicity is 2 to 3 years (USFWS, 2014).

Fecundity is related to body size. The largest upper Missouri River fish can produce as many as 150,000 to 170,000 eggs, whereas smaller bodied females in the southern extent of the range may only produce 43,000 to 58,000 eggs. Spawning appears to occur between March and July, with lower latitude fish spawning earlier than those in the northern portion of the range. Adult Pallid Sturgeon can move long distances upstream prior to spawning; a behavior that can be associated with spawning migration. Females likely spawn at or near the apex of these movements. Spawning appears to occur adjacent to or over coarse substrate (boulder, cobble, gravel) or bedrock, in deeper water, with relatively fast, converging flows, and is driven by several environmental stimuli including day length, water temperature, and flow. Incubation rates are governed by and dependent upon water temperature. In a hatchery environment, fertilized eggs hatch in approximately 5 to 7 days. Incubation rates may deviate slightly from this in the wild. Newly hatched larvae are predominantly pelagic, drifting in the currents for 11 to 13 days and likely dispersing several hundred km downstream from spawn and hatch locations (USFWS, 2014).

Current Stressors and Threats

- Habitat degradation
  Modification and curtailment of Pallid Sturgeon habitat and range are attributed to large river habitat alterations, including river channelization, bank stabilization, impoundment, entrainment from energy water intake structures, and altered flow regimes (USFWS, 2014). The Pallid Sturgeon is ectothermic, that is its body temperature is dependent on water temperatures. As a result, water temperatures influence nearly every aspect of the Pallid Sturgeon life history requirements. Thus, the altered

temperature profiles of riverine habitats downstream from large bottom-release dams influence nearly every aspect of the life-history requirements and habitats of Pallid Sturgeon (USFWS, 2014).

- Water quality
  Much of the available information regarding the likely effects to Pallid Sturgeon from contaminants comes from information obtained for Shovelnose Sturgeon, which can be used as a surrogate species to evaluate environmental contaminant exposure. Shovelnose Sturgeon are considered a suitable surrogate species for Pallid Sturgeon in that they live for 20 years or longer, inhabit the same river basins, spawn at similar intervals and locations, and accumulate similar inorganic and organic contaminants. However, Pallid Sturgeon may be at greater risk than Shovelnose Sturgeon to contaminants that bioaccumulate and cause reproductive impairment because they have a more piscivorous diet, greater maximum lifespan, and a longer reproductive cycle than Shovelnose Sturgeon (USFWS, 2014). Tissue samples from three Missouri River Pallid Sturgeon and 13 other Pallid Sturgeon, mostly collected from the Mississippi River had metals (e.g., mercury, cadmium, and selenium), PCBs, and organochlorine pesticides (e.g., chlordane, dichloro-diphenyltrichloroethane, and dieldrin) at concentrations of concern (USFWS, 2014).
- Entrainment
  Another issue that can cumulatively have negative consequences for Pallid Sturgeon range-wide is entrainment loss. The loss of Pallid Sturgeon associated with cooling intake structures for power facilities, towboat propellers, dredge operations, irrigation diversions, and flood control points of diversion has not been fully quantified, but entrainment has been documented for both Pallid and Shovelnose sturgeon (USFWS, 2014).
- Disease or predation
  Little information is available implicating piscivory as a threat affecting the Pallid Sturgeon. Predation on larval and juvenile fishes of all species occurs naturally. However, habitat modifications that increase water clarity and artificially high densities of both nonnative and native predatory fishes could result in increased rates of predation. Maintaining artificially elevated populations of certain species in these reservoirs has been hypothesized as a contributing factor in poor survival of larval and juvenile Pallid Sturgeon. Walleye and Sauger (*S. canadensis*) are capable of eating wild paddlefish up to 167mm (6.6in) body length, 305mm (12in) total length and, thus, likely could consume naturally-produced Pallid Sturgeon larvae, fry, and fingerlings (USFWS, 2014).

List of References

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U.S. Fish & Wildlife Service (USFWS). (2014). Revised Recovery Plan for the Pallid Sturgeon (*Scaphirhynchus albus*). Denver, Colorado. 115pp.

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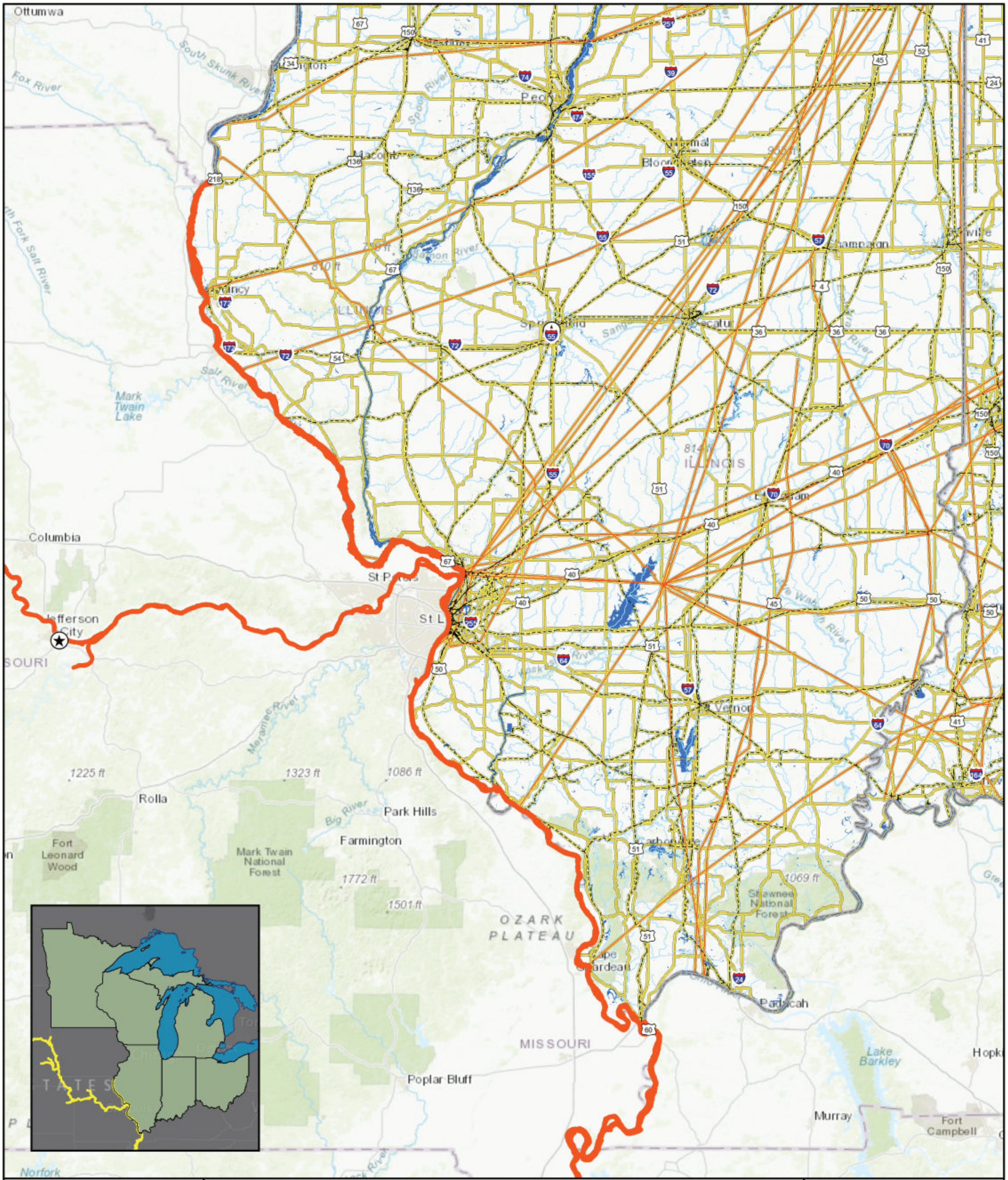

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PALLID STURGEON (*SCAPHIRHYNCHUS ALBUS*) ACTION AREA OVERVIEW MAP

SCALE 1:3,000,000

— Petroleum Pipeline	— Commercial Navigable Waterway	🟩 1-Mile Coastal Inland Buffer
— Major Road	— Rivers & Streams	🟨 Action Area
------ Railroad	🟦 Lakes & Ponds	▭ Pallid Sturgeon (*Scaphirhynchus albus*) Counties of Occurrence

N

Basemap courtesy of Esri. Date: 5/25/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS Projection: WGS 1984 Web Mercator

Popeye Shiner (*Notropis ariommus*)

Federal Listing: Under Review. The Popeye Shiner was petitioned for Federal listing under the Endangered Species Act in 2010, and a 90-day finding was issued in 2011 (76 FR 59836).
State Listing within the AA: Endangered in Ohio; Presumed Extirpated from Illinois

Species Description

The Popeye Shiner is distinguished from other similar species of shiners (genus *Notropis*) by its very large eye (proportionally the largest eye compared to other species of *Notropis*), the diameter of which is usually >1.5 times its snout length. Adult Popeye Shiners range from 55–80 mm in standard length (tip of snout to caudal fin base). The body is characterized as laterally compressed and moderately to somewhat elongate (i.e., slender), with a moderate head, round to slightly pointed snout, and a large, terminal mouth. Dorsal fin origin is above or slightly posterior to pelvic fin base. It has a complete lateral line that distinctly (shallowly) slopes from just posterior to head. Pharyngeal teeth are usually 2,4-4,2. Dorsum is dusky (scales distinctly outlined by melanophores) and pale olive to olive-green, fading ventrally to white; lower two-thirds of body silvery. Lateral stripe present and diffuses anteriorly. Breeding males have small, densely spaced, tubercles on head, body (except along breast or urosome), and pectoral fins. Breeding females may have tiny tubercles on snout. Popeye Shiners closely resemble, and can occur sympatrically with, Telescope Shiners (*Notropis telescopus*). These species can be distinguished by typical anal ray counts of 9 in *N. ariommus* (versus 10 in *N. telescopus*), and the distinctly irregular shaped and sized anterdorsolateral scales with dark margins that appear as a zig-zag pattern, and black pre-dorsal stripe, that characterize *N. telescopus* and are absent in *N. ariommus* (NEAFWA, 2018).

Popeye Shiners (*Notropis ariommus*) belong to the carp and minnow family, Cyprinidae. Popeye Shiners and Telescope Shiners were first described by Cope (1867, 1868) as two distinct species. Later, and without rationale, Kuhne (1939, as cited by Gilbert 1969) listed *N. telescopus* as a subspecies of *N. ariommus*. This led to the notion that *N. ariommus* was composed of 2–3 subspecies based on geographically distinct distributions found in the Ohio (as *N. ariommus ariommus*), Cumberland and Tennessee (as *N. ariommus telescopus*), and (possibly) White River (as *N. ariommus arcansanus*) systems. It is believed that this idea erroneously developed in response to the lack of *N. ariommus* collections since 1893, and the little collections from the Cumberland and Tennessee pre-1900s. However, Gilbert (1969) suggests that this absence of occurrence data "can be attributed to failure of ichthyologists to collect at localities [during the 1894–1948 period] where the fish [had historically] occurred." Gilbert's (1969) comprehensive assessment of the systematics and distributions of *N. ariommus* and *N. telescopus* disputed those assertions and concluded these are two distinct species, which are the taxonomic distinctions recognized today. In addition to their different morphometric and meristic characteristics, *N. ariommus* and *N. telescopus* generally have different habitat preferences. *Notropis telescopus* can occur across a variety of sized systems, from headwaters to smaller streams, and sometimes larger rivers, whereas *N. ariommus* prefers to occupy larger creeks to small rivers (NEAFWA, 2018).

Species Distribution

Popeye Shiner populations were distributed widely, but are spotty, across the Tennessee, Cumberland, and Ohio river drainages, and have experienced fluctuating locality occurrences and abundances from the 1860s to 1970s. Popeye Shiners tend to be rare and highly localized. Historically, most of the occupied localities were centralized in and around Tennessee, Kentucky, West Virginia, and Virginia; extended outwards into adjacent the states of Alabama, Georgia, Indiana, North Carolina, Ohio, and Pennsylvania.
Today, Popeye Shiners occur in spotty distributions across the Ohio, Tennessee, and Cumberland River drainages, with most of its occupied localities continuing to be centralized within Tennessee, Kentucky, West Virginia, and Virginia. Popeye Shiners are now believed to be extirpated from Alabama, Pennsylvania, and Indiana, although a 2006 Indiana survey reported collections in at least one locality. One recent occurrence from Pennsylvania results from the collection of one individual believed to have washed downstream from an upper West Virginia extant population. Popeye Shiners still occur in the Scioto River

drainage of Ohio and were last collected in Georgia in the South Chickamauga Creek in 1993. It is unclear if this species still occurs in North Carolina (NEAFWA, 2018).

Distribution within Action Area

Popeye Shiners are found in extremely clear waters in moderate sized streams. These streams usually have slow to moderate flow and many long slow pools in which the Popeye Shiners reside. This species was thought to have disappeared from Ohio prior to 1900 until a population was discovered in Scioto Brush Creek in Southern Ohio in the mid 1980's.

Critical Habitat

No critical habitat has been designated for the Popeye Shiner.

Life History

Popeye Shiners are assumed to reproduce in spring or summer but little is known about their reproductive activities or requirements. It is likely that spawning occurs from late May to late June.

Popeye Shiners feed on various aquatic invertebrates and terrestrial insects that fall in the water or fly just above the surface (ODNR, 2017).

Current Stressors and Threats

- Habitat degradation
  The most significant threat to Popeye Shiner populations is the loss, degradation, and fragmentation of suitable habitat resulting from increased urbanization and agriculture, pollution (e.g., non-point source, contaminant spills, wastewater treatment plant effluent), coal mining, channel modification, dams, and climate change. (NEAFWA, 2018).
- Water pollution
  In regard to water quality, the species does not seem to have recovered from a fish kill event in 1967 on the Clinch River. However, the species did exhibit some population recovery on the North Fork of the Holston River after pollution was reduced there.
- Dams (spawning, habitat fragmentation)

List of References

Northeast Association of Fish and Wildlife Agencies (NEAFWA). (2018). Popeye Shiner Five Factor Status Review. Retrieved from https://rcngrants.org/sites/default/files/final_reports/RCN%202016-2%20PopeyeShiner_5FactorAnalysis.docx

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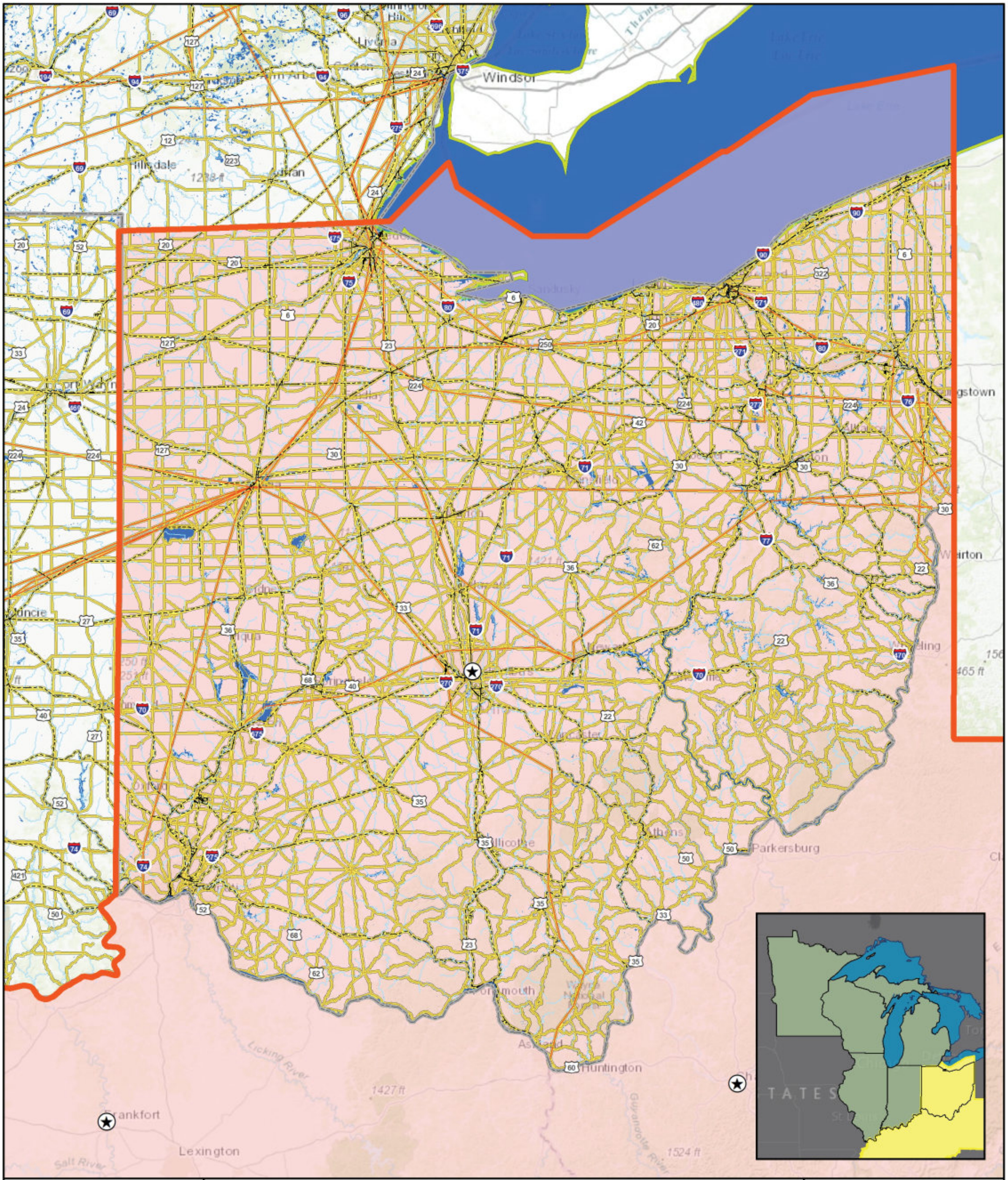


POPEYE SHINER (*NOTROPIS ARIOMMUS*) ACTION AREA OVERVIEW MAP

SCALE 1:3,000,000

- Petroleum Pipeline
- Major Road
- Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- 🟦 Lakes & Ponds
- 🟩 1-Mile Coastal Inland Buffer
- 🟨 Action Area
- 🟧 Popeye Shiner (*Notropis ariommus*) Counties of Occurrence

N

Basemap courtesy of Esri. Date: 5/25/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS Projection: WGS 1984 Web Mercator

Scioto Madtom (*Noturus trautmani*)

Federal Listing: Endangered; Recommended Extinct. Despite extensive searches, no one has seen this madtom in the wild since 1957 and many biologists believe it is extinct (USFWS, 1997).
State Listing within the AA: Endangered, Recommended Extinct in Ohio

Species Description

The Scioto Madtom has a long, slender body that is gray to dusky olive-brown above and has 4 dark saddles. The low adipose fin is broadly joined to the caudal fin with a small notch between the fins. The adipose fin is clear, without a dark bar or blotch. The short pectoral spine has 5 to 7 large teeth on the rear edge and small teeth along the front. The caudal fin has a straight edge or is slightly rounded. The caudal fin has 2 dark bands, 1 in the middle of the fin and 1 near the clear edge. There are 13 to 16, usually 14, anal rays. To 2.25in (6.1cm) total length (Florida Museum, 2021).

The Scioto Madtom prefers stream riffles of moderate current over gravel bottoms with high quality water that is free of suspended sediments. It is an omnivorous bottom feeder that eats a wide variety of plant and animal life, which it finds with its sensory barbels hanging down in front of its mouth (USFWS, 1997).

Species Distribution

It is believed to be endemic to the Scioto River basin in central Ohio. Only 18 individuals of the Scioto Madtom were ever collected. All were found along one stretch of Big Darby Creek, and all but one was found within the same riffle known as Trautman's riffle. The riffle habitat was comprised of glacial cobble, gravel, sand, and silt substrate, with some large boulders (USFWS, 2009).

Critical Habitat

No critical habitat has been designated for the Scioto Madtom.

Life History

Little is known of reproductive habits of the Scioto Madtom, though it likely spawned in summer and migrated downstream in the fall (USFWS, 1997).

Current Stressors and Threats

- Habitat degradation
- Water pollution (industrial and agriculture)
- Competition

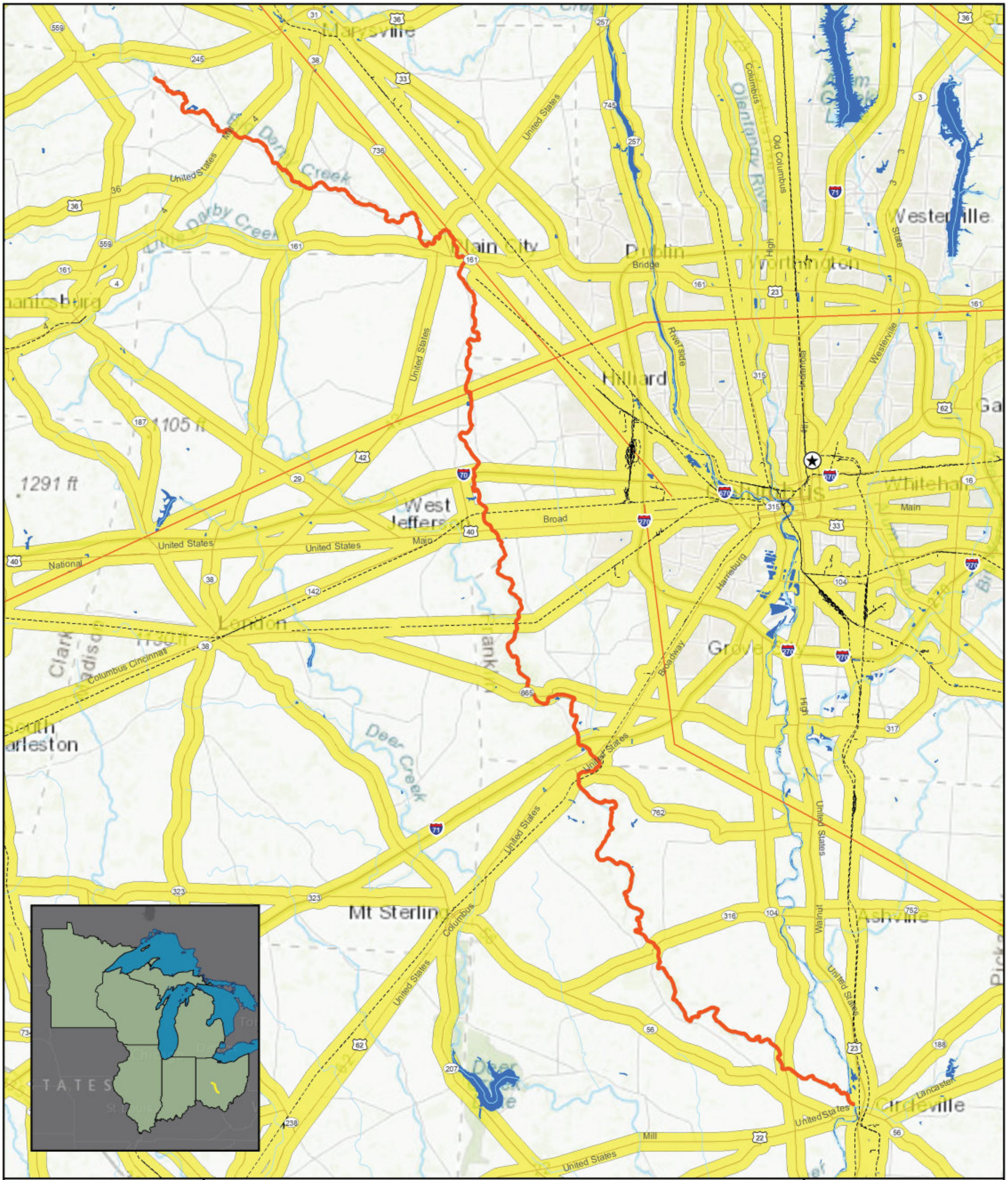
The exact cause of the Scioto Madtom's decline is unknown but was likely due to modification of its habitat from siltation, suspended industrial effluents, and agricultural runoff. In addition, competition from the Northern Madtom (*Noturus stigmosus*), first observed the same year the last Scioto Madtom was collected, may have also contributed to this fish's decline (USFWS, 2009).

List of References

Florida Museum. (2021). Scioto Madtom (*Noturus trautmani*). Retrieved from https://www.floridamuseum.ufl.edu/fish/catfish/ictaluridae/scioto-madtom/

U.S. Fish & Wildlife Service (USFWS). (1997). Scioto Madtom (*Noturus trautmani*). Retrieved from https://www.fws.gov/midwest/endangered/fishes/sciot_fc.html

U.S. Fish & Wildlife Service (USFWS). (2009). Scioto Madtom (*Noturus trautmani*) 5-year review: summary and evaluation. Columbus, Ohio. 10pp.



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SCIOTO MADTOM (*NOTURUS TRAUTMANI*) ACTION AREA OVERVIEW MAP

SCALE 1:450,000

━ Petroleum Pipeline	━ Commercial Navigable Waterway	🟩 1-Mile Coastal Inland Buffer
━ Major Road	━ Rivers & Streams	🟨 Action Area
------ Railroad	🟦 Lakes & Ponds	▭ Scioto Madtom (*Noturus trautmani*) Counties of Occurrence

N

Basemap courtesy of Esri.

Date: 5/25/2021

Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS

Projection: WGS 1984 Web Mercator

Sicklefin Chub (*Macrhybopsis meeki*)

Federal Listing: Under Review. The Sicklefin Chub was petitioned for Federal listing under the Endangered Species Act in 2016, and a 90-day finding was issued in 2017 (82 FR 60362).
State Listing within the AA: Not Listed

Species Description
The Sicklefin Chub is a small, obligate large-river minnow that has evolved specific phenotypic adaptations to the formerly turbid, moderate velocity Missouri River. These included a fusiform body shape, long sickle-shaped pectoral fins, a deeply forked caudal fin, reduced optic brain lobes and eyes, and development of external sensory organs, termed compound taste buds. It is usually light green to brown above, often with many dark brown and silver specks, and silver sides. It is distinguished from the Sturgeon Chub by long, sickle-shaped pectoral fins and the absence of ridge-like projections on its scales. Juvenile Sicklefin Chub diets are less specialized than diets of juvenile Sturgeon Chub, and comparison of taste bud distribution suggests *M. meeki* may be efficient at sorting and concentrating food after it has been ingested (WildEarth Guardians, 2016).

Maxillary barbels are positioned behind the blunt and slightly overhanging snout. Sicklefin Chubs use these barbels and external taste buds to locate food as their eyes are small and of little value in turbid waters. Their diet primarily consists of immature aquatic insects. Maximum size rarely exceeds 95mm and they have a relatively short life span (< 4 years) (WildEarth Guardians, 2016).

Species Distribution
Statistical analysis found four significant habitat variables influencing Sicklefin Chub distribution in the Missouri River: distance to upstream impoundment, flow constancy, mean segment turbidity, and percent of annual flow in August. Occurrence of Sicklefin Chub was highest when the river segment was greater than 187 miles (301km) downstream from a dam; flow constancy was 0.56 or less, indicating an association with river segments having more variable flow regimes; mean summer-early fall turbidity levels were 80 NTUs [Nephelometric Turbidity Units] or greater; and the percent of flow in August was low, less than 10 percent of the total annual flow (WildEarth Guardians, 2016).

Historically this species was recorded in 13 states of the Mississippi and Missouri rivers and their larger tributaries, including approximately 85 miles (136km) of the lower Yellowstone River, 1,950 miles (3,120km) of the main stem Missouri River (mouth to North Dakota), and about 1,150 miles (1,840km) of the Mississippi River below the mouth of the Missouri River (south to southern Mississippi); also the lower Kansas River in eastern Kansas (NatureServe, 2021)

This species lives in the main channel of the Mississippi River where there is a strong current and turbid water. The Sicklefin Chub historically occurred in 1,150 miles of the mainstem Mississippi River, from the mouth of the Missouri to the Gulf of Mexico. The USFWS estimates that as of 2001 it was still present in the entire mainstem, but it is now considered rare everywhere except the middle Missouri. The Sicklefin Chub historically occurred in 1,950 miles of the mainstem Missouri River, from the mouth of Cow Creek, Montana, to the confluence of the Mississippi. As of 2001 it occupied 1,015 miles of the Missouri: Cow Creek, Montana to the headwaters of Fort Peck Reservoir; Fort Peck Dam to the headwaters of Lake Sakakawea; and from Gavins Point Dam to the confluence of the Mississippi. The Sicklefin Chub historically occurred in at least 70 miles of the Lower Yellowstone River, from the mouth of Thirteen Mile Creek to the confluence of the Missouri River. Very few Sicklefin Chub have been collected in the Kansas River. (WildEarth Guardians, 2016).

Distribution within Action Area
This species lives in the main channel of the Mississippi River (adjacent to Illinois) where there is a strong current and turbid water.

Critical Habitat

No critical habitat has been designated for the Sicklefin Chub.

Life History

The Sicklefin Chub can reach sexual maturity at age 2, with most fish mature by age 3. The fish first become mature at shorter lengths of 70 to 79mm (2.8 to 3.1in) in the Missouri River in Montana than the 90 to 99mm (3.5 to 3.9in) downstream in Kansas and Missouri. Spawning occurs throughout the summer at water temperatures of 18 to 28°C (64.4 to 82.4°F). Multiple stages of eggs in gravid females suggest that the fish spawn multiple times during the summer. Sicklefin Chubs may have a protracted spawning period and may have a high degree of post-spawn mortality. The most recent study on Sicklefin Chub reproduction determined that *M. meeki* hatch dates showed a distinct, bell-shaped curve that started in early June, peaked in mid-July and subsided in mid-August. While *M. gelida* and *M. meeki* both require long reaches of unfragmented river, *M. meeki* may be tied to a more specific spawning cue, as suggested by their unimodal peak in hatch dates (WildEarth Guardians, 2016).

Sicklefin Chub are “pelagic-spawning cyprinids,” small-bodied fish that “produce semi-buoyant, nonadhesive eggs within pelagic zones of large flowing streams.” These fish produce eggs that achieve semi-buoyancy soon after fertilization but require water movement to remain in suspension. The Sicklefin Chub is a lithopelagophilic broadcast spawner, with a similar reproductive strategy to the Sturgeon Chub except that the eggs are released over rock or gravel and might be initially adhesive. Pelagic-spawning cyprinids represent 25-40% of imperiled species within ecoregions of the Great Plains and have precipitously declined since at least the 1950s when species belonging to this guild dominated vertebrate communities within Great Plains prairie rivers. A growing body of literature suggests imperilment of pelagic-spawning cyprinid species is a direct consequence of stream fragmentation. The availability of downstream transport (unfragmented river kilometers) is particularly important for the pelagic-spawning reproductive guild because high mortality rates occur among ichthyoplankton [drifting eggs and larvae] deposited within downstream reservoirs, due to suffocation within anoxic sediments or predation from lacustrine species (WildEarth Guardians, 2016).

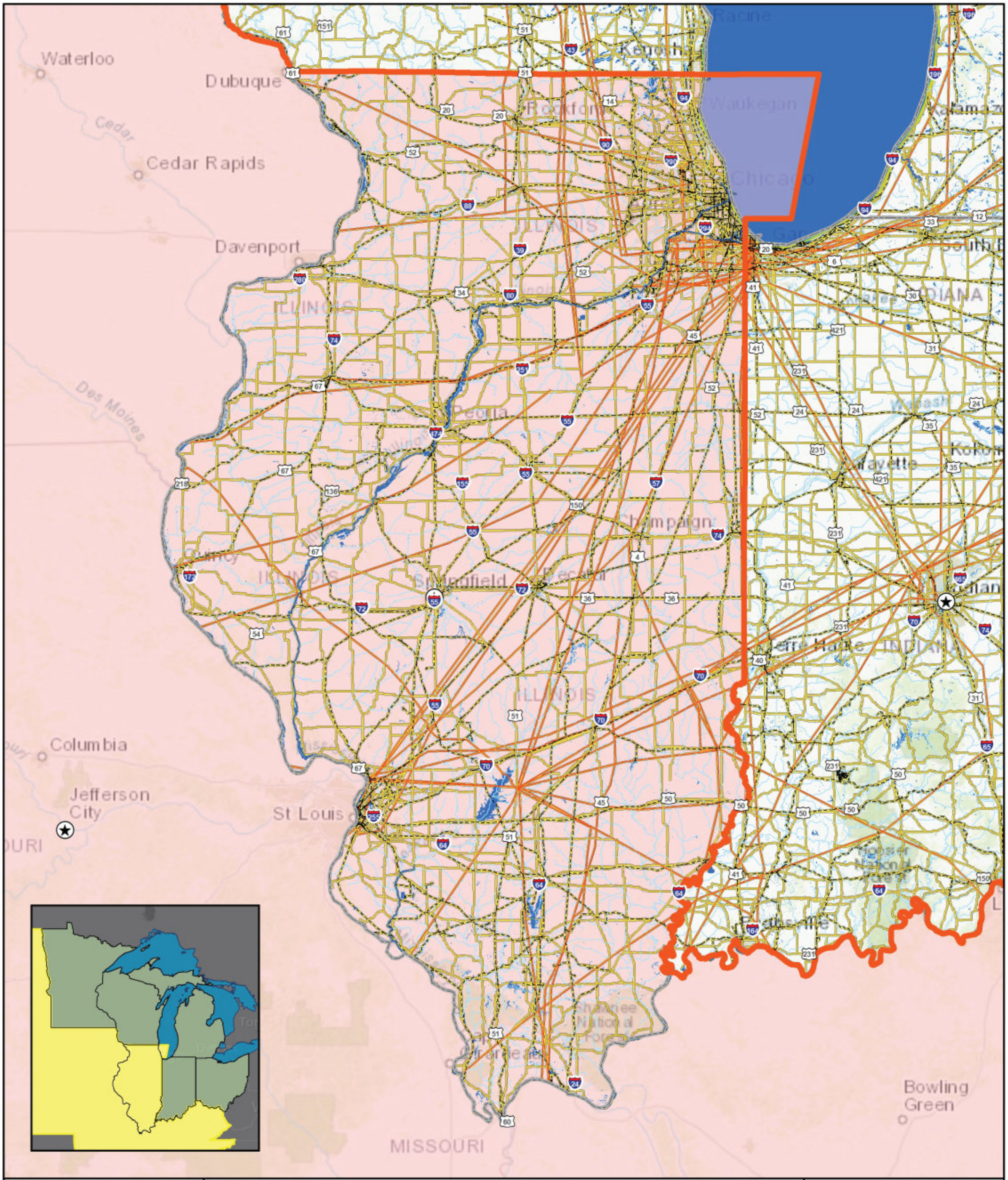
Current Stressors and Threats

- Dams (habitat fragmentation, temperature, flow regimes)
  Decline in Sicklefin Chub populations has resulted from human-induced changes in river conditions. Dams have flooded river habitat, altered temperature and flow regimes, reduced sediment transport and turbidity, fragmented populations, and reduced movement opportunities. Channelization has reduced habitat diversity and reduced overbank flooding.
- Water pollution and industrial depletion
  Pollution and water depletion from industry and agriculture may have altered water quality. Sand and gravel excavation have removed habitat and restricted fish movements in some areas. Further water depletion is likely to occur in the future due to energy development in the Upper Missouri River Basin, increased interbasin transfer of water, and increased municipal, industrial, and irrigation use.
- Dredging of river substrates
  Dredging for channel maintenance and sand/gravel extraction will continue in new areas.
- Invasive species
  Sicklefin Chub may be negatively impacted by the numerous species of non-native fishes that have been introduced into the habitat. Ongoing and proposed conservation measures are likely to have a beneficial impact on Sicklefin Chub and Sturgeon Chub populations (NatureServe, 2021).

List of References

WildEarth Guardians. (2016). Petition to list the Sturgeon Chub (*Macrhybopsis gelida*) and Sicklefin Chub (*Macrhybopsis meeki*) under the U.S. Endangered Species Act. Denver, Colorado. 70pp.

NatureServe. (2021). NatureServe Explorer – Sicklefin Chub (*Macrhybopsis meeki*). Retrieved from https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.101978/Macrhybopsis_meeki



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SICKLEFIN CHUB (*MACRHYBOPSIS MEEKI*)
ACTION AREA OVERVIEW MAP

SCALE 1:4,000,000

— Petroleum Pipeline	— Commercial Navigable Waterway	🟩 1-Mile Coastal Inland Buffer
— Major Road	— Rivers & Streams	🟨 Action Area
------ Railroad	🟦 Lakes & Ponds	▭ Sicklefin Chub (*Macrhybopsis meeki*) Counties of Occurrence

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Basemap courtesy of Esri. Date: 5/25/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS Projection: WGS 1984 Web Mercator

Sturgeon Chub (*Macrhybopsis gelida*)

Federal Listing: Under Review. The Sturgeon Chub was petitioned for Federal listing under the Endangered Species Act in 2016, and a 90-day finding was issued in 2017 (82 FR 60362).
State Listing within the AA: Endangered in Illinois

Species Description

The Sturgeon Chub is a slender, streamlined benthic minnow that inhabits mainstem, turbid rivers and resides over sandy and gravel shoals. Generally, their back is light brown with silvery colored sides and belly with the defining characteristic being its long snout that overhangs the mouth, similar to the morphology of sturgeon species, and presence of ridge-like projections on many scales. Similar to other chub species, maxillary barbels and external taste buds cover the head and body and are used to locate food in highly turbid waters. They are benthic insectivores with small eyes that are of little value for locating food. Maximum size has been reported to be 70mm; however, adults exceeding 100mm have been captured in the channelized Missouri River. Juvenile diets are dominated by midge larvae. The Sturgeon Chub is a relatively short-lived species with a lifespan of up to four years; however, few live beyond two years (WildEarth Guardians, 2016).

Sturgeon Chub have characteristics considered typical of fish associated with benthic, fast-water environments, including a narrow, streamlined shape, large fins, dorsally positioned eyes, a subterminal mouth, and an arched back and flattened ventral surface. The unique epidermal ridges on the scales of Sturgeon Chub have been proposed to function as keels. The adaptation of Sturgeon Chub to high turbidity is evident by their reduced eyes, numerous cutaneous taste buds, and a brain morphology that indicates well developed chemosensory perception (WildEarth Guardians, 2016).

Species Distribution

Historically, the Sturgeon Chub occurred throughout 2,100 miles of the main stem Missouri River and 1,150 miles of the main stem Mississippi River. The species also was found in the Yellowstone River in Montana and North Dakota and 30 tributaries to the Yellowstone and Missouri Rivers. The Sturgeon Chub occurred in portions of four tributaries in Wyoming, nine in Montana, five in North Dakota, six in South Dakota, six in Nebraska, and four in Kansas. Other tributaries that historically hosted Sturgeon Chub include the Big Horn, Little Missouri, and Republican Rivers (WildEarth Guardians, 2016).

As of 2001, Sturgeon Chub occupied approximately 1,155 miles or about 55 percent of its former range in the Missouri River. The species also continues to be found in 11 of 30 tributaries to the Yellowstone and Missouri Rivers that were documented as providing Sturgeon Chub habitat. Field studies have documented a viable population of Sturgeon Chub in the Middle Mississippi River and in the Wolf Island area of the Lower Mississippi River. They are “fairly common” in the middle Missouri River and rare elsewhere, meaning that in the Middle Missouri they may be found in their preferred habitat within their range, but are very unlikely to be found in their preferred habitat within their range outside the Middle Missouri. A 2010 study indicated that Sturgeon Chub have been extirpated from a majority (75 percent) of 60 Great Plains stream fragments surveyed (WildEarth Guardians, 2016).

Distribution within Action Area

This species lives in the main channel of the Mississippi River (adjacent to Illinois).

Critical Habitat

No critical habitat has been designated for the Sturgeon Chub.

Life History

The Sturgeon Chub reaches sexual maturity at age 2. Spawning occurs throughout the summer at water temperatures of 18.3 to 22.7°C (65 to 72.9°F). Multiple stages of eggs in gravid females suggest that fish spawn multiple times during the summer. Estimates of fecundity range from 2,000 to 5,310 eggs per female. The most recent study on Sturgeon Chub reproduction determined that *M. gelida* spawned throughout the summer, ranging from early May to late August. Sturgeon Chub exhibit no sexual dimorphism during the breeding season (WildEarth Guardians, 2016).

Sturgeon Chub are pelagic-spawning cyprinids, small-bodied fish that “produce semi-buoyant, nonadhesive eggs within pelagic zones of large flowing streams. These fish “produce eggs that achieve semi-buoyancy soon after fertilization but require water movement to remain in suspension. The Sturgeon Chub is a pelagophilic broadcast spawner, meaning it reproduces by releasing non-adhesive, semi-buoyant eggs in open water whereby they are passively transported downstream by the current (WildEarth Guardians, 2016).

Pelagic-spawning cyprinids represent 25-40% of imperiled species within ecoregions of the Great Plains and have precipitously declined since at least the 1950s when species belonging to this guild dominated vertebrate communities within Great Plains prairie rivers. A growing body of literature suggests imperilment of pelagic-spawning cyprinid species is a direct consequence of stream fragmentation. The availability of downstream transport (unfragmented river kilometers) is particularly important for the pelagic-spawning reproductive guild because high mortality rates occur among ichthyoplankton [drifting eggs and larvae] deposited within downstream reservoirs, due to suffocation within anoxic sediments or predation from lacustrine species (WildEarth Guardians, 2016).

Current Stressors and Threats

- Habitat fragmentation (dams, temperature, flow regimes)
  Decline resulted mainly from human-induced changes in river conditions, particularly the development and operation of reservoirs on large rivers. Dams have flooded river habitat, altered temperature and flow regimes, reduced sediment transport and turbidity, fragmented populations, and reduced movement opportunities. By fragmenting the habitat and chub populations, dams exacerbate the loss of fish populations caused by drought, channel dewatering due to irrigation, or poor water quality. For example, extended drought may extirpate a population. and impoundments may block recolonization pathways from potential source populations in mainstem rivers. Also, existing habitat fragments may be too small to support successful spawning and development. When impoundments are numerous, Sturgeon Chub eggs and fry may become entrained in reservoirs and encounter heavy predation. Water diversion for irrigation potentially threatens chub populations where eggs and fry enter and become stranded in canals. Channelization has reduced habitat diversity and reduced overbank flooding.
- Water pollution and industrial depletion
  Pollution from industry and agriculture may negatively alter water quality and ongoing water depletion is likely to occur in the future due to energy development in the Upper Missouri Basin, increased interbasin transfer of water, and increased municipal, industrial, and irrigation use. Sever drought in the 1990s may have eliminated populations in some Missouri River tributaries. Populations in the mainstem Missouri River may be too small and widespread to naturally recolonize these tributaries even if suitable habitat is available.
- Dredging of river substrates
  Sand and gravel excavation have removed habitat and restricted fish movements in some areas. Dredging for channel maintenance and sand/gravel extraction will continue in new areas.
- Non-native fish competition
  This species also may be negatively impacted by the numerous species of non-native fishes that have been introduced into the habitat. These non-native fishes flourish in dam-altered waters with reduced turbidity, and they may compete with and prey on Sturgeon Chubs. However, the degree and effect of predation on Sturgeon Chub populations are unknown. Similarly, the effects of potential non-native competitors are unknown (NatureServe, 2021).

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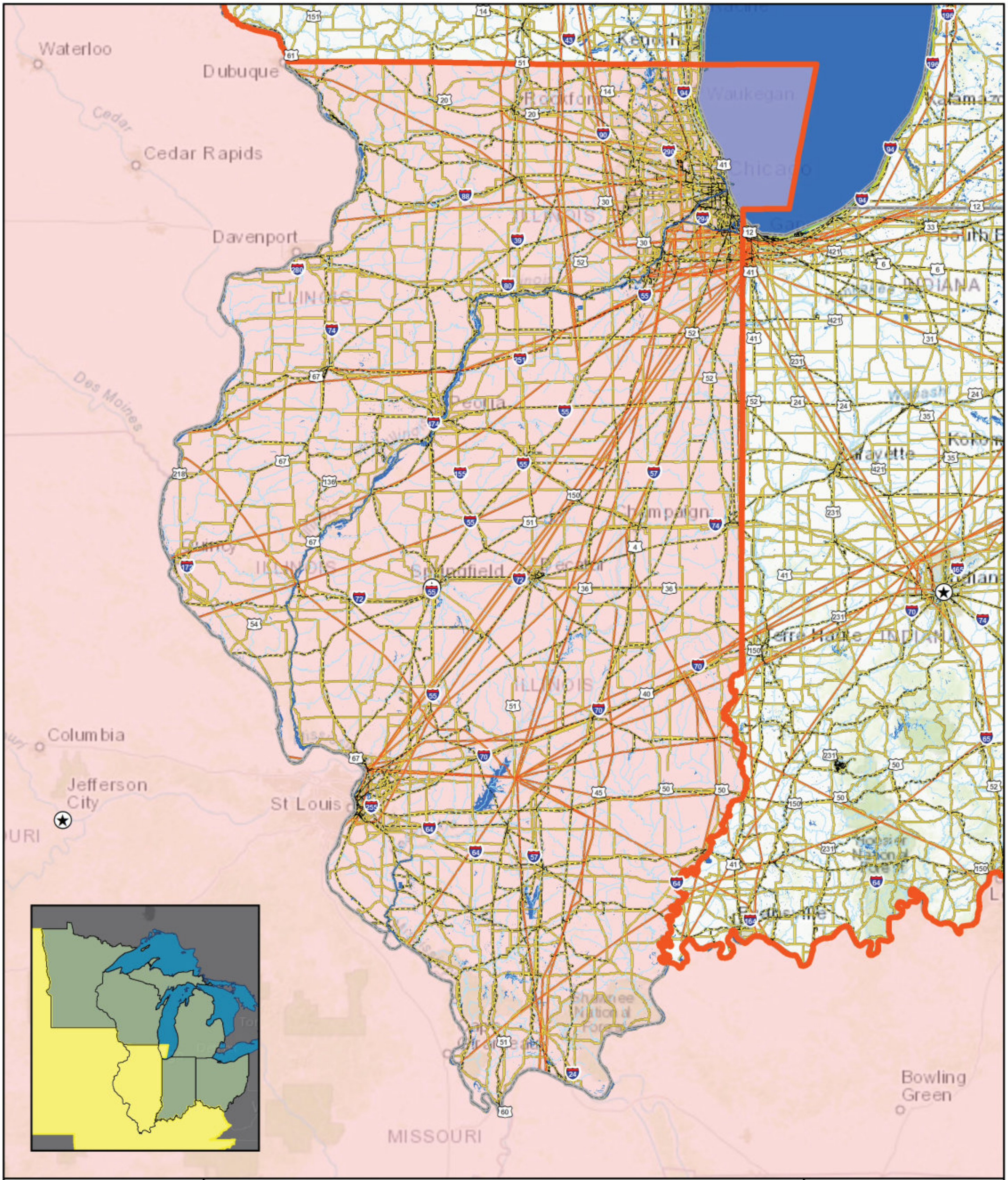

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Miles
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STURGEON CHUB (*MACRHYBOPSIS GELIDA*)
ACTION AREA OVERVIEW MAP

SCALE 1:4,000,000

Petroleum Pipeline
Major Road
Railroad
Commercial Navigable Waterway
Rivers & Streams
🟦 Lakes & Ponds
🟩 1-Mile Coastal Inland Buffer
🟨 Action Area
Sturgeon Chub (*Macrhybopsis gelida*) Counties of Occurrence

N

Basemap courtesy of Esri.
Date: 5/25/2021
Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS
Projection: WGS 1984 Web Mercator

Topeka Shiner (*Notropis topeka*)

Federal Listing: Endangered
State Listing within the AA: Special Concern in Minnesota

Species Description

The Topeka Shiner is a small, stout minnow, not exceeding 75mm in total length. The head is short with a small, moderately oblique (slanted or sloping) mouth. The eye diameter is equal to or slightly longer than the snout. The dorsal fin is large, with the height more than one half the predorsal length of the fish, originating over the leading edge of the pectoral fins. Dorsal and pelvic fins each contain 8 rays. The anal and pectoral fins contain 7 and 13 rays respectively, and there are 32 to 37 lateral line scales. Dorsally the body is olivaceous (olive-green), with a distinct dark stripe preceding the dorsal fin. A dusky stripe is exhibited along the entire longitudinal length of the lateral line. The scales above this line are darkly outlined with pigment, appearing crosshatched. Below the lateral line the body lacks pigment, appearing silvery-white. A distinct chevron-like spot exists at the base of the caudal (tail) fin. The species is dimorphic only during the reproductive season (63 FR 69008).

Species Distribution

The Topeka Shiner is characteristic of small, headwater, prairie streams with good water quality and cool temperatures, although they also may tolerate relatively harsh conditions that can develop in winter and summer low-water periods. Many streams in which Topeka Shiners occur generally exhibit perennial flow, however, some approach intermittency (periodic flow) during summer. At times when surface flow ceases, pool levels and cool water temperatures are frequently maintained by percolation through the streambed, spring flow and/or groundwater seepage. The predominant substrate types within some streams inhabited by Topeka Shiners are clean gravel, cobble and sand. However, bedrock and clay hardpan overlain by a thin layer of silt are not uncommon and thick layers of silt predominate in some occupied habitats. Topeka Shiners most often occur in pool and run areas of streams, seldom being found in riffles.

The Topeka Shiner is known to occur in portions of South Dakota, Minnesota, Kansas, Iowa, Missouri, and Nebraska. In South Dakota, Topeka Shiners were known at 11 localities in the Vermillion and James River watershed at the time of listing, and were believed extirpated from the Big Sioux River drainage. Since listing, Topeka Shiners have been captured from an additional 48 streams, including many from the Big Sioux River watershed. In Minnesota, Topeka Shiners were known from 15 locales in 8 streams in the Rock and Big Sioux River watersheds at the time of listing. The species is now known from 75 sites in at least 17 named streams. The species is now believed to be widely distributed in the Rock and Big Sioux River watersheds in Pipestone, Nobles, and Rock counties, with an additional number of occurrences in adjoining Murray and Lincoln Counties. The species also has been discovered to inhabit off-channel floodplain pools adjacent to these streams. In Kansas, Topeka Shiners were extant in several watersheds within the Kansas and Cottonwood River basins at the time of listing. These populations were largely restricted to portions of the Flint Hills region. An additional isolated population was known from Wallace County, near the Colorado border in the Smoky Hill River watershed. The Wallace County population is now believed extirpated, resulting in the elimination of the last known population of the species in Kansas west of the Flint Hills. In Iowa, at the time of listing, the Topeka Shiner was known extant at 10 sites in 4 tributaries to the North Raccoon River watershed, from 2 sites in the Boone River watershed, and 1 site immediately adjacent to the Minnesota border in the Big Sioux/Rock River watershed. Since 1999, the species has been captured from streams or off-channel pools of 16 tributaries to the North Raccoon River and from 5 off-channel pools adjacent to the mainstem North Raccoon River. The species also has been captured in low numbers from 2 tributaries in the Des Moines River and in 5 tributaries of the Boone watershed. In Missouri, three populations were believed extant at the time of listing. At present, two populations exist in the wild. The Bonne Femme Creek watershed population is now presumed extirpated. The last collection of the species from this stream occurred in 1997. In Nebraska, the Topeka Shiner was believed extant in two streams in Cherry and Madison counties at the time of listing. The last capture of the species from these streams occurred in 1989 and 2000, respectively. Access is now prohibited at the Cherry County site; however, a single Topeka Shiner was found in a small stream in Cherry County in 2006 approximately 6 miles from the previous record site as of 2006 (USFWS, 2009).

Distribution within Action Area
This species is known from Lincoln, Pipestone, Murray, Rock, and Nobles Counties, Minnesota (MNDNR, 2021).

Critical Habitat

Designated critical habitat consists of 83 stream segments, representing 1,356km (836 miles) of stream in Iowa, Minnesota, and Nebraska (USFWS, 2004). In determining which areas to designate as critical habitat, the USFWS considered physical and biological features, referred to as primary constituent elements (PCEs), that are essential to the conservation of the species, and that may require special management considerations or protection. These include but are not limited to space for individual and population growth and for normal behavior; food, water, light, minerals, or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, and rearing or development of offspring; and, habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species. The area designated as critical habitat for the Topeka Shiner is a subset of the geographical area presently occupied by the species and contains the physical or biological features essential for species conservation. When critical habitat was first proposed in 2002, it encompassed all of the known range of the species (USFWS, 2019).

Life History

The Topeka Shiner is pelagic in nature, occurring in mid-water and surface areas, and are primarily considered a schooling fish. Occasionally, individuals of this species have been found in larger streams presumably as waifs (strays) and downstream of known populations. In Minnesota, Iowa, and South Dakota, Topeka Shiners depend heavily on off-channel habitats, such as oxbows, that may be only periodically connected to nearby streams. Densities in these off-channel habitats are typically several times greater than in adjacent instream habitats. Juveniles are sometimes abundant during autumn in off-channel habitats. The value of these off-channel habitats may depend on inflows of groundwater. Such inflows may also be important in maintaining sufficient dissolved oxygen and water temperatures to allow the species to persist in its headwater habitats during periods when dissolved oxygen or temperature levels would otherwise result in significant mortality. Definitions of Topeka Shiners' general diet vary among studies, although insect larvae and microcrustacea seem to be consistently important. The species is primarily a diurnal feeder on insects, with chironomids (midges), other dipterans (true flies), and ephemeropterans (mayflies) making up the bulk of the diet. However, the microcrustaceans Cladocera and Copepoda (zooplanktons) also contribute significantly to the species' diet. Identification of 25 food categories in a gut analysis of Topeka Shiners in Minnesota led Hatch and Besaw (2001) to conclude that the species is an opportunistic and omnivorous feeder, although insect larvae and microcrustacea comprised 75% of the gut contents (USFWS, 2019).

Current Stressors and Threats

- Water pollution (agriculture, stormwater)
  Water quality throughout the Topeka Shiner's range has been degraded by nutrient and pesticide run-off, heavy sediment loading, highway construction, urban development, and dewatering and construction of impoundments. Minnesota and South Dakota populations may be more secure due to availability of off-channel habitat as summer refugia and as low-predator environments.
- Dams
- Sedimentation
  Siltation of streams in southwestern Minnesota is still a concern and should be minimized. To protect Topeka Shiner spawning habitat, no in-stream work should be conducted before August 15.
- Introduced species predation

The introduction of Largemouth Bass (*M. salmoides*) has been identified as one factor causing the drastic decline of the species. The impact on Topeka Shiners of a new piscivorous species in their habitats, which are relatively free of predators, is unknown and needs further study (MNDNR, 2021).

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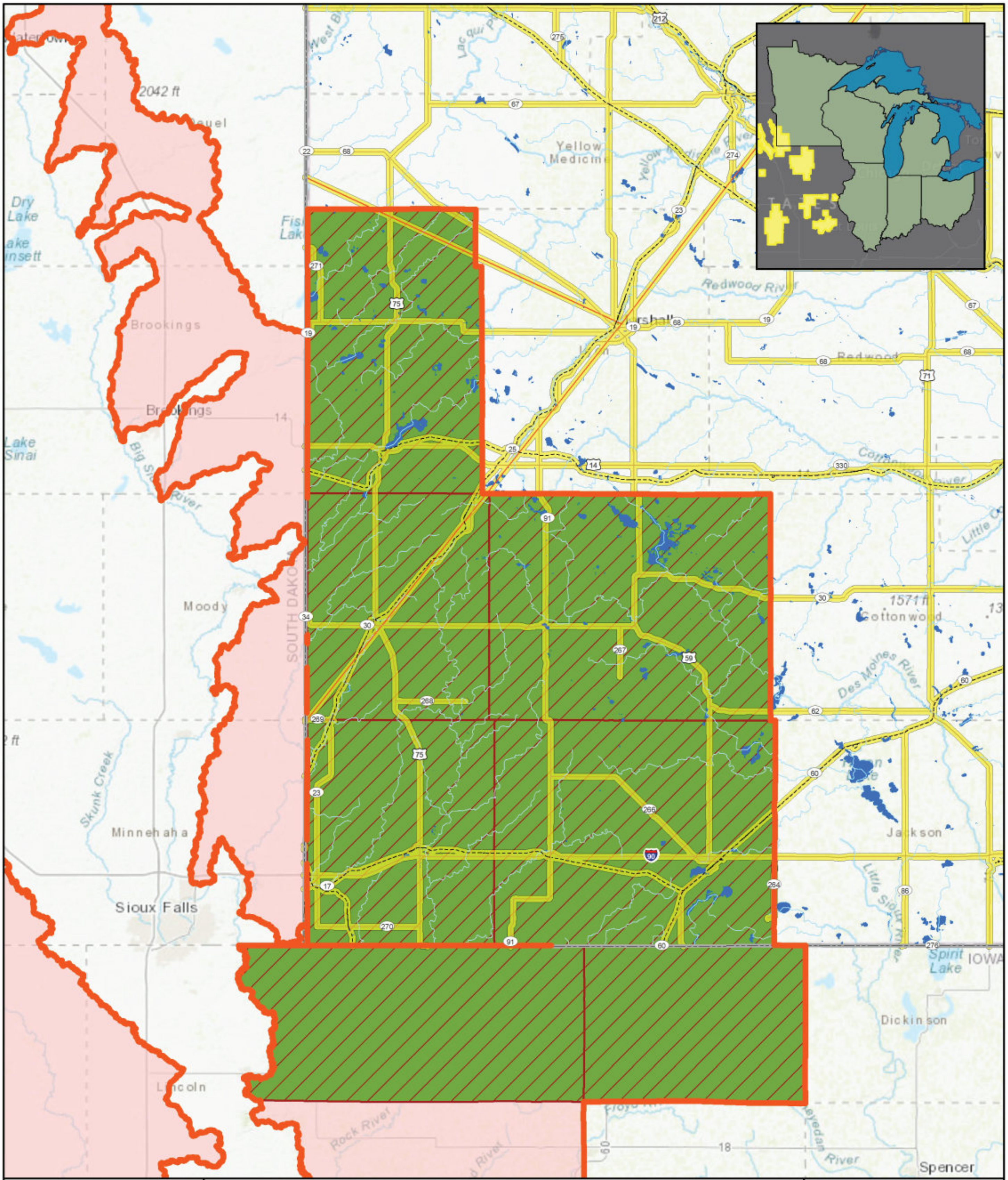

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Miles
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Kilometers

TOPEKA SHINER (*NOTROPIS TOPEKA*)
ACTION AREA OVERVIEW MAP

SCALE 1:1,250,000

—	Petroleum Pipeline
—	Major Road
------	Railroad
—	Commercial Navigable Waterway
—	Rivers & Streams
🟦	Lakes & Ponds
🟩	1-Mile Coastal Inland Buffer
🟨	Action Area
▨	Topeka Shiner (*Notropis topeka*) Critical Habitat
☐	Topeka Shiner (*Notropis topeka*) Counties of Occurrence

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**** Critical Habitat is designated for this species; however, data is unavailable.***

Basemap courtesy of Esri.

Date: 5/24/2021

Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS

Projection: WGS 1984 Web Mercator

HERPTILES

Alligator Snapping Turtle (*Macrochelys temminckii*)

Federal Listing: Under Review. The Alligator Snapping Turtle was petitioned for Federal listing under the Endangered Species Act in 2012, and a 90-day finding was issued in 2015 (80 FR 37568).
State Listing within the AA: Endangered in Illinois and Indiana

Species Description

The AST is characterized by a very large head and three rows of spiked scutes (enlarged scales or laminae). The rows of spiked scutes usually form three distinct complete or incomplete keeled ridges on the brown carapace (upper shell), which distinguish *M. temminckii* from the Snapping Turtle (*Chelydra serpentina*). Some of the marginal scutes on the carapace occur in a double row rather than the single row seen in *Chelydra*. A strongly hooked beak is present on most, but not all specimens. The tongue has a unique worm-like appendage ("fishing lure"). The plastron (lower shell) is relatively small. AST is the largest freshwater turtle in the U.S. reaching a record carapace length of 800mm (31.5in), and weight of 113.9kg (251lbs) (Fuller & Somma, 2019).

Species Distribution

Habitat consists of slow-moving, deep water of rivers, sloughs, oxbows, and canals or lakes associated with rivers (e.g., large impoundments including reservoirs); also swamps, bayous, and ponds near rivers, and shallow creeks that are tributary to occupied rivers, sometimes including swift upland streams. This turtle sometimes enters brackish waters near river mouths. Usually, it occurs in water with a mud bottom and some aquatic vegetation but uses sand-bottomed river and creeks in Florida. Within streams, Alligator Snapping Turtles may occur under or in logjams, beneath undercut banks, under rock shelters, or in deep holes. These turtles are highly aquatic and rarely are found out of water (except during nesting) (NatureServe, 2021).

The indigenous range of AST encompasses eastern Texas, eastern Oklahoma, extreme southeastern Kansas and adjacent southwestern Missouri, the Mississippi River Valley of eastern Missouri up the valley northward through western Illinois, southern Indiana, and southeastern Iowa, western Kentucky and Tennessee (including disjunct populations in central Indiana and Tennessee), and other Gulf Coast drainages in Arkansas, Alabama, Louisiana, Mississippi, southwestern Georgia, and northern Florida as far south as the Santa Fe and Suwanee Rivers (Fuller & Somma, 2019).

Distribution within Action Area

The status of the Alligator Snapping Turtle in Illinois has been the subject of extensive debate since the Illinois Department of Natural Resources announced plans to reintroduce the species to Illinois waters in 2005. With less than 20 confirmed records in Illinois, the species has been considered an infrequent visitor; the result of rare, long-distance migrants from the south via the large rivers. Ed Moll considered all records north of St. Louis questionable and considered the Big Muddy River and its confluence with the Mississippi River as the most promising area in the state to search for viable populations (INHS, 2021). Kessler et al. (2017) report the first record of a wild Alligator Snapping Turtle in Illinois since 1984, only the second in the past 50 years. This individual was captured in a tributary of the undammed portion of the Mississippi River in close proximity to the last 3 published records in Illinois. It is possible that this region provides the last accessible, suitable habitat for the species in Illinois. As it was unlikely the species would persist in Illinois without active management, a reintroduction feasibility study was initiated by IDNR (with many partners) in 2008, and reintroductions began in July 2014 (Kessler et al., 2017).

In Indiana, ASTs are known from the lower Wabash and Ohio Rivers from historic written and oral accounts as well as old, bleached shells and shell fragments found in the area. They may have been more widespread at one time, but presumed sharp population declines coupled with the scarcity of incidental encounters with such an aquatic animal make understanding their historic population trends impossible. A more recent record for a large adult in the White River likely represents either an escaped/released captive animal or a very old adult that gradually made its way upstream from populations further south. In all likelihood, this species is either extirpated or functionally extirpated (no breeding population, just a few old adults) in rivers in Indiana (Indiana Herp Atlas, 2021).

Critical Habitat

No critical habitat has been designated for the Alligator Snapping Turtle.

Life History

Alligator Snapping Turtles are long-lived organisms and have lived longer than 70 years in captivity. Based on laparoscopic examination of the reproductive tracts of free-ranging subadults found no reproductive females under 15 years old, and no reproductive males under 17 years old. In captivity, mating has been observed from February to October, but geographic variation in mating season is poorly understood. Males apparently are capable of sperm production year-round. Females ovulate in the spring, and most nesting occurs in May through July. Females appear to breed annually but may skip a year if they have poor foraging success. Production of multiple clutches in a single year has not been observed in the wild. Somewhat surprisingly considering their larger size, AST has a lower average reproductive output than *C. serpentina*. Clutch sizes are 31 to 40 (n=17) in the Apalachicola River (FL), but some adult females may lay as few as 9 eggs in GA. In Louisiana, a series of 13 harvested females had clutch sizes averaging 23.8 (range 16 to 38), and egg sizes were 34.0 to 51.8mm at their greatest diameter. Reproductive output is positively correlated with female body size, but this relationship is characterized by high variability among females. Like most turtles, it appears that AST has high adult survivorship under natural conditions (i.e., absent anthropogenic mortality). Average age of adults is greater than that of many other turtles, suggesting that adult survivorship of AST especially important demographically. ASTs are omnivorous and consume a wide variety of plant and animal matter. They possess a unique lingual lure used to catch fish, and fish are a dietary mainstay. However, dietary items other than fish are common in their stomachs; these include plant matter (oak acorns, tupelo fruits, wild grapes, roots, palmetto fruits, hickory nuts, persimmons, etc.) and animal matter (salamanders, crayfish, mussels, snakes, alligators, turtles, clams, mammals, snails, etc. ASTs are among the most aquatic of freshwater testudines, and overland movements appear to be undertaken only by nesting females and juveniles moving from the nest to water. Females have been observed to nest up to 72m from the nearest water, although nests averaged 12.2m from the nearest water. Radiotelemetry indicates that adults are capable of moving >1 km/day, and mean daily distances traveled ranged from 27.8 to 115.5m/day (Reed et al., 2002).

Current Stressors and Threats

Overharvesting and habitat alteration are the major threats to the species (CBD, 2012).

- Habitat alteration and destruction
  Water pollution and erosion have altered the food chain and otherwise degraded the turtle's habitat in many areas. In addition, dredging river bottoms to maintain shipping channels destroys habitat. May inhabited sites were manipulated for channelization or drained and converted to agricultural fields. Dams have blocked passage of Alligator Snapping Turtles on many rivers and thermal alteration by hypolimnetic releases from impoundments have caused declines.
- Overutilization
  Given its size and catchability, the Alligator Snapping Turtle has a long history of both commercial and personal harvest throughout its range.
- Disease and predation
  As for all turtles, predation, particularly by human-subsided raccoons, accounts for the loss of a majority of Alligator Snapping Turtle eggs throughout their range.
- Inadequacy of existing regulatory mechanisms
  Although the Alligator Snapping Turtle is now protected from take across most of its range, collection remains a threat. Endangered Species Act protection would prohibit all take and increase fines and resources for enforcement that would likely deter illegal collection.

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Miles
0 30 60 120 180 240
Kilometers

ALLIGATOR SNAPPING TURTLE (*MACROCLEMYS TEMMINCKI*) ACTION AREA OVERVIEW MAP

SCALE 1:10,000,000

Petroleum Pipeline	Commercial Navigable Waterway
Major Road	Rivers & Streams
Railroad	Lakes & Ponds
🟩 1-Mile Coastal Inland Buffer	🟨 Action Area
Alligator Snapping Turtle (*Macroclemys*) Counties of Occurrence.	

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Basemap courtesy of Esri.

Date: 5/25/2021

Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS

Projection: WGS 1984 Web Mercator

Blanding's Turtle (*Emydoidea blandingii)*

Federal Listing: Under Review. Blanding's Turtle was petitioned for Federal listing under the Endangered Species Act in 2012, and a 90-day finding was issued in 2015 (80 FR 37568).
State Listing within the AA: Endangered in Illinois and Indiana; Threatened in Minnesota and Ohio; Special Concern in Michigan; Delisted (2014) in Wisconsin

Species Description

Blanding's Turtles are dark brown to black with some yellow spotting on the carapace. The carapace is domed and elongate and the plastron in hinged at the pectoral-abdominal seam. The characteristic that most easily separates them from other species within their range is the bright yellow color of the entire ventral portion of their throat and long neck. The vent is located posterior to the margin of the carapace and the plastron is slightly concave in males. The plastron hinge of juveniles becomes movable by ages two to three and the anterior of the plastron can completely close at five years of age. Across most of their range, adults of both sexes range from approximately 150 to 240mm in carapace length, and from about 750 to 1400g in body mass (Congdon et al., 2008).

Species Distribution

In general, Blanding's Turtles occupy a variety of eutrophic wetlands such as swamps, marshes, beaver dams, permanent and temporary ponds/pools, and slow flowing streams. Blanding's Turtles frequently emerge from water to bask on logs and tussocks, or sedge clumps (Congdon et al., 2008).

The main range extends disjunctly from southeastern Ontario, adjacent Quebec, and southern Nova Scotia, south into New England, and west through the Great Lakes to western Nebraska, Iowa, and extreme northeastern Missouri. With the exception of two populations in the western portion of their range (Minnesota and Nebraska), populations are frequently small, discontinuous, and often isolated. In the eastern USA and Canada, small and disjunct populations occur in southeastern New York, Massachusetts, New Hampshire, and Nova Scotia. A major population center of this species included southeastern Ontario, the lower peninsula of Michigan, Wisconsin, and Minnesota. Two populations of note are in southeastern Minnesota (>5000 adults) and north central Nebraska (>130,000 individuals) (Congdon et al., 2008).

Distribution within Action Area

ECOS does not provide specific range information for Blanding's Turtle. Blanding's Turtle is considered vulnerable in Wisconsin and imperiled in Illinois, Indiana, Michigan, Minnesota, and Ohio (NatureServe, 2021).

Critical Habitat

No critical habitat has been designated for Blanding's Turtle.

Life History

Blanding's Turtles were considered to be primarily terrestrial in the early literature, whereas they have been considered to be primarily aquatic and secondarily terrestrial in more recent publications. One explanation of the difference in perception is that the extensive terrestrial nesting activity was mistakenly viewed as indicative of the entire activity season. Another reason may be that a reduction in temporary wetland and terrestrial movement corridors in human dominated landscapes has let to less overall terrestrial activity by Blanding's Turtles. Blanding's Turtles make seasonal movements among aquatic areas that may be related to seasonally abundant resources or access to mates. Winter dormancy is primarily between mid-October/November until late March but Blanding's Turtles have been recorded active until early December and as early as March 1. Adult *Emydoidea* are thought to be primarily carnivorous or omnivorous consuming crayfish and other crustaceans, insects, other invertebrates, and vegetable matter. On average, nesting takes place from late May to early July. Most nesting activity occurs from 1900 to 2100 hrs, with nest construction taking 2 to 2.5 hours to complete. Some females apparently return to the same general nesting area over a number of years while others had up to 2km inter-nest distances between years. Exposure to sunlight, low vegetation cover, well-drained soils, and proximity to wetlands combine to determine the quality of a nesting area. Nest predation rates are highly variable and most nest predation is due to raccoons and foxes. From nest construction to hatchling emergence takes approximately 84 days and results in hatchlings emerging from late August through early October. Although most hatchlings emerge from nests in the fall, some do not immediately move toward water. As a result, a few hatchlings may successfully overwinter on land but only if the surrounding area is moist enough to prevent desiccation. Females mature between ages 14 and 20. Clutch sizes range from 3 to 19 eggs. There are no data to suggest that females produce more than one clutch per year, and some adult females do not reproduce each year. Both egg size and clutch frequency increase with ae of females, but clutch size does not. Annual survival of adults exceeds 0.94 and life table analysis results in a mean cohort generation time of approximately 37 years. Blanding's Turtles are long-lived (known maximum ages >75 years). Several adult Blanding's Turtles were marked between 1953 and 1957 on the University of Michigan's E.S. George Reserve and were still alive and reproductive in 2007. Because of their extended longevity, long reproductive lifespans, and apparently lack of expression of actuarial senescence, Blanding's Turtles have become of interest to life historians researching the evolution of longevity and gerontologists working with non-human models of aging (Congdon et al., 2008).

Current Stressors and Threats

Blanding's Turtles are suffering from degradation of wetlands and the terrestrial portion of their core habitat. Reduction and alteration of nesting areas and wetland habitat, together with delayed maturations, less than annual reproductive frequency, and losses due to predations, collecting, and automobiles are all serious problems. In many instances females either cross roads, or due to nest site limitations, nest on road edges (both make females susceptible to collectors and being killed by cars). Negative impacts on their populations are exacerbated by life history traits associated with delayed sexual maturity, low annual fecundity, and extreme longevity (Congdon et al., 2008).

The Center for Biological Diversity list these threats in the petition document (2012)

- Habitat alteration and destruction
  Blanding's Turtles are suffering from degradation of wetlands and the terrestrial portion of their core habitat. These impacts are especially severe near large metropolitan areas. Destruction of resident aquatic habitat is of primary conservation concern because it impacts all stages of the life cycle. Reduction in the numbers of such wetlands can increase risks of mortality for adults and reduce hatchling recruitment into populations. Cultivation to the edge of wetlands and the use of fertilizers, pesticides, and herbicides that wash into wetlands can also degrade aquatic habitats. Blanding's Turtles are known to be sensitive to use of herbicides, which destroy aquatic vegetation and likely affect the turtle itself. Water management activities related to fish management and agriculture can be detrimental to overwintering Blanding's Turtle populations if they are conducted during winter. Drawdown activities to remove undesired fishes such as carp and vegetation in lakes were cited in both Illinois and Minnesota as detrimental due to death from predation, road mortality, freezing when the substrate was exposed in late winter, and poisoning from pesticides sprayed on the exposed lake bottom after the turtles were already moving in late spring. Subpopulations are increasingly fragmented by the extensive road network that crisscrosses all of this turtle's habitat, and Blanding's Turtles have been reported as being impacted by road mortality. Indeed, the complex movement ecology and habitat requirements of Blanding's Turtles make their populations especially vulnerable to road mortality: over the course of a year, they typically visit multiple wetlands to forage, mate, thermoregulate, and overwinter, requiring frequent overland migrations and road crossings. Nesting females are especially susceptible to roadkill because they often attempt to nest on gravel roads or on shoulders of paved roads.
- Overutilization
  While Blanding's Turtles are not consumed, the pet trade is a serious ongoing threat.
- Disease or predation

Eggs and young hatchlings are highly vulnerable to predation by birds, mammals, and predatory fishes.

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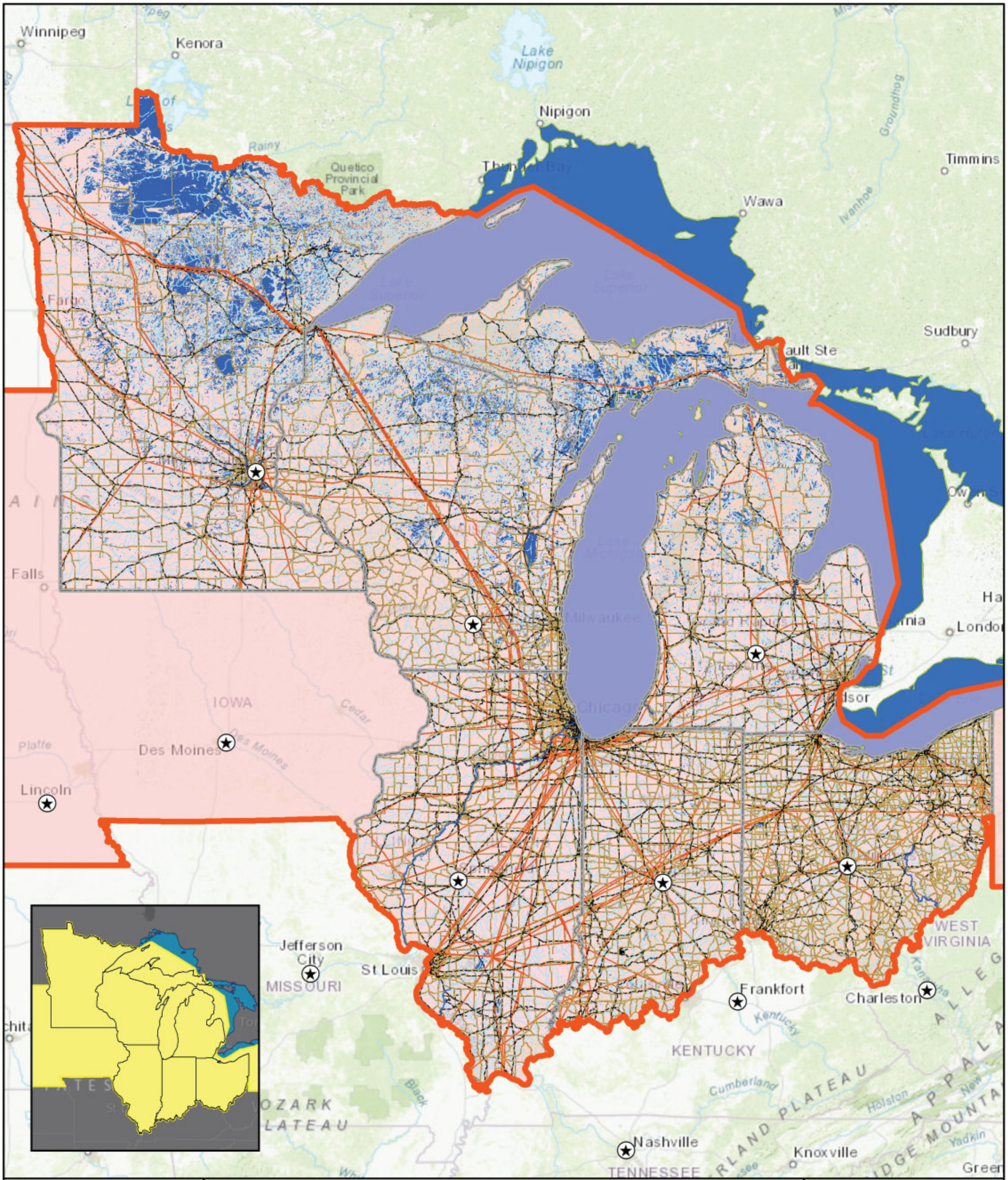

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Miles
0 30 60 120 180 240
Kilometers

BLANDING'S TURTLE (*EMYDOIDEA BLANDINGII*) ACTION AREA OVERVIEW MAP

SCALE 1:10,000,000

- Petroleum Pipeline
- Major Road
- ------ Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- ▨ Lakes & Ponds
- 🟩 1-Mile Coastal Inland Buffer
- 🟨 Action Area
- ☐ Blanding's Turtle (*Emydoidea blandingii*) Counties of Occurrence.

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Basemap courtesy of Esri.

Date: 5/25/2021

Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS

Projection: WGS 1984 Web Mercator

Copperbelly Water Snake (*Nerodia erythrogaster neglecta*), northern DPS

Federal Listing: Threatened
State Listing within the AA: Endangered in Indiana, Michigan, and Ohio

Species Description

Copperbelly Water Snakes have solid, dark, dorsal coloration with bright orange-red ventral coloration that is typically visible from the side; however, body color varies with age. Juveniles often have obvious dorsal banding for the first year or two of their life. This banding is gradually lost leading to the typical solid, dark, dorsal color over time (USFWS, 2008). Copperbelly Water Snakes may be confused with the co-occurring Northern Water Snake (*Nerodia sipedon sipedon*), which may occasionally display similar dark dorsal coloration, yet the Northern Water Snake lacks the solid colored ventral coloration, instead having a pattern of half-moon shaped spots (USFWS, 2008). The Copperbelly Water Snake grows 3 to 5ft in length, with females often larger than males. Relative to other water snakes, the head and eyes of the Copperbelly Water Snake are proportionally larger (USFWS, 2008).

Species Distribution

Copperbelly Water Snakes migrate seasonally across their habitat, which includes wetlands like bottomland forests and scrub-shrub swamps and surrounding upland forest and forest edge. Generally, wetlands used by this species have shallow water, an open canopy, and short dense vegetation. Copperbelly Water Snakes also frequently use upland habitats including forest and grasslands for both foraging and movement among wetlands across the landscape. Due to the variety of habitats required through their life history, the species requires 13.1 to 18.5ha (32 to 46ac) of contiguous wetland/upland habitat and corridors (USFWS, 2008).

The historical range of the Copperbelly Water Snake is somewhat convoluted, but certainly included “south central Michigan and northeastern Ohio, southwestward through Indiana to extreme southeastern Illinois and adjacent Kentucky” (USFWS, 2008). The northern distinct population segment is defined as all populations occurring north of 40˚ north latitude. At the time of listing, the northern distinct population segment consisted of eight clusters knows to have individuals present in the ten years prior, with snakes found at only five of these clusters in 1996 (62 FR 4183).

Distribution within Action Area

- Indiana: only a single individual Copperbelly Water Snake was observed at a single site in the Fish Creek watershed in northeastern Indiana.
- In Michigan, surveys from 1997 – 2000 only found Copperbelly Water Snake populations at three localities including two in Hillsdale Co. and one in Cass and St. Joseph Co. Subsequent surveys from 2001 – 2006 failed to detect individuals at the site in Cass and St. Joseph Co., but did find individuals at three sites in Hillsdale Co., possibly representing a metapopulation that extends to connect population in Indiana and Ohio (USFWS, 2008).
- In Ohio, surveys from 2001 – 2006 detected one substantive metapopulation in Williams Co., located across two adjacent sites (USFWS, 2008). This population located in the West Branch St. Joseph River watershed is believed to connect to three sites in Hillsdale Co., Michigan. Conant (1951) describes an additional small population in Hardin Co. near Mt. Victory, Ohio; however, this population is now extirpated.

Critical Habitat

No critical habitat has been designated for the Copperbelly Water Snake.

Life History

Copperbelly Water Snakes emerge from hibernacula in early spring at which point they remain nearby hibernacula for a period of time. As ambient and water temperatures increase, the snakes begin moving to adjacent wetlands for foraging and searching for mates. Courtship and mating activities for this species primarily occur in the spring but may extend into the early summer (62 FR 4183). During this period, snakes will engage in a behavioral pattern of spending a few days to weeks in one wetland, followed by a move to upland or another wetland (USFWS, 2008). During the summer, as ephemeral forested wetlands dry out, snakes increasingly rely on upland habitats for foraging and aestivation. In fall, Copperbelly Water Snakes migrate to hibernacula sites, typically located in or near bottomland forests (USFWS, 2008).

Hibernacula for Copperbelly Water Snakes are generally located in portions of habitat positioned above flood stage, but where the water-table is accessible but will also utilize areas that may become briefly inundated. Although hibernacula sites may include root wads, dense brush piles, fieldstone piles, and potentially muskrat or beaver lodges, more often abandoned crayfish burrows are used. Early studies indicated that hibernacula in upland habitats may be critical for the survival of the species due to the risk of inundation or freezing temperatures. More recently, however, multiple radio-tracked snakes were found covered by 2 to 3m of floodwater for more than two weeks and emerged with no mortality, suggesting that upland hibernacula may be less important than previously assumed (USFWS, 2008).

Copperbelly Water Snakes forage in both aquatic and terrestrial environments. In wetlands, these snakes forage in water only a few centimeters deep in search of amphibian adults and larvae, but do not forage in deeper water or actively pursue fish. The gradual drying of ephemeral wetlands provides important breeding habitat for amphibians and foraging habitat for Copperbelly Water Snakes as tadpoles become stranded in the shallow waters (USFWS, 2008).

Current Stressors and Threats

Historical habitat loss and fragmentation have occurred across the range of the northern distinct population segments of the Copperbelly Water Snake. Much of the critical wetland habitat has been modified or destroyed for conversion to agricultural, commercial, or residential uses (USFWS, 2008). Impacts of fragmentation have resulted in few extant small, scattered, and isolated populations (62 FR 4183). USFWS (2008) also references the observed presence of skin lesions and blisters and noted it as a fairly common occurrence. Recent studies indicate this to likely be snake fungal disease, a potentially fatal fungal infection caused by *Ophidiomyces ophiodiicola* (Allender et al., 2015).

In the Final Rule to list the Copperbelly Water Snake as threatened, the USFWS determined that the species is impacted by one or more of the following factors to the extent that he species meets the definition of a threatened species under the ESA:

- Habitat loss and fragmentation due to conversion of wetlands to agricultural, commercial, and residential land uses;
- Collection of specimens for scientific and museum studies and commercial pet trade:
- Predation related to mowing, roads, and farming activities that may increase predation during movement and mortality due to vehicle strikes;
- Inadequate existing regulatory mechanisms within the southern population segment that provide loopholes for illegal take and trade; and
- Other natural or manmade factors including small isolated populations that leave the species vulnerable to extreme weather events, continued habitat destruction and modifications, and collection and persecution.

In the most recent 5-year review, the USFWS recommended that the Copperbelly Water Snake be uplisted to endangered due to a documented high degree of threat from continued habitat loss and fragmentation.

List of References

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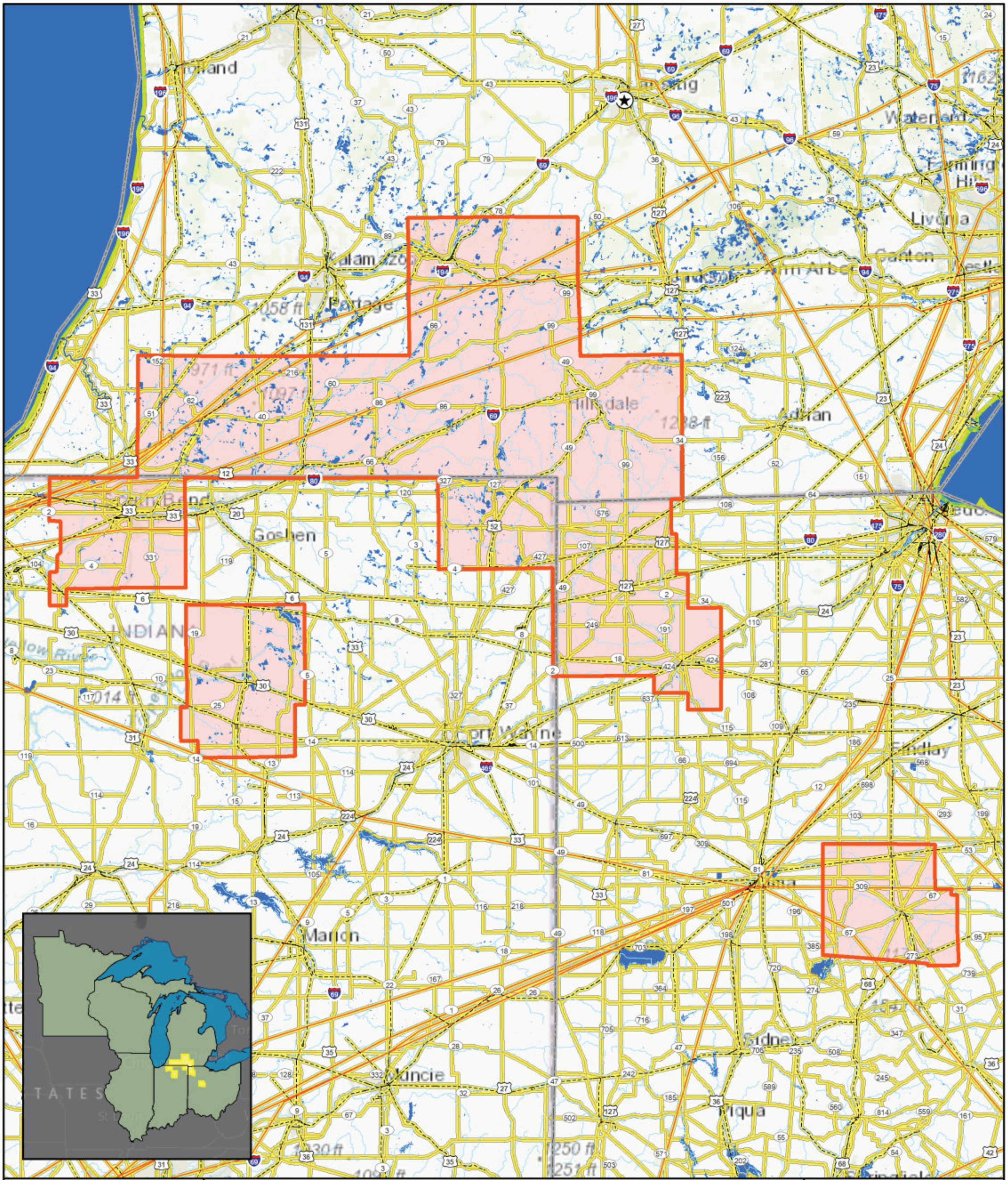

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Kilometers

COPPERBELLY WATERSNAKE (*NERODIA ERYTHROGASTER NEGLECTA*) ACTION AREA OVERVIEW MAP

SCALE 1:2,000,000

- Petroleum Pipeline
- Major Road
- Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- Lakes & Ponds
- 1-Mile Coastal Inland Buffer
- Action Area
- Copperbelly Watersnake (*Nerodia erythrogaster neglecta*) Counties of Occurrence

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Basemap courtesy of Esri. Date: 5/25/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS Projection: WGS 1984 Web Mercator

Eastern Massasauga (=rattlesnake) (*Sistrurus catenatus*)

Federal Listing: Threatened
State Listing within the AA: Endangered in Illinois, Indiana, Ohio, Wisconsin, and Minnesota (extirpated); Special Concern in Michigan

Species Description

The EMR is a small, heavy-bodied snake with a heart-shaped head and vertical pupils. The average length of an adult is approximately 0.6m (2ft), with a maximum length of approximately 1m (3ft). Adult EMRs are most often gray or light brown with large, light-edged chocolate brown to black blotches on the back and smaller blotches on the sides, though in some areas (especially in northeast Indiana, southeast Michigan, and northern Ohio) significant numbers of individuals in populations may be nearly or completely black in color. The belly is marbled dark gray or black and there are brown stripes on the sides of the head, each of these bordered by a narrow, white stripe. Its tail has several dark brown rings and is tipped by gray-yellow keratinized rattles. Young snakes have the same markings as adults, but are paler, and have bright yellow tails that darken in color as age progresses. Until the first time the neonates (newborns) shed their skin, the rattle is represented by a single “pre-button” and between the first and second time they shed, the rattle is represented by a complete terminal segment called a “button.” As pitvipers, this species, and all rattlesnakes have an extrasensory “pit” located on each side of the head between the eyes and nares. These pits allow thermal sensing of the environment, potential prey, and other objects (USFWS, 2015).

Species Distribution

The type of habitat used during the active season generally consists of high, dry habitats, open canopy wetlands and adjacent upland areas. Active season habitat use varies regionally, and this variability has been observed in multiple EMR populations across its range. Because of this, individual snakes can be found in a wide variety of habitats including old fields, bogs, fens, shrub swamps, wet meadows, marshes, moist grasslands, wet prairies, sedge meadows, peatlands, forest edge, scrub shrub forest, floodplain forests, and coniferous forests. Active season habitat use can also be site dependent even within a particular region. Active season habitat consists of thermoregulatory or basking sites, retreat sites, and foraging sites and are thoroughly examined in the SSA. After the active season, EMRs move to low wet areas for overwintering or hibernation. To survive the winter, each individual EMR requires a suitable hibernation site which is critical to avoid lethally low temperatures and reduce the risk of desiccation. Consequently, hibernation sites must provide insulated and moist subterranean spaces below the frost line where individuals can avoid freezing and dehydration. Most EMRs will either return to the same hibernacula annually or to an area within roughly 100m (328ft) of their previous hibernation site. Across its range, EMRs have been reported to hibernate for up to six months of the year, and have used crayfish burrows, mammal burrows, rocky crevices, rodent holes, hummocks, old stumps, rotten logs, and tree and shrub root systems or any excavation that reaches the water table. The snakes hibernate either singly or in small groups or clusters, aggregating where favorable microhabitats occur (USFWS, 2015).

The documented historical range of the EMR included sections of western New York, western Pennsylvania, southeastern Ontario, the upper and lower peninsulas of Michigan, the northern two thirds of Ohio and Indiana, the northern three quarters of Illinois, the southern half of Wisconsin, extreme southeast Minnesota, east central Missouri, and the eastern third of Iowa. The limits of the current range of the EMR resemble the boundaries of its historical range. However, the geographic distribution of extant localities has been restricted by the loss of the populations from much of the area within the boundaries of that range. Extant populations in central and western Missouri previously considered to be EMR are now known to cluster genetically with the western massasauga rattlesnake. However, the non-extirpated populations in the St. Louis metropolitan area of east central Missouri are believed to be EMRs. This determination is based entirely upon phenotypes of museum specimens, but because no viable tissues are available to confirm their phylogeographic relationships through molecular techniques (as the species is extirpated throughout Missouri), USFWS includes these populations within the historical range of the EMR.

Based on the information that USFWS has collected, the EMR is also likely extirpated from Minnesota (USFWS, 2015).

Distribution within Action Area

- Illinois: Clinton, Cook, DuPage, Knox, Lake, Piatt, and Will Counties
- Indiana: Allen, Carroll, Elkhart, Fulton, Kosciusko, LaGrange, Lake, LaPorte, Marshall, Noble, Porter, Pulaski, Starke, Steuben, St. Joseph, and Whitley Counties
- Michigan: 57 counties
- Ohio: 27 counties
- Wisconsin: Buffalo, Columbia, Crawford, Jackson, Juneau, La Crosse, Monroe, Pepin, Rock, Sauk, Trempealeau, Walworth, and Wood Counties

Critical Habitat

USFWS determined that the designation of critical habitat for EMR is not prudent due to an increased risk of collection and persecution (81 FR 67193).

Life History

The annual cycle of EMR is characterized by 2 seasons: the active season and the inactive or winter dormant season. The start of the active season varies by latitude but generally it begins in March or April when EMRs emerge from their winter hibernacula and move to their summer habitat where mating and parturition occurs in later summer. Generally, males and non-gravid females spend the active season foraging, while gravid females thermoregulate to obtain optimal body temperatures for young development. In fall, EMRs return to their winter areas to hibernate. Massasauga populations demonstrate considerable variation in reproductive traits throughout the range. Most recent data indicate that mating is actually most prevalent in summer or early autumn, though it may rarely occur in spring. The mating system of many pitvipers includes ritualized male-male aggression, sometimes called “combat” to assert dominance, though it is not as well known in the genus *Sistrurus*. However, there are published observations of male massasaugas behaving aggressively towards one another. Males may also use chemical cues to simultaneously trail and pursue individual females during the mating season. Because mature male EMRs often occur at a higher ratio to receptive females, competition for mates can be intense. Males may exhibit prolonged periods of mate searching, longer daily movements, and defensive female polygyny during the mating season. Like most pitvipers, the EMR is ovoviviparous, meaning embryos develop within eggs held by the female, and gives birth to live young. Data indicate average brood size varies greatly across the range (average 9.3). With few exceptions, the female reproductive cycle in EMRs follows a biennial pattern in which mating, and parturition are skipped in years following ones where broods are born. Ovulation and fertilization take place following emergence from hibernation during the following spring, with embryonic heartbeats detectable by late May. Skeletal formation, growth of the embryos, and birth follows from late July to August. Following giving birth in summer, females enter a non-reproductive state characterized by the presence of non-vitellogenic oocytes and may forage heavily before entering hibernation. The time needed to forage and reallocate nutrient resources expended while carrying broods may be great, and the success in replenishing lost energy reserves may not only determine whether they will survive hibernation, but also whether they will mate or reproduce the following year. Because of this, receptive females may occur in lower proportion to males during the breeding season, even in populations in which there is a female bias. The diet or prey of the EMR varies across the species range but may consist primarily of small mammals. Juvenile EMR occasionally feed on snake species. It has been demonstrated that subadults consume an equal proportion of both mammal and snake prey (USFWS, 2015).

Current Stressors and Threats

See the SSA (USFWS, 2015) for detailed discussion of stressors and threats:

- Habitat loss and modification

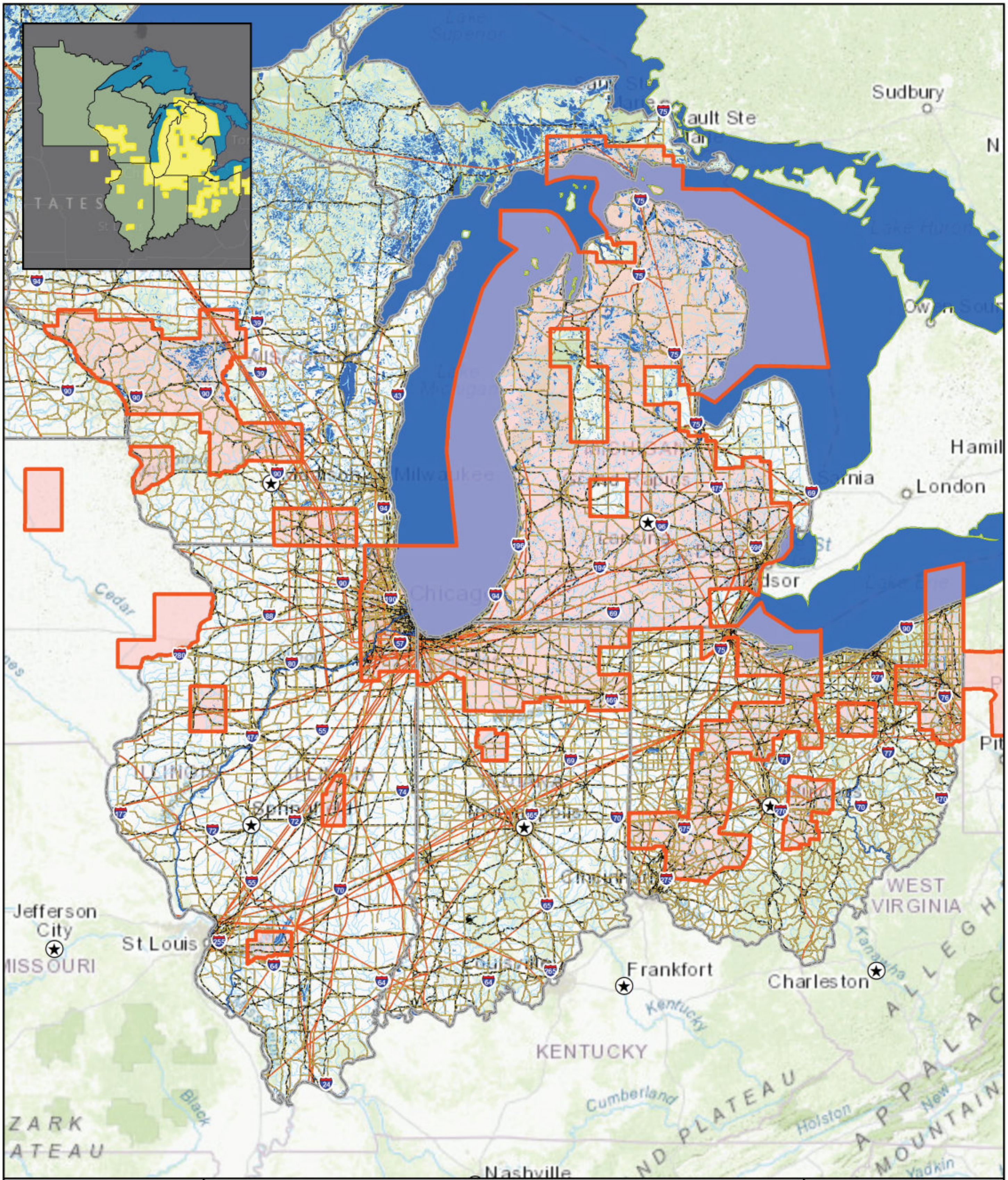
The loss of habitat was historically, and continues to be, the primary threat affecting this species. Habitat loss includes direct habitat destruction of native land types (e.g., grassland, swamp, fen, bog, wet prairie, sedge meadow, marshland, peatland, floodplain forest, coniferous forest) due to conversion to agricultural land, development, and infrastructure associated with development (roads, bridges).

- Management practices
  An effective tool for controlling vegetative succession is the use of prescribed fire which kills or temporarily sets back the growth of woody vegetation, retards the growth of undesirable species, and stimulates the response of prairie species. However, direct mortality of EMR can result from exposure to fire if burning occurs when the snakes are out of their hibernacula. Mowing prior to burning results in additional direct mortality to EMRs beyond that incurred by prescribed burning.
- Road mortality
  Although viperids like EMR are more sedentary than other snakes, they also move more slowly which increases the probability of being killed while crossing roads.
- Persecution and collection
  Collection and killing are forms of loss to both the snake individually and to the population; the animals are removed from the population either through death (persecution) or disappearance (collection).
- Disease
  The recent documentation of disease in EMR populations is an additional threat to the species. Although disease (Snake Fungal Disease [SFD] and/or ophidian paramyxovius) in any snake population could be considered a normal life event, a fatal disease outbreak in a population with low population size may compromise the viability and integrity of the entire population.

List of References

U.S. Fish & Wildlife Service (USFWS). (2015). Species status assessment for the Eastern Massasauga Rattlesnake (*Sistrurus catenatus*). 102pp.

U.S. Fish & Wildlife Service (USFWS). (2019). Draft recovery plan for the Eastern Massasauga Rattlesnake (*Sistrurus catenatus*). Bloomington, Minnesota. 17pp.



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Miles

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Kilometers

EASTERN MASSAUGA (*SISTRURUS CATENATUS*) ACTION AREA OVERVIEW MAP

SCALE 1:7,500,000

—	Petroleum Pipeline
—	Major Road
------	Railroad
—	Commercial Navigable Waterway
—	Rivers & Streams
🟦	Lakes & Ponds
🟩	1-Mile Coastal Inland Buffer
🟨	Action Area
🟥	Eastern Massasauga (*Sistrurus catenatus*) Counties of Occurrence

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Basemap courtesy of Esri.

Date: 5/25/2021

Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS

Projection: WGS 1984 Web Mercator

Illinois Chorus Frog (*Pseudacris illinoensis)*

Federal Listing: Under Review. The Illinois Chorus Frog was petitioned for Federal listing under the Endangered Species Act in 2012, and a 90-day finding was issued in 2015 (80 FR 37568).
State Listing within the AA: Threatened in Illinois

The taxonomic status of the ICF and Strecker's Chorus Frog (SCF; *P. streckeri*) has been debated in the literature. The principal range of SCF extends from central Texas and adjacent Louisiana through Oklahoma to extreme southcentral Kansas and over to central Arkansas. There are a few separated populations in west-central and southwestern Illinois, southeastern Missouri and adjacent Arkansas of what has been considered the sub-species *P. streckeri illinoensis. Pseudacris illinoensis* was proposed as a separate species due to its separated geographic distribution and distinct physical features. However, recent work has shown ICF and SCF are not genetically different and the disconnected populations have only recently separated from the Texas populations. Still, physical features vary geographically. The International Union for Conservation of Nature recognizes a single species, *P. streckeri*, with disjunct populations. The Integrated Taxonomic Information System recognizes both *P. streckeri* and *P. illinoensis* as valid species. In Illinois, the ICF was recognized as *P. s. illinoensis* until the 2009 revision of the endangered and threatened species list, when it was listed as *P. illinoensis* (Henning and Hinz, 2016).

Species Description

The Illinois Chorus Frog (ICF) is a small (1.4 to 1.75in and 0.2oz) tan to gray frog. Its body is stout and toad-like with robust forearms. Its skin is granular rather than smooth. It has dark brown or black lines on its back with a white belly. It has a characteristic dark masklike stripe from snout to shoulder, a dark spot under each eye, and a V- or Y-shaped mark between the eyes. The throat (vocal pouch) of the male ICF darkens during the breeding season. ICF tadpoles can be distinguished from other tadpoles by their round shape, large size, forward attachment point of the tail, and large tail height. Once they develop two functioning limbs, they also develop other ICF markings including the dark "Y" between the eyes. ICF are rarely seen because they spend most of their lives underground, emerging only during the breeding season. The males' breeding call is a series of high-pitched, rapid, birdlike whistles that can be heard as much as 1.3 mile away (Henning and Hinz, 2016).

Species Distribution

ICF populations are restricted to Missouri, Arkansas, and Illinois. ICF likely migrated into Illinois along river floodplains that contain sands or sandy soils deposited by either water or wind.

Distribution within Action Area

In Illinois, ICF records occur in three widely separated sandy floodplain regions. The northern region covers the largest area; it occurs along the east side of the Illinois River in the central portion of the state from Tazewell County in the north to Scott County in the south and east to Logan County. The central region near the Mississippi River in Monroe and Madison counties has been greatly reduced to an area of roughly 250 acres in Madison County. The southern region near the junction of the Ohio and Mississippi Rivers in extreme southern Illinois in Alexander County has a single population with multiple breeding ponds in the area around Horseshoe Lake Conservation Area. A genetic comparison of the northern and southern regions of the state found the populations were genetically different, indicating little to no connectivity between the regions. Habitat conditions that are similar to these three regions have been identified in additional areas in Illinois, but there is no evidence ICF has ever inhabited these areas (Henning and Hinz, 2016).

Critical Habitat

No critical habitat has been designated for the Illinois Chorus Frog.

Life History

ICF spend most of their life underground, where they dig forward through the sandy soil with their unusually strong forearms, rather than backward with their hind legs like most fossorial amphibians. Only four ICF burrows have ever been observed and documented; they were found in April and November in areas free of vegetation. The burrows observed have varied in depth between 4 to 8in and from roughly level (into a hill side) to nearly straight down. There is some evidence (surface depressions and lab experiments) that ICF may surface at night, especially in association with rainstorms, yet very little is known about this behavior. No overwintering burrows have been located, but ICF is not freeze tolerant and must therefore burrow below the freeze line to overwinter. One season of soil temperature monitoring at a Madison County site indicated that ICF must burrow at least 5in below the surface, perhaps as deep at 10in, to avoid freezing. When there is a shallow layer of clay below the upper layer of sandy soil, it will likely limit the depth of ICF burrowing and impede ICF overwintering in that area (Henning and Hinz, 2016).

ICF are the only known frog capable of feeding below ground, but surface feeding is also likely. During the breeding season, adult ICF diet consists of small insects and burrowing larvae including moth and butterfly larvae (specifically the agricultural pest dingy cutworm *Feltia ducens*), true bugs (specifically nabids), beetles (specifically curculionids), and flies. Very little is understood about their fossorial behavior and their ability to locate prey items. Although many adult frogs are visual predators, ICF cannot use sight while feeding underground. It is presumed prey are eaten as encountered, but ICF may be using vibrations or chemical cues to track and detect prey as has been observed in some other amphibians (Henning and Hinz, 2016).

ICF are among the earliest of Illinois frogs to emerge and call, often while snow is on the ground and air temperatures are below freezing in late winter or early spring (February to April). ICF emergence often coincides with heavy rainfall (1in or greater), although it is unknown which cue triggers the emergence: moisture, temperature, vibration, etc. ICF may not breed in years without suitable breeding conditions, such as drought. Breeding begins soon after emergence and continues irregularly for approximately seven weeks. ICF may be able to detect the presence of fish and forego breeding ponds containing fish. Upon emergence, breeding males gather in wetlands to form choruses, calling at night to attract females. Most choruses consist of 1 to 20 males but may have as many as 100 males. The males temporarily maintain calling territories with about 5ft between them. Most males call from water while clasping emergent vegetation to keep their vocal sac above the water line. Advertisement calls that attract females can be heard from more than 1 mile away. Breeding mostly takes place in the center of ponds in deeper water and further from the shoreline. Females approach and swim around the calling male until the male jumps onto and clasps the female's back. The pair then deposits eggs and sperm clusters of 10 to 40 eggs on the underside of submerged or floating vegetation. Egg masses quickly become covered by silt and debris, perhaps disguising and protecting them. No further parental care is given (Henning and Hinz, 2016).

ICF eggs likely hatch into tadpoles within a few days. As tadpoles they eat suspended matter, organic debris, algae, plant tissue, and plankton. There is evidence that some ICF tadpoles may be cannibalistic, capable of eating smaller ICF tadpoles when necessary, to ensure their metamorphosis prior to drying of breeding ponds. After about two months, ICF tadpoles undergo metamorphosis into the terrestrial form and disperse from the pond around late May or early June. They have been found more than half a mile from their pond of origin and are likely capable of traveling much further, perhaps as much as 2 to 3 miles away. Immature ICF grow rapidly and are capable of breeding after one year of growth. Most ICF were not found to return to their birth pond for breeding but dispersed across the landscape colonizing other breeding ponds (Henning and Hinz, 2016).

Current Stressors and Threats

The largest threat to ICF populations is likely loss of breeding habitat, which is associated with agricultural drainage. Additional threats, such as loss of terrestrial habitat, invasive species, pollution, disease, and climate change are also of concern. These threats and avoidance/minimization best practices are detailed IDNR Conservation Guidance (Henning and Hinz, 2016).

- Habitat loss
  Loss of breeding habitat is likely the greatest threat to ICF. Hydrology has been altered on a large scale by agricultural production and other developments that have eliminated some breeding habitats, caused others to dry up before tadpoles have time to undergo metamorphosis, and reduced habitat connectivity of individual breeding ponds. In addition, some temporary wetlands have been dammed creating permanent water bodies that allow fish to survive, making unsuitable ICF habitat.
- Fragmentation
  Fragmentation of habitat, such as by highway construction, reduces dispersal and limits connectivity, which decreases population persistence and genetic diversity in the long term. In recent years there have been numerous linear development projects, such as roads, underground pipelines, and transmission lines, which have crisscrossed ICF habitat and increased fragmentation. Road kills are common around breeding ponds as frogs disperse to terrestrial habitat across roadways.
- Habitat degradation
  Even areas that are protected may become unsuitable due to habitat degradation from invasive species and succession. Invasive species can alter ICF habitat, making it unusable. For instance, woody encroachment of black locust (*Robinia pseudoacacia*) or red cedar (*Juniperus virginiana*) into sand prairie openings consolidates soil making it difficult for ICF to burrow.
- Climate change
  ICF is rated as “Extremely Vulnerable” or “Highly Vulnerable” to climate change due to potential drying of ephemeral pools, which is worsened by fragmented landscapes and increased water demand for irrigation.

List of References

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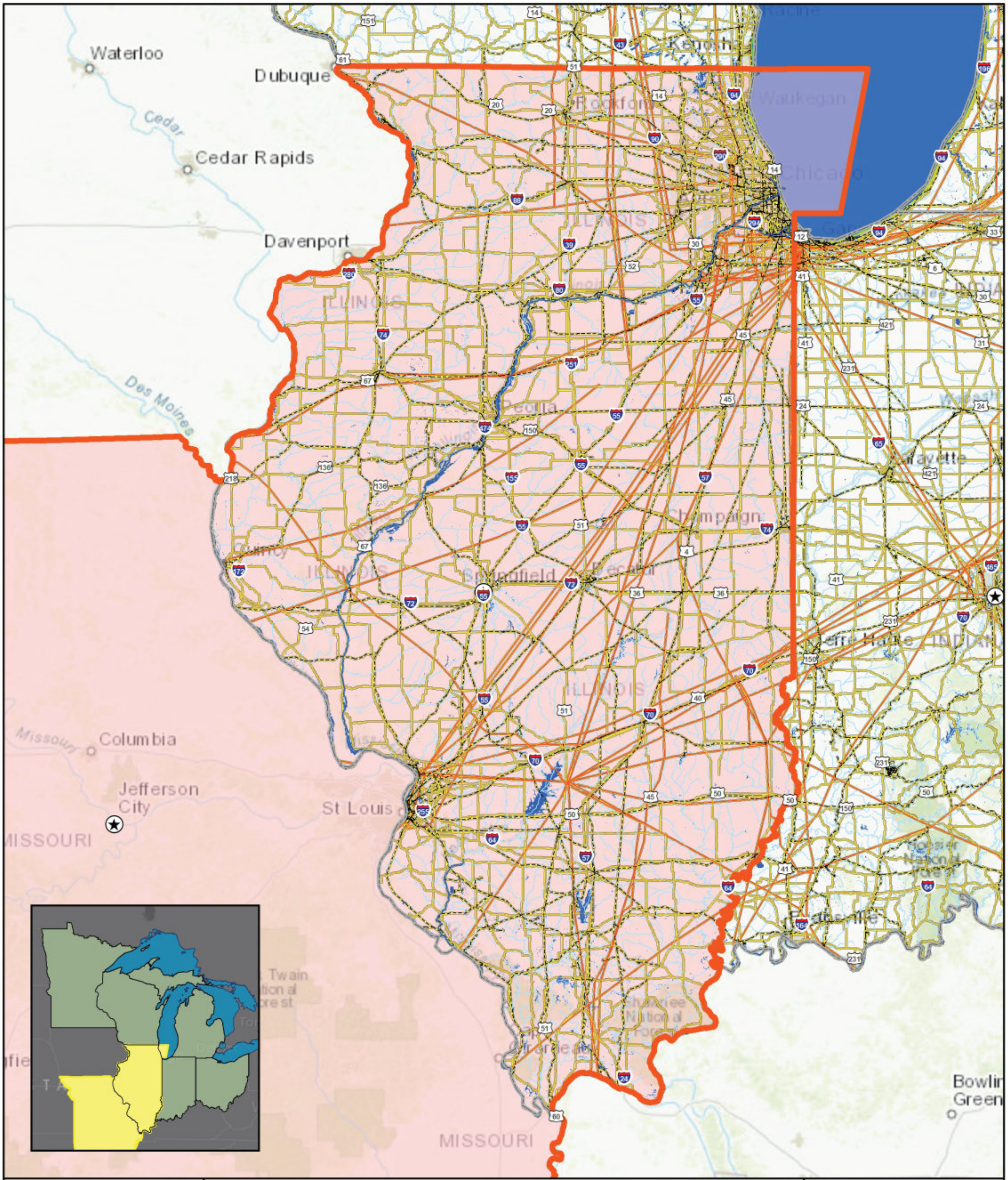

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Miles
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Kilometers

ILLINOIS CHORUS FROG (*PSEUDACRIS ILLINOENSIS*) ACTION AREA OVERVIEW MAP

SCALE 1:4,000,000

— Petroleum Pipeline
— Major Road
------ Railroad
— Commercial Navigable Waterway
— Rivers & Streams
▬ Lakes & Ponds
▬ 1-Mile Coastal Inland Buffer
▬ Action Area
▭ Illinois Chorus Frog (*Pseudacris illinoensis*) Counties of Occurrence.

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Basemap courtesy of Esri. Date: 5/25/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS Projection: WGS 1984 Web Mercator

Spotted Turtle (*Clemmys guttata)*

Federal Listing: Under Review. The Spotted Turtle was petitioned for Federal listing under the Endangered Species Act in 2012, and a 90-day finding was issued in 2015 (80 FR 37568).
State Listing within the AA: Endangered in Illinois and Indiana; Threatened in Michigan and Ohio

Species Description

The Spotted Turtle is a relatively small freshwater turtle species, with adult carapace (upper shell) length averaging 9 to 14cm. The species is recognized by its black keel-less, unserrated carapace overlaid with an irregular pattern of yellow or yellow-orange spots. Hatchlings usually have one spot per carapacial scute. The plastron (lower shell) is orange to yellow-orange with black blotches on each scute; however, the plastron tends to become more black with age. Individuals from some subpopulations may exhibit a spotless carapace or an entirely black plastron. The head is black, with yellow to yellow-orange spots and large orange "ear" patches on either side. The legs are black with yellow-orange spots on the upper surface and orange to pinkish-orange on the lower surface. Spotted Turtles are sexually dimorphic. Females have orange mandibles and irises, a flat to convex plastron, and relatively small, thin tails with cloaca at the margin of the carapace. In contrast, males have brown-buff mandibles and irises, a concave plastron, and larger, thicker tails with cloaca extending past the margin of the carapace. Male coloration may not develop until maturity. Adult Spotted Turtles may be confused with juvenile Blanding's Turtles (*Emydoidea blandingii*). which have a similarly dark carapace with yellow spots and flecks; however, young Blanding's Turtles can be distinguished by their yellow throats and chins and by the yellow, rather than orange scales, on their otherwise black legs (Ernst & Lovich, 2009).

Species Distribution

Spotted Turtles occur in high organic content wetlands with unpolluted shallow waters, soft substrates, and high amounts of aquatic and emergent vegetation including: ponds, vernal pools, ditches, acidic bogs, alkaline fens, Cattail/tussock marshes, shallow graminoid meadowmarsh, woodland streams, sheltered edges of shallow bays, and various swamp habitats. Sphagnum moss, grass and sedge tussocks, cattails, floating plants and mats of vegetation, and hydrophilic shrubs appear to be important components of aquatic habitats in northern populations. Spotted Turtles use a mosaic of habitat types, display distinct seasonal shifts in habitat use and may require terrestrial habitats during certain times of their seasonal activity cycle (COSEWIC, 2014).

The Spotted Turtle's current distribution is restricted to eastern North America. Disjunct subpopulations range from southern Ontario and Maine southward along the Atlantic Coastal Plain to central Florida, and westward through Pennsylvania, Ohio, Indiana, northeastern Illinois, and across the lower peninsula of Michigan (COSEWIC, 2014).

Distribution within Action Area

- Historically known from Cook and Will Counties in Illinois. No Cook County populations are extant. This species survives in Illinois at two Nature Preserves in Will County (INHS, 2021).
- Currently known from 15 counties in northern Indiana (Indiana Herp Atlas, 2021).
- Known throughout the lower peninsula of Michigan, but populations more disjunct in the northern portion (MNFI, 2021).
- In Ohio, the Spotted Turtle is known from the southwest, northwest, and northeast portions of the state but distribution is patchy, and many records are historic (ODNR, 2018).

Critical Habitat

No critical habitat has been designated for the Spotted Turtle.

Life History

Spotted Turtles aggregate in aquatic habitats in early spring to mate and tend to show fidelity to breeding sites. Nesting takes place from May to June and is primarily nocturnal with most reports of nest construction starting between 1700 and 2300 hrs; however, females will also nest on warm overcast afternoons during rain events. Females may disperse outside their regular home range to oviposit, making upland travels of 0 to 900m and spending up to 9 days on land before returning to wetland habitat. Egg incubation is at least 72 days in the wild with up to 108 days recorded for a couple of nests at a southwestern Ontario marsh. In northern North America hatchling emergence occurs around September and October though neonates may overwinter in the nest chamber and emerge the following spring. Spotted Turtles have low reproductive output. Clutch sizes for northern Spotted Turtles range from 1 to 7 eggs, with a mean of 4 to 5 eggs. Most females do not oviposit every year, and some do not produce eggs for at least three consecutive years. Adult females in better body condition (i.e. non-gravid body mass relative to carapace length) have been shown to produce more eggs through greater frequency of reproduction. Spotted Turtles at the northern limit of their range are larger and have larger clutch sizes but reproduce less frequently than their southern U.S. counterparts. A stage-classified matrix model, based on average nest survivorship data collected from across the North American range, estimated that average egg survivorship for this species is 55%. Sexual maturity is delayed until turtles are 7 to 15 years old. Spotted Turtle body size varies across the species' range with the largest turtles occurring in the northern (45°N latitude) and the smallest turtles occurring near the northcentral part of the range (39°N latitude). This drop in body size near 39°N latitude likely represents a "transition zone" where there is a tradeoff between growth and reproductive output, with turtles north of this zone producing fewer clutches per year and thereby allotting more resources to growth. Food items reported for U.S. Spotted Turtles include algae, cranberries, earthworms, aquatic insect larvae, small crustaceans, snails, tadpoles, salamanders, and carrion from fish and birds. Some individuals in some subpopulations avoid the hot, dry, and desiccating conditions of summer by aestivating in either aquatic or terrestrial habitats. Summer dormancy may be a more appropriate term than aestivation for this behavior as not all turtles become inactive in summer and for those that do, activity becomes reduced, rather than ceased. This reduced activity period may occur from late June through to early September and may last several days or weeks. Emergence from hibernation in northern populations occurs from late March to late April with dispersal from hibernacula occurring from early to late April. Spotted Turtles move back to hibernation areas in late summer to late fall and enter hibernacula between mid-September and mid-November, where they remain until the following spring Spotted Turtles often hibernate communally and as many as 16 to 34 individuals have been observed using a single den; however, they also hibernate singly. Spotted Turtles have also been observed to occasionally share hibernacula with Blanding's Turtles. Spotted Turtles often show fidelity to hibernation areas; however, individuals may also choose hibernacula that differ in habitat and locality between years (COSEWIC 2014).

Current Stressors and Threats

Spotted Turtle numbers are in decline mainly due to road mortality; collection for the pet, food, and medicine trade; and the loss and degradation of wetland habitat from invasive plants and development. The Spotted Turtle is particularly susceptible to habitat destruction and to exploitation by poachers in spring and fall when turtles aggregate at breeding and hibernation sites, respectively. Low juvenile recruitment, low fecundity, and late age of maturity exacerbate the Spotted Turtle's vulnerability to decline. Subpopulations are at high risk of demographic stochasticity given their small sizes and high degree of isolation from each other (COSEWIC, 2014).

The Center for Biological Diversity list these threats in the petition document (2012):

- Habitat alteration and destruction
  Habitat alteration and fragmentation is a major threat. The species is reasonably specialized in its habitat requirements and is not a good disperser. Additionally, the complex movement ecology and habitat requirements of Spotted Turtles make their populations especially vulnerable to road mortality: over the course of a year, they typically visit multiple wetlands to forage, mate, thermoregulate, and overwinter, requiring frequent overland migrations and road crossings.

- Overutilization
  Legal and illegal commercial exploitation (for both domestic use and export) and incidental collecting have impacted and continue to impact Spotted Turtle populations in many parts of the species' range.
- Predation
  Subsidized predators (i.e., unnaturally large populations of predators subsidized by easily available resources near human settlements) have a huge impact on eggs and juveniles and reduce recruitment into existing populations. This threat increases as the habitat becomes more and more fragmented by urbanization.

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Miles
0 30 60 120 180 240
Kilometers

SPOTTED TURTLE(*CLEMMYS GUTTATA*) ACTION AREA OVERVIEW MAP

SCALE 1:10,000,000

- Petroleum Pipeline
- Major Road
- Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- Lakes & Ponds
- 1-Mile Coastal Inland Buffer
- Action Area
- Spotted Turtle (*Clemmys guttata*) Counties of Occurrence.

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Basemap courtesy of Esri. Date: 5/25/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS Projection: WGS 1984 Web Mercator

Streamside Salamander (*Ambystoma barbouri)*

Federal Listing: Under Review. The Streamside Salamander was petitioned for Federal listing under the Endangered Species Act in 2010, and a 90-day finding was issued in 2011 (76 FR 59836).
State Listing within the AA: Special Concern in Indiana

Species Description

The Streamside Salamander is of medium size, with a relatively small head, short snout, stout body, short limbs, relatively short and fat tail, 14 to 15 deeply impressed costal grooves on the body, and similarly impressed grooves along most of the tail. The dorsal ground color is dark gray, black, or brown but is largely hidden by a dense pattern of gray (dorsally) and light blue-gray (laterally) lichenose frosting; ventral ground color is slightly lighter, with more discrete lichenose blotches. Internal morphological features are important for distinguishing the Streamside Salamander from its closest relatives that are not discussed here (see Kraus, 2013). Adults reach 89mm snout vent length and can reach 146mm total length. Larvae are dark green-brown dorsally and laterally, dirty white ventrally, with a sharp transition to the pale mid-ventral coloration laterally at a point below the limb insertions. They have dark throat and a wide dorsal tail fin that extends to the rear of the head. Young larvae typically have 3 to 6 paired, light dorsal blotches or saddles. These eventually become obscure or disappear in older larvae; the throat lightens in color somewhat, and the pigmentation on the sides becomes a black reticulum. Larvae metamorphose at approximately 37 to 40mm. Newly metamorphosed animals are uniformly dark brown, gray, or gray-brown and they begin to acquire adult color pattern elements within 3 to 6 weeks after transforming. The Streamside Salamander is easily distinguished from other members of the genus, except for the Small-mouthed Salamander. The most reliable means of distinguishing them is by examining the maxillary/premaxillary teeth but can be distinguished by being somewhat stockier than Small-mouthed with relatively fatter tail, which is often thick and well-rounded along most of its length with conspicuous grooves. Small-mouth tails are usually thinner and more compressed, at least posteriorly; if grooves are present, they are usually shallow and limited to the anterior portion. The lichenose frosting of Streamside Salamanders is typically denser and of a light blue color than that of Small-mouthed Salamanders, wich is usually arrayed in more discrete blotches and is brown, gray, or dark blue-gray. The breeding habitat and egg-laying habitat of the two species also differ, with Streamside Salamanders usually breeding in first and second-order streams, depositing a layer of singly attached eggs on the undersides of rock. Small-mouthed salamanders usual breed in ponds/pools and lay small clusters of eggs on vegetation (Kraus, 2013).

Species Distribution

The species inhabits upland deciduous forests or rolling topography. Most populations occur on a substrate of limestone bedrock, but some inhabit substrates of sandstone or shale. Forested areas within its native range have been highly disturbed by humans, and the species can often persist in highly fragmented landscapes. However, in such landscapes these salamanders will typically be limited to remnant forests and will not be found in cleared areas. For breeding habitat, it is dependent on ephemeral first- and second-order streams having natural barriers that prevent the ingress of fish, so salamanders are never found far from the hills that provide such habitat. Breeding streams are typically small (2 to 5m wide) and shallow (usually <50cm), contain large flat rocks, and have alternating areas of pools, runs, and riffles. Larvae typically inhabit small, still, shallow stream pools having clear water and a bottom of bedrock and silt, with large flat rocks that can be used as refugia (Kraus, 2013).

The range of the Streamside Salamander lies largely within the upper Bluegrass Region in the middle portion of the Ohio River Drainage. The majority of the range encompasses central Kentucky and the immediately adjacent areas of southwestern Ohio and southeastern Indiana, but outlying populations occur in western and southern Kentucky, northern Tennessee and western West Virginia. Some of these outlying populations show evidence of genetic introgression with Small-mouthed Salamanders. The two species were likely segregated by habitat and closely parapatric originally, but extensive forest clearing has obscured the original distributional pattern of Streamside Salamanders along the northern margins of their range. Populations on the western and northern margins of their range may be parapatric with Small-mouthed Salamanders.

Distribution within Action Area

- In Ohio adults have been obtained from Adams, Brown, Butler Clermont, Clinton, Hamilton, Jackson, Lawrence, Montgomery, Scioto and Warren counties (Kraus, 2013).
- Streamside Salamanders are restricted to the southeastern part of Indiana and some of the south-central counties bordering the Ohio River (Indiana Herp Atlas, 2021).

Critical Habitat

No critical habitat has been designated for the Streamside Salamander.

Life History

Like other members of the genus, adult Streamside Salamanders spend most of their lives underground. Adults are most readily observed while present in streams during their breeding season, and they can sometimes be located under large logs or rocks adjacent to these streams during or immediately after that period. When not active on the surface adults have not be located, and they presumably reside in the forest patches adjacent to their breeding streams. How widely they disperse from breeding habitats into surrounding upland is unknown. Migration to breeding stream begins in autumn and continues in late winter. This gives a bimodal patters of surface activity, with an autumnal peak in late October, a decrease in surface activity during the harsh winter months, followed by a larger peak during February and March as additional animals migrate. Prior to breeding, autumnal migrants presumably remain burrowed into the hillsides adjacent to breeding streams. As with other Ambystoma, males initiate migration before females do. Migration is highly correlated with occurrence of rainfall, and surface activity typically ends within 30 minutes of cessation of rainfall; however, migration is not correlated with the intensity of rainfall, with air temperature, or with time of night. The breeding period is extensive commencing in January/February and extending through April. During the breeding season, small numbers of animals enter and breed in the stream at any one time. In streams, eggs are almost always attached on the undersides of flat limestone rocks; eggs may occur singly, but most often occur in a layer under the rock, sometimes in groups up to several hundred. Clutches are usually deposited in shallow pools or runs of 10 to 20cm depth, with a preference for pools. Eggs incubate for a period ranging from 29 to 82 days, with those laid later in the season requiring shorter incubation times. Hatchlings from longer incubating eggs are typically larger and more developmentally advanced, and eggs can delay hatching in the presence of chemical cues from predatory flatworms or fish, thereby allowing hatchling to emerge at a larger size that may confer greater resistance to these predators. Larvae feed primarily on a diversity of zooplankton and chironomid fly larvae but will take isopods and amphipods if they prey is not too large to swallow. The larval period is approximately 7 to 9 weeks (Kraus, 2013).

Current Stressors and Threats

The Center for Biological Diversity list these threats in the petition document (2010):

- Habitat destruction
  The Streamside Salamander has declined due to the loss of native forests for agriculture and urban development. This salamander's habitat in Kentucky is undergoing rapid development and one of the two known populations in West Virginia was lost due to urbanization. In Tennessee, what is possibly the last remaining population in the state is imminently threatened by development. Deforestation is also a threat to this species. Where surrounding land has been logged, this salamander is usually not detected. Siltation is also likely a threat to the Streamside Salamander. The Ohio Division of Wildlife reports that the Streamside Salamander is threatened by logging, urbanization, pollution of stream habitats by acid mine drainage, pesticides, and the channelization and scouring of streams.
- Predation
  Predation is a significant source of mortality for Streamside Salamander populations. Fish predation may restrict this species to upper portions of breeding. Flatworms and water nakes are also known to

prey on Streamside Salamander larvae. In conjunction with other threats, natural predation could increasingly threaten this species.

- Stochastic weather events
  Stream drying and flooding are significant mortality sources for this species.

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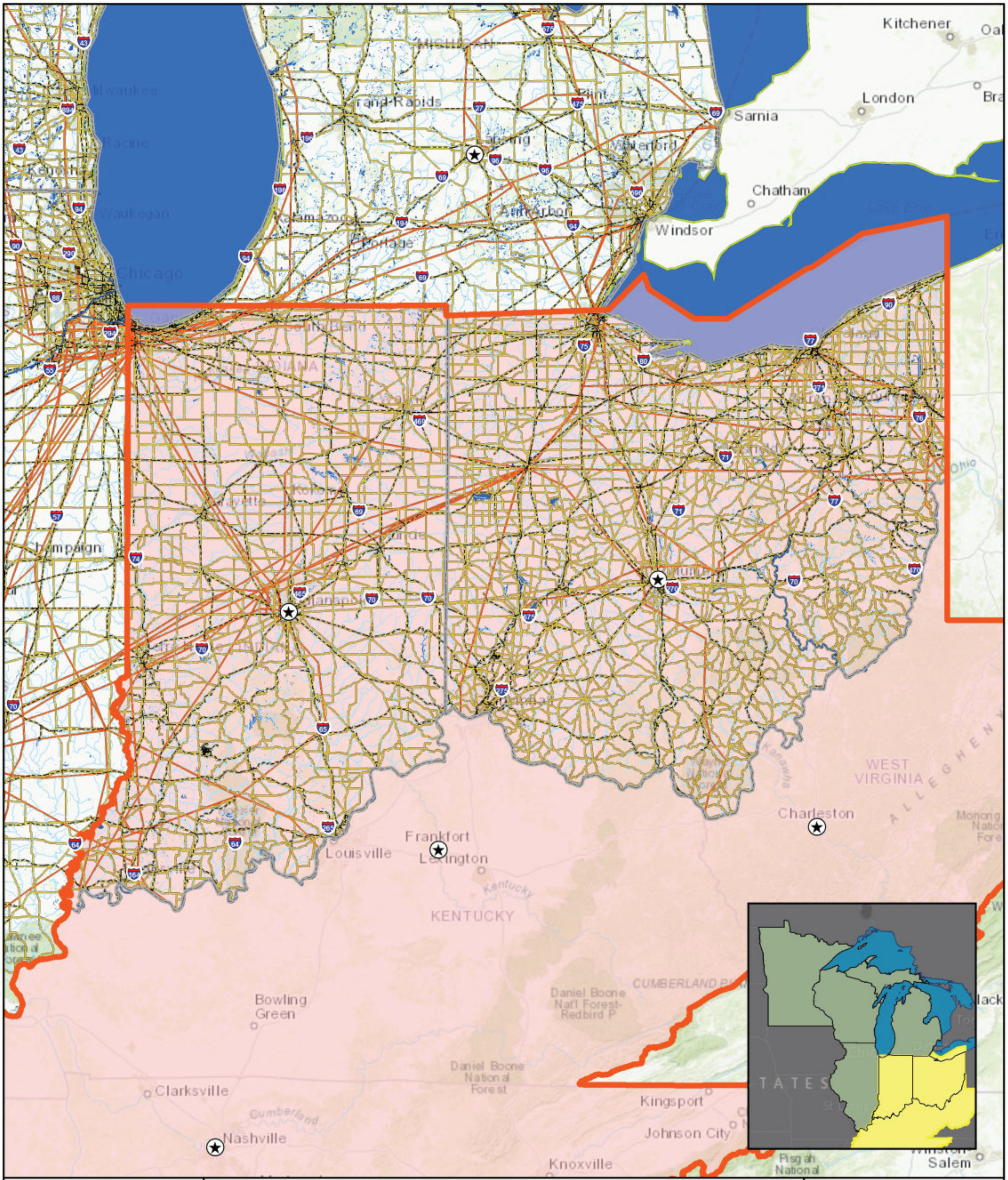

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Miles

0 15 30 60 90 120
Kilometers

STREAMSIDE SALAMANDER (*AMBYSTOMA BARBOURIN*) ACTION AREA OVERVIEW MAP

SCALE 1:5,000,000

Petroleum Pipeline	Commercial Navigable Waterway	🟩 1-Mile Coastal Inland Buffer
Major Road	Rivers & Streams	🟨 Action Area
Railroad	🟦 Lakes & Ponds	▭ Streamside Salamander (*Ambystoma barbourin*) Counties of Occurrence.

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Basemap courtesy of Esri. Date: 5/25/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS Projection: WGS 1984 Web Mercator

Wood Turtle (*Glyptemys insculpta*)

Federal Listing: Under Review. The Wood Turtle was petitioned for Federal listing under the Endangered Species Act in 2012, and a 90-day finding was issued in 2015 (80 FR 37568).
State Listing within the AA: Threatened in Minnesota and Wisconsin (delisting recommended); Special Concern in Michigan. Only two old records from extreme eastern Ohio (not listed).

Species Description

The Wood Turtle is a medium-sized turtle. Carapace (upper shell) length ranges from 12 to 24cm (4.7 to 9.4 in). Unlike many species of turtles, mature males are usually 7 to 10% larger than mature females. Their low-keeled carapace ranges in color from brown to grayish brown to tan, and is accompanied with black and yellow flecks, at times with yellow rays. Scutes on the carapace have an irregular, pyramidal appearance from the concentric circles that are formed by growth rings and ridges. Dorsal portions of the head, arms, legs, and tail are dark brown, while the neck, throat, and forelegs are yellow, orange, or red. Females are generally pale yellow in color, while pigmentation in males is often bright yellow, orange, or red. The hingeless plastron (lower shell) has a yellow base with a black blotch on the outer posterior corners of each scute. Wood Turtle plastrons are flat in females, whereas they become more concave in sexually mature males. Males have long, thick tails with the cloacal opening posterior to the margin of the shell, and females have shorter tails with the cloacal opening level to or under the carapace margin (WIDNR, 2016).

Species Distribution

Wood Turtles are most often found in and around clear, moderate to fast moving rivers and streams with sand, gravel, or cobble substrates. Wood Turtles are habitat generalists, using a wide variety of forested habitats that are in close proximity to water. Forest edges near open canopy habitats are often used for thermoregulation and foraging. Young mixed forest stands with low to moderate levels of shrub and tree cover are often preferred at the microhabitat level. Prior to nesting and hibernation (i.e., in the spring and fall when nighttime air temperatures are low), Wood Turtles are found predominantly near aquatic habitats and alder thickets. Nesting habitat includes moderately sloughing sand banks, sand prairies and barrens, agricultural fields, roadsides, and other areas with disturbed sandy or gravelly substrates that support little or no vegetation. During mid-summer, Wood Turtles also use dry and wet meadows, upland fields, pastures, swamps, and bogs. In Wisconsin, summer shelters include rabbit holes, sod overhangs, gullies, hollow logs, and buttressed tree roots. Wood Turtles overwinter underwater in rivers and streams within deep pools, under overhanging banks, roots, and logs, and in beaver lodges and muskrat burrows (WIDNR 2016).

Wood Turtles are native to eastern North America. They range in the northeast from Nova Scotia, New Brunswick, and Maine, southwest along the Atlantic coast to Maryland, Virginia, and West Virginia, northwest to Wisconsin, northeast Iowa, and eastern Minnesota, and north to southern Ontario and southern Québec.

Distribution within Action Area

- Wood Turtles are found throughout the northern and southwestern portions of Wisconsin. They are absent from southeast Wisconsin and the southern Lake Michigan drainage. Species occurrences are scattered throughout their Wisconsin range; however, occurrences are most dense in the forested regions of the northern and western portions of the state (WIDNR, 2016).
- The Wood Turtle is found on the western edge of its range in Minnesota and is restricted to the western third of the state (MNDNR, 2021).
- Occurrences in Michigan are in the northern half of the lower peninsula and throughout the upper peninsula (MNFI, 2021).

Critical Habitat

No critical habitat has been designated for the Wood Turtle.

Life History

In the Upper Great Lakes Region, the active season for the Wood Turtle generally begins with the emergence of turtles from streams in April or May and lasts until September or October as turtles return to their overwintering stream. Overwintering typically begins in October. Their terrestrial activity varies and is dependent on geographic location and annual fluctuations in weather. From late June until August, Harding and Bloomer found females preferring terrestrial sites over aquatic ones. Wood Turtles have been found mating from April until November, although mating is more widely documented in the fall. Females search for nesting habitat and lay eggs from late May until early July, peaking in June. In years with sufficient temperatures for embryo development, eggs begin to hatch throughout August and September. Wood Turtles remain relatively close to streams and rivers during the spring and fall and often return to the water at night when air temperatures are low. During warmer summer months, they begin to disperse further distances from the water as they forage for food and as females look for suitable nesting areas. A large subset of Wood Turtle telemetry studies throughout their range, including Wisconsin, have documented high proportions of individuals remaining within 300 m (984 ft) of flowing water throughout their active season. A small proportion of Wood Turtles have been found dispersing longer distances (i.e., 400 – 933 m [1,312 – 3,061 ft]) from moving water throughout their range. Wood Turtles typically reach sexual maturity around 14 – 18 years of age. Maturation can be as early as 12 years and as late as 20 years. Mating generally takes place in 0.1 – 1.2 m (0.3 – 3.9 ft) of water; however, terrestrial copulation has also been observed. Females nest generally from mid-May to early-July, though it is quite uncommon after 30 June. Preferred nesting areas include well-drained yet moist soils that are free of rocks and thick vegetation, with direct sunlight exposure, 2.0 – 5.0 m (6.6 – 16.4 ft) above water levels, and within 40 m (131 ft) of flowing water. Most nests are located within 10 m (33 ft) of flowing water, but some females have been documented nesting up to 150 m (492 ft) away (Walde et al. 2007). Females will typically lay one clutch a year (occasionally two); however, clutches may not be laid every year. Clutch sizes are known to be as high as 20 eggs. Hatchlings emerge from the nest between August and October. Hatchlings rarely overwinter in the nest, and are thought to survive terrestrial overwintering only in the warmest of winters (WIDNR 2016).

Current Stressors and Threats

Threats are explored in many of the status assessments referenced above. In the upper Great Lakes region (but also range wide), they include (WIDNR, 2016):

- Habitat loss

  Habitat destruction and modification are widely considered to be the most serious threats to Wood Turtle populations. Urbanization, recreation, some agricultural practices, and flood control (i.e., dams and stream channelization/stabilization) in suitable Wood Turtle habitat are often associated with localized habitat loss, alteration, and fragmentation. These threats may eliminate or modify all or a significant portion of the critical habitat Wood Turtles need for nesting, foraging, and overwintering. Foraging and nesting grounds often become overgrown by succession due to a lack of natural disturbance (i.e., fire, flooding, and beavers) and are often infiltrated by invasive plants. Flood control measures prevent or slow sand and gravel from distributing downstream to enhance or create new nesting sites. Wood Turtles respond to this decline of suitable nesting habitat by searching elsewhere, often finding sandy or gravelly substrates in fragmented habitats near roads and bridges that serve as ecological sinks or traps. Roads also contribute to direct mortality of individuals moving from one fragmented habitat to another, and subsequently provide easier access for predators (e.g., raccoons) and humans to exploit nests and adults. Fragmented habitats also promote further isolation of populations by minimizing natural recolonization attempts into previously extirpated areas and by lessening inter-population exchange of individuals. Pollution and agricultural pesticides that filter into rivers and streams are also suspected of causing population declines in some areas.
- Adult removal

  Wood Turtles have low fecundity, delayed maturity, and high hatchling/juvenile mortality levels. Therefore, the consistent annual removal of one or more adults from a population can be detrimental to future population sustainability. Road mortality of adult Wood Turtles is a significant issue in areas with increasing human population pressures. Females make up a higher proportion of road mortality cases, due to their annual upland forays to lay eggs in suitable nesting grounds. Adult turtles, in addition, are found crushed by agricultural and utility equipment in many parts of their range. Adult predation by raccoons and humans (illegal shooting/poaching) has been reported in some cases to cause population decline. Localized declines are also associated with the over-collection of wild individuals for human use.

- Low recruitment
  As a result of extremely low and reduced levels of hatchling/juvenile recruitment, many Wood Turtle populations display high proportions of adults to young. Nest predation (especially from raccoons and skunks) is common in highly urbanized and fragmented landscapes although high predation rates in non-fragmented and remote locations are also possible.

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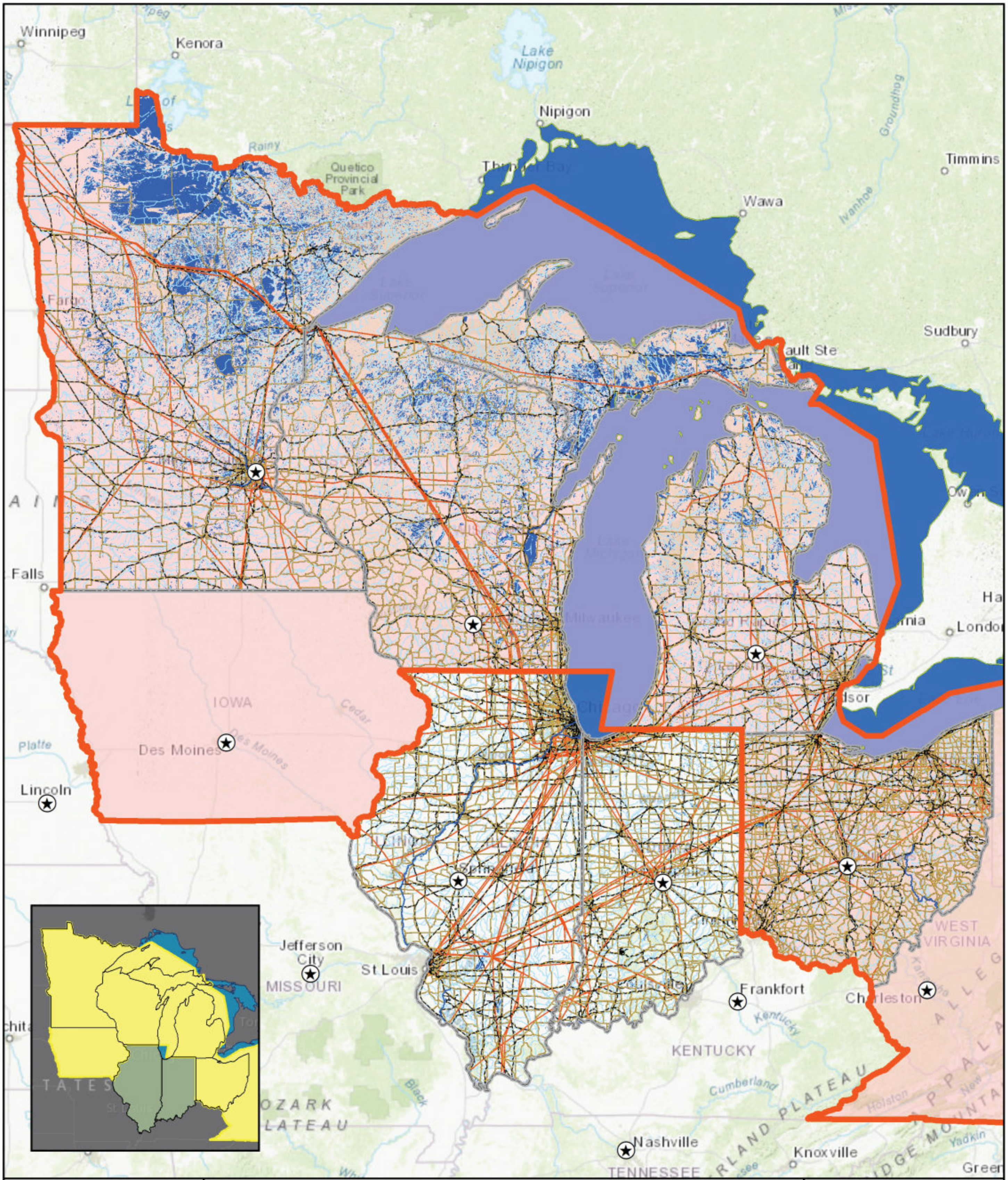

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Miles
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Kilometers

WOOD TURTLE (*GLYPTEMYS INSCULPTA*)
ACTION AREA OVERVIEW MAP

SCALE 1:10,000,000

- Petroleum Pipeline
- Major Road
- Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- Lakes & Ponds
- 1-Mile Coastal Inland Buffer
- Action Area
- Wood Turtle (*Glyptemys insculpta*)Counties of Occurrence.

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Basemap courtesy of Esri.

Date: 5/25/2021

Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS

Projection: WGS 1984 Web Mercator

MAMMALS

Canada Lynx (*Lynx canadensis*) Contiguous Distinct Population Segment

Federal Listing: Threatened
State Listing within the AA: Endangered in Michigan; Special Concern in Minnesota

Subspecies Description

The Canada Lynx is a medium-sized cat with long legs and large, well-furred paws. In winter, the lynx's fur is dense and has a grizzled appearance with a grayish-brown mix of buff or pale brown fur on the back, and a grayish-white or buff-white fur on the belly, legs, and feet. In summer, its fur is more reddish to gray-brown. It has long tufts of black hairs extending from the tips of its ears, a short, completely black-tipped tail, and often a distinct dish-like facial ruff of pale hairs tipped black. Lynx generally measure 75 to 90 cm (30 to 35 in) long and weigh 6 to 14 kg (14 to 31 lb), and males are 13-25 percent larger than females. The lynx's large feet and long legs make it well-adapted for traversing and hunting in deep, powdery snow, where its low foot-loading (weight per surface area of foot) is thought to provide a competitive advantage over other terrestrial predators of snowshoe hares, the lynx's primary prey. In southern Canada and the northern contiguous United States, where the southern edge of the lynx range overlaps the northern edge of the bobcat range, the 2 species are easily confused because of their similar size and appearance. However, the lynx's longer ear-tufts, larger feet, and black-tipped tail distinguish it from the bobcat, which has shorter ear tufts, small feet, and white on the underside of the tail. Bobcats are much more common, widespread, and abundant than lynx in most of the contiguous United States (USFWS, 2017).

Species Distribution

The Canada Lynx is broadly distributed across northern North America from eastern Canada to Alaska. It is strongly associated with the expansive, continuous boreal forests of those areas, and its range largely overlaps that of its primary prey, the snowshoe hare, also a boreal forest specialist. In Canada, lynx are thought to occupy about 5.5 million km^2 (over 2.1 million mi^2), which represents 95 percent of their historical range in that country, and over 89 percent of the species' entire distribution. Nationally in Canada, lynx are classified as secure, widespread, and abundant; they are managed for long-term population stability. In Alaska, lynx are distributed across roughly 534,454 km^2 (206,354 mi^2) of boreal forest, which represents about 8.7 percent of the species' breeding distribution. Lynx in Alaska are apparently secure, with low to moderate threats, and populations appear stable statewide, although total abundance is unknown (USFWS, 2017).

When it listed the DPS under the ESA, the Service defined its range as the forested portions of Maine, New Hampshire, New York, Vermont, Michigan, Minnesota, Wisconsin, Colorado, Idaho, Montana, Oregon, Utah, Washington, Wyoming. Some of these states, and parts of others, are thought to have historically supported only dispersing lynx or to have only occasionally supported resident breeding lynx. Such areas were included within the range of the DPS because of the possibility that lynx could establish small, local populations in them and perhaps contribute to the persistence of the DPS, though evidence of this was (and remains) lacking and on research and monitoring that have occurred since then, it seems likely that lynx occurred historically in some states (New York, Vermont, Wisconsin, Oregon, and Utah) only intermittently as dispersers or as small, naturally ephemeral populations; not as persistent resident breeding populations. In other states (New Hampshire, Michigan, Colorado, and Wyoming), it remains uncertain whether resident lynx occurred historically as small but persistent breeding populations or only ephemerally. Parts of the remaining states (Idaho, Maine, Minnesota, Montana, and Washington) show the strongest evidence of historical and recent (at the time of listing and since then) persistent resident populations. In Minnesota, research conducted since the 2003 remand has demonstrated the continuous presence of a resident lynx population in the northeastern part of the state that seems to be the southern periphery of a larger population in southwestern Ontario (USFWS, 2017).

Distribution within Action Area

- Occurs on Michigan's Upper Peninsula in Alger, Baraga, Chippewa, Delta, Dickinson, Gogebic, Houghton, Iron, Keweenaw, Luce, Mackinac, Marquette, Menominee, Ontonagon, and Schoolcraft Counties
- Occurs in northern Minnesota in Aitkin, Beltrami, Carlton, Cass, Clearwater, Cook, Itasca, Koochiching, Lake, Lake of the Woods, Marshall, Pine, Roseau, and St. Louis Counties
- Occurs in northern Wisconsin in Ashland, Bayfield, Burnett, Douglas, Florence, Forest, Iron, Marinette, Oneida, Price, Sawyer, Vilas, and Washburn Counties

Critical Habitat

Critical habitat for the DPS was designated in 2006 (71 FR 66008). The Service revised the critical habitat designation for the DPS in 2009 (74 FR 8616) and 2014 (79 FR 54782). The final critical habitat designation totals 38,954 square miles in five units: northern Maine, northeastern Minnesota, northwestern Montana and northeastern Idaho, north-central Washington, and the Greater Yellowstone area of southwestern Montana and northwestern Wyoming.

Life History

All aspects of lynx life history are inextricably tied to its primary prey, the snowshoe hare, which comprises most of the lynx diet throughout its range. Lynx are highly specialized hare predators and require landscapes that consistently support relatively high hare densities. Although lynx take a variety of alternate prey species, especially red squirrels, which may be important when hare numbers are low, hare abundance is the major driver of lynx population dynamics. Lynx denning area selection, pregnancy rates and litter sizes, as well as survival (kitten, subadult, and adult), recruitment, and dispersal rates, and population age structure, home range sizes, density, and distribution are all strongly influenced by hare abundance. Lynx and snowshoe hares are strongly associated with moist boreal forests, where winters are long, cold, and snowy. The predominant vegetation of boreal forest is conifer trees, primarily species of spruce and fir. Snowshoe hares feed on conifers, deciduous trees, and shrubs and are most abundant in forests with dense understories that provide forage, cover to escape from predators, and protection during extreme weather. Lynx population dynamics, survival, and reproduction are closely tied to snowshoe hare availability, making snowshoe hare habitat the primary component of lynx habitat. However, lynx do not occur everywhere within the range of snowshoe hares in the contiguous United States. This may be due to inadequate abundance, density, or spatial distribution of hares in some places, or the absence of snow conditions that would provide lynx a competitive advantage over other terrestrial hare predators, or a combination of these factors.

Lynx typically mate in March and April, and kittens are born from late April to mid-June after a 60- to 70-day gestation period. Female lynx typically reach reproductive maturity in their second year (at 22 months of age); however, when hares are abundant, females may breed at 10 months of age and produce kittens as 1-year-olds. Males do not seem to breed as yearlings, and they do not contribute to rearing of young. Lynx dens are typically located in areas of dense cover, where coarse woody debris, such as downed logs and windfalls, provides security and thermal cover for lynx kittens. Dens must be near foraging habitat to allow females to adequately provision dependent kittens, and females seem to select den sites near prey sources to minimize time spent away from kittens while foraging. Females attend kittens at the natal den site and 1 or more (up to 5) alternate or maternal dens until kittens are about 6-10 weeks old. Thereafter, kittens remain with their mothers through their first winter, apparently learning from her how to hunt and capture prey, initially on a small portion of her home range, but by fall on the larger area the female used before kittens were born. Juveniles remain closely associated with their mothers until February or March, when family groups begin to break up, with young typically dispersing in April and May to establish their own home ranges. Female offspring may establish home ranges overlapping or adjacent to their mother's home range and maintain mother-daughter bonds throughout their lives. Male home ranges may slightly overlap adjacent male home ranges. While male home ranges typically overlap 1 to 3 female home ranges, and female home ranges are partially or completely encompassed by a male's home range, core areas within home ranges appear to be exclusive except during the breeding season. Fidelity to home ranges over several years has been documented for both sexes, but shifts and abandonment of home ranges have also been. Lynx have been documented to live up to 16 years in the wild (USFWS, 2017).

Current Stressors and Threats

- Inadequate regulations/management

Lynx in the contiguous U.S. were designated a distinct population segment (DPS) and were listed as threatened under the Endangered Species Act in 2000 because regulations governing forest management activities on Federal lands were deemed inadequate, at that time, to conserve lynx and their habitats. Since listing, most Federal land managers throughout the lynx's range, as well as States and several private landowners in Maine, have formally amended management plans to conserve lynx and hare habitats.

- Climate change

Recent modeling suggests that climate change is likely to impact lynx in the DPS. Although the timing, magnitude, and consequences of climate-related impacts are difficult to predict, lynx habitats and populations in the contiguous U.S. are likely to be smaller and more isolated in the future and, therefore, more vulnerable to other threats (USFWS, 2013).

List of References

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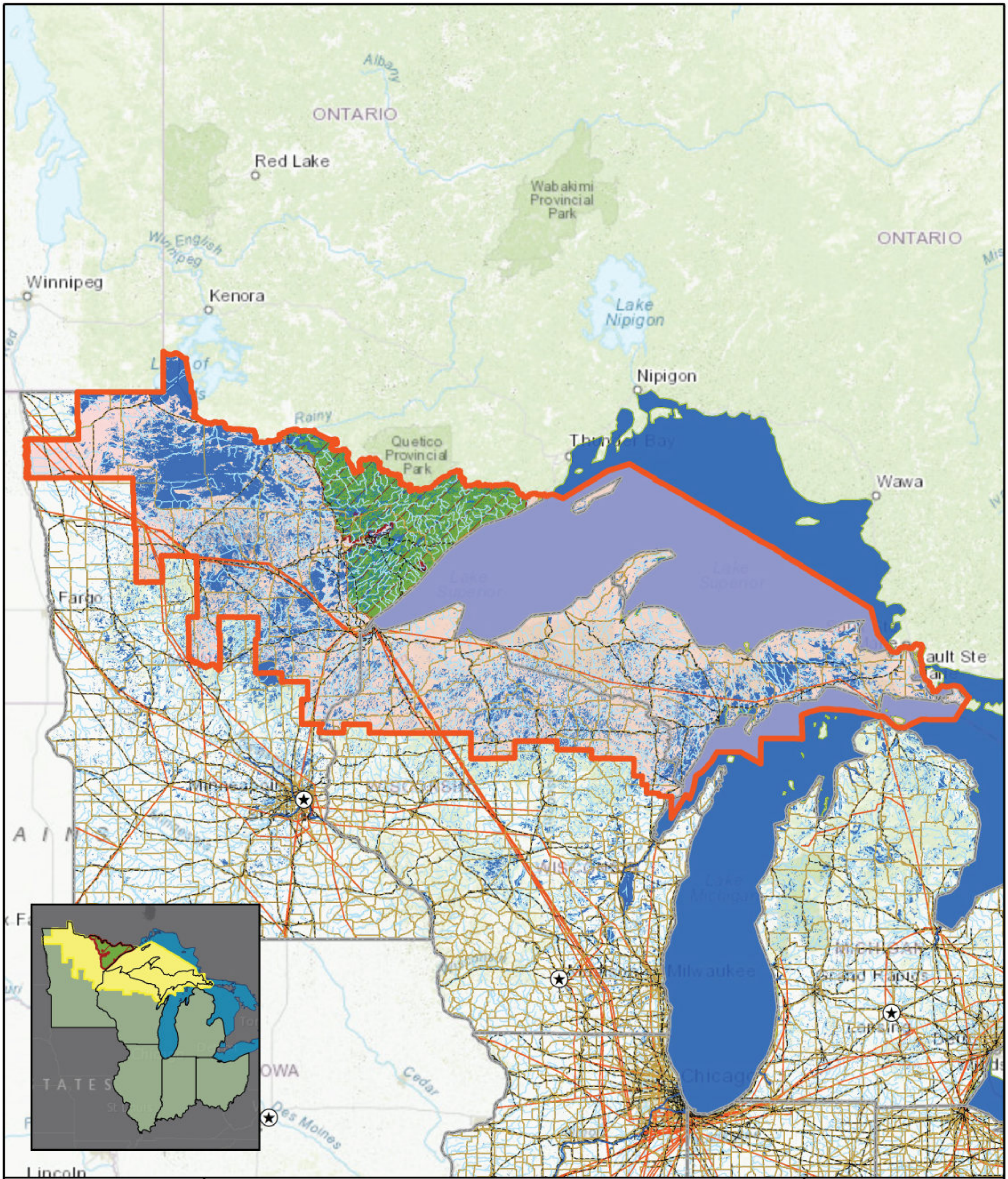

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Miles

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Kilometers

CANADA LYNX (*LYNX CANADENSIS*)
ACTION AREA OVERVIEW MAP

SCALE 1:8,500,000

- Petroleum Pipeline
- Major Road
- ------ Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- Lakes & Ponds
- 1-Mile Coastal Inland Buffer
- Action
- Canada Lynx (*Lynx canadensis*) Critical Habitat
- Canada Lynx (*Lynx canadensis*) Counties of Occurrence

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Basemap courtesy of Esri.

Date: 5/24/2021

Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS

Projection: WGS 1984 Web Mercator

Gray Bat (*Myotis grisescens)*

Federal Listing: Endangered
State Listing within the AA: Endangered in Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin

Species Description

The Gray Bat can reach a body length of 3.5 in (8.9 cm), a wingspan of 9-11 in (22.9-27.9 cm) and a forearm length of 1.8 in (4.6 cm). Although typically gray, the fur can turn to a reddish-brown color during the summer. Gray Bats also have a calcar (spur of cartilage) on their foot, which is used for stability during flight (FFWCC, 2021).

Gray Bats are distinguished from other bats by the unicolored fur on their back. In addition, following their molt in July or August, Gray Bats have dark gray fur which often bleaches to a chestnut brown or russet. They weigh 7-16 g. The bat's wing membrane connects to its ankle instead of at the toe, where it is connected in other species of *Myotis*.

The diet of the Gray Bat primarily consists of insects, including moths and beetles. Bats are nocturnal hunters, typically remaining inactive throughout the day and flying at night to hunt. During extended periods of inactivity, bats go into a state of reduced activity called torpor. During torpor, they decrease their heart rate and body temperature to conserve energy.

Gray Bats reach sexual maturity at the age of two years, which makes it one of the slowest maturing small mammals. The Gray Bat breeds before hibernation begins (in the winter) and the female bats retain sperm until spring when eggs are fertilized. Pregnant females form nursing colonies, which contain few male bats. It is not known why exactly males can be found in nursing colonies. Females migrate to their nursing colonies in the spring where they give birth to one pup. Offspring are weaned at two months old (FFWCC, 2021).

Species Distribution

The Gray Bat occupies a limited geographic range in limestone karst areas of the southeastern United States. They are mainly found in Alabama, northern Arkansas, Kentucky, Missouri, and Tennessee. A few can be found in northwestern Florida, western Georgia, southeastern Kansas, southern Indiana, southern and southwestern Illinois, northeastern Oklahoma, northeastern Mississippi, western Virginia, and possibly western North Carolina.

Distribution within Action Area

- Occurs in southwestern Illinois in Alexander, Hardin, Jackson, Johnson, Monroe, Pike, Pope, and Pulaski Counties
- Occurs in southern Indiana in Clark, Crawford, Floyd, Harrison, Perry, and Spencer Counties

Critical Habitat

No critical habitat has been designated for the Gray Bat.

Life History

Gray Bats roost, breed, rear young and hibernate in caves year-round. They migrate between summer and winter caves and will use transient or stopover caves along the way. Mating occurs as bats return to winter caves in September and October. By November, most Gray Bats are hibernating. Adult females begin to emerge in late March, followed by juveniles and adult males. Females store sperm over winter and become pregnant the following spring. A few hundred to many thousands of pregnant females congregate to form maternity colonies. Males and nonreproductive females gather in smaller groups to form "bachelor colonies". A single pup is born in late May or early June. Young begin to fly 20 to 25 days after birth. Gray

Bats feed primarily on flying insects over rivers and lakes. Aquatic insects, particularly mayflies, make up most of their diet (KDFWR, 2021).

Current Stressors and Threats

- Human disturbance
  Gray Bats are endangered largely because of their habit of living in very large numbers in only a few caves. As a result, they are extremely vulnerable to disturbance. Arousing bats while they are hibernating can cause them to use up a lot of energy, which lowers their energy reserves. If a bat runs out of reserves, it may leave the cave too soon and die. In June and July, when flightless young are present, human disturbance can lead to mortality as frightened females drop their young in the panic to flee from the intruder.
- Flooding and reservoir construction
  Many important caves were flooded and submerged by reservoirs. Other caves are in danger of natural flooding. Even if the bats escape the flood, they have difficulty finding a new cave that is suitable (USFWS, 1997).
- Commercialization of caves
  The commercialization of caves drives bats away. Any gating on the cave that prevents access or alters the air flow, temperature, humidity, and amount of light is harmful (USFWS, 1997).

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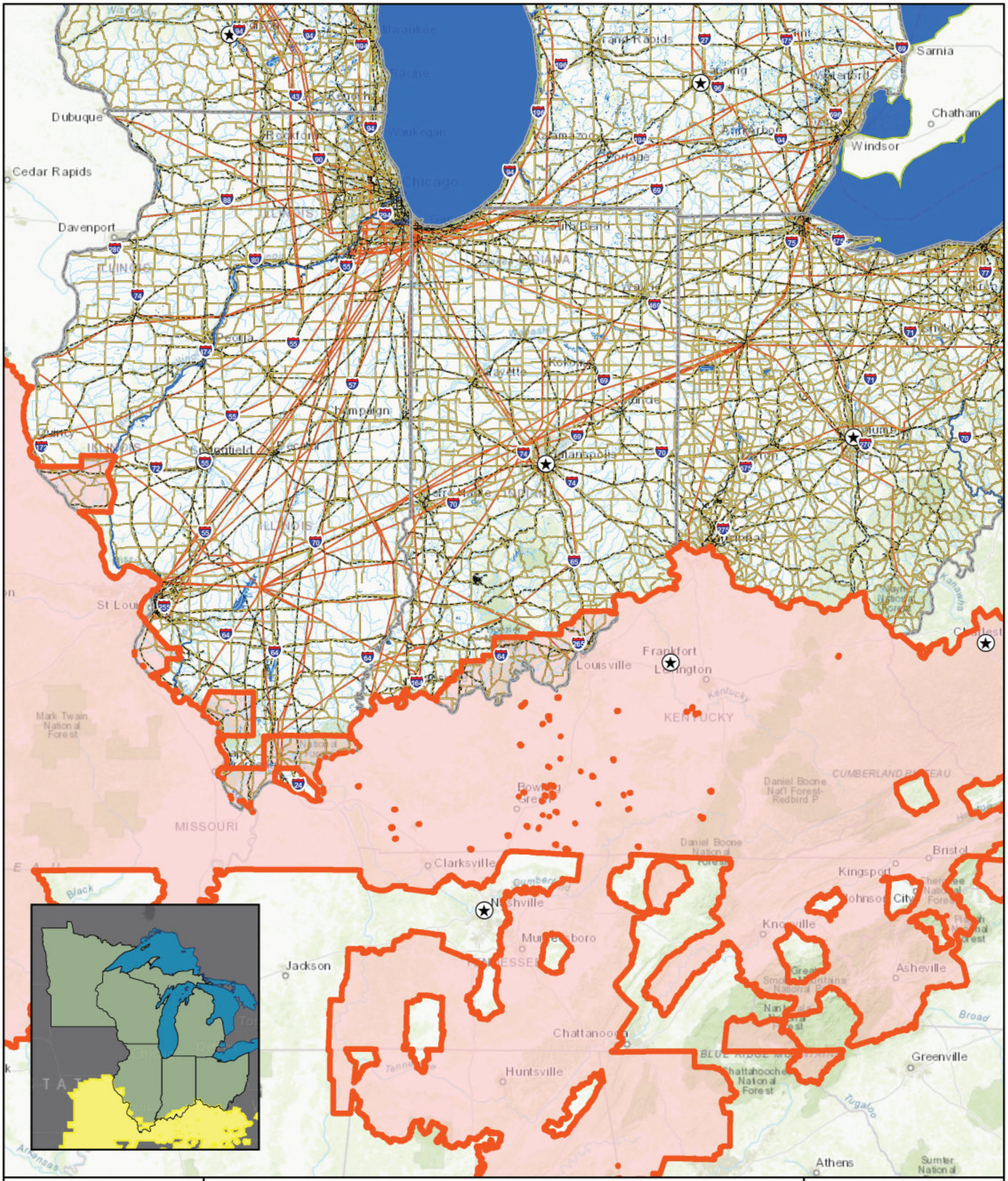

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Miles
0 20 40 80 120 160
Kilometers

GRAY BAT (*MYOTIS GRISESCENS*) ACTION AREA OVERVIEW MAP

SCALE 1:6,000,000

- Petroleum Pipeline
- Major Road
- Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- 🟦 Lakes & Ponds
- 🟩 1-Mile Coastal Inland Buffer
- 🟨 Action Area
- ▭ Gray Bat (*Myotis grisescens*) Counties of Occurrence

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Basemap courtesy of Esri.　Date: 5/25/2021　Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS　Projection: WGS 1984 Web Mercator

Gray Wolf (*Canis lupus*)

Federal Listing: Delisted
State Listing within the AA: Special Concern in Michigan; Delisted in Minnesota

Prior to European settlement, the Gray Wolf inhabited most of North America south to at least 20deg latitude. Human persecution, habitat deterioration, and the reduction of prey populations led to the decline of wolves. Wolves were almost eliminated from the western United States by the 1930s. In Wisconsin and Michigan, wolves were eliminated by the mid-1960s. At that time, only a small number of wolves survived in northeastern Minnesota and on Isle Royale in Michigan, although large populations remained in Canada and Alaska. In the first federal Endangered Species Preservation Act Gray Wolves were classified as endangered and provided limited protection (1967). In 1974, four subspecies of Gray Wolves in the lower 48 states were afforded full protection under the federal Endangered Species Act (ESA) of 1973. In 1978, the Gray Wolf was relisted as endangered at the full species level (*C. lupus*) throughout the conterminous 48 States and Mexico, except for Minnesota where it was reclassified as threatened. Gray Wolves were originally state listed as threatened in Minnesota in 1984, but as wolf numbers continued to increase, they were reclassified as state special concern in 1996 (MNDNR, 2021). This expansion led to wolves naturally recolonizing northwest Wisconsin and the first breeding pack confirmed in Douglas County in 1978. While initial population growth was slow, by the mid-1990s Wisconsin's wolf population began to increase and expand steadily. Wolves in the Western Great Lakes region surpassed federal recovery goals in the winter of 1999-2000, when Wisconsin and Michigan had a combined total of 100 wolves for 5 consecutive years, and the population in Minnesota remained stable or continued to grow (WIDNR, 2021). In January 2012, wolves in the western Great Lakes population, including Minnesota, were completely removed from the federal Endangered Species List. On December 19, 2014, a federal judge issued a decision to immediately reinstate federal ESA protections for Gray Wolves in Minnesota, Wisconsin and Michigan. In Minnesota, this ruling returned the wolf to threatened status under the federal ESA and returned management to the U.S. Fish and Wildlife Service. In Minnesota, the current density of the Gray Wolf is approximately 1 per 10 square miles. Alaska is the only US state with a higher population of Gray Wolves than Minnesota. Minnesota's Gray Wolf range has expanded from a 12,000 square mile area in the 1950's to over 27,000 square miles. As of 2013, the population was estimated at 2,200, which exceeded the federal delisting goal of 1,250-1,400. Minnesota's Gray Wolf population has remained stable over the last 10 years, with most areas of suitable habitat in the state now occupied. The Gray Wolf was removed from Minnesota special concern status in 2013 (MNDNR, 2021). USFWS removed Gray Wolves from the federal endangered species list in January 2021, returning management authority to state agencies.

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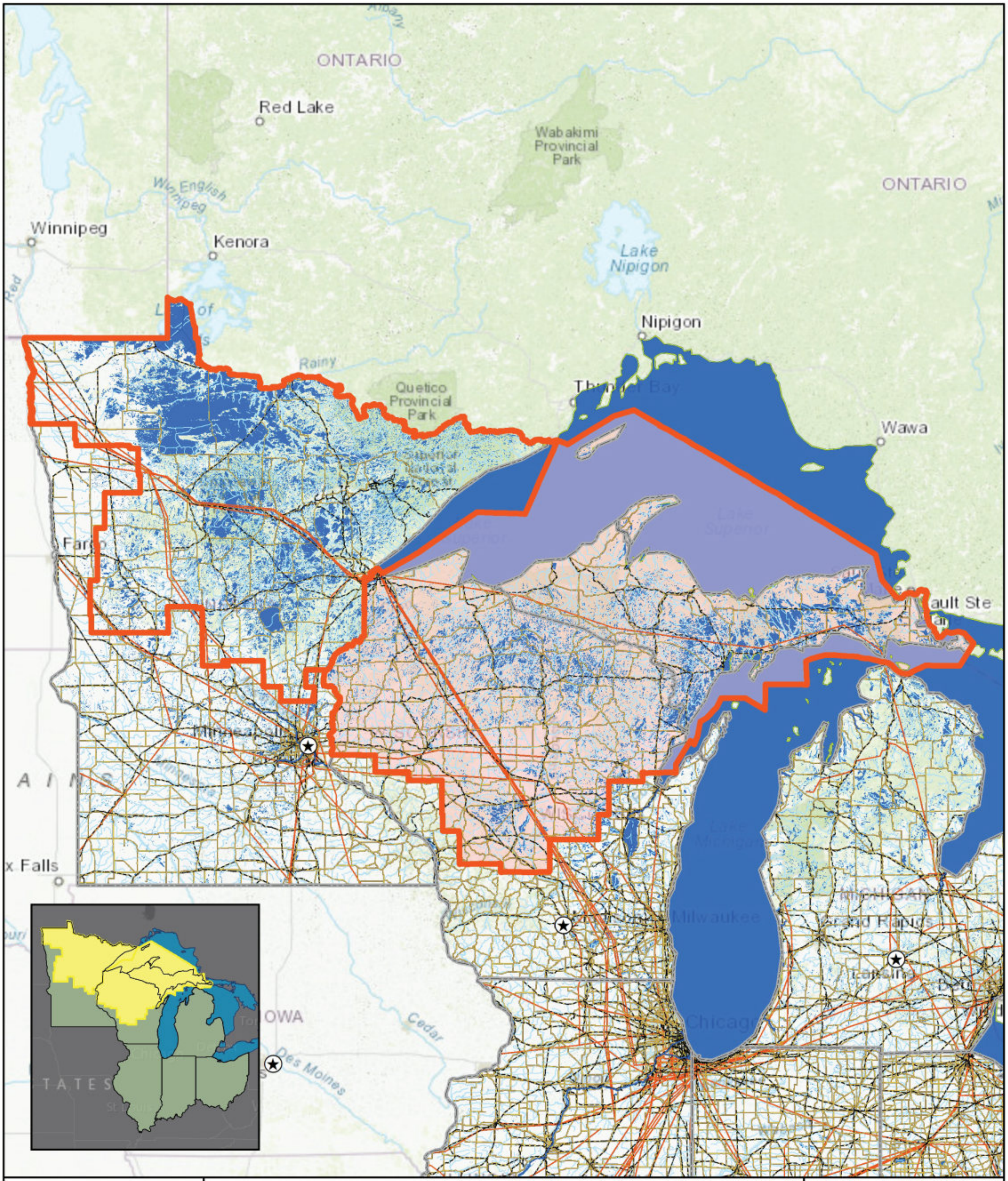

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Miles
0 25 50 100 150 200
Kilometers

GRAY WOLF (*CANIS LUPUS*) ACTION AREA OVERVIEW MAP

SCALE 1:8,500,000

- Petroleum Pipeline
- Major Road
- ------ Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- Lakes & Ponds
- 1-Mile Coastal Inland Buffer
- Action Area
- Gray Wolf (*Canis lupus*) Counties of Occurrence

N

Basemap courtesy of Esri.

Date: 5/25/2021

Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS

Projection: WGS 1984 Web Mercator

Indiana Bat (*Myotis sodalis)*

Federal Listing: Endangered
State Listing within the AA: Endangered in Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin

Species Description

The Indiana Bat was listed as endangered in 1967 due to episodes of people disturbing hibernating bats in caves during winter, resulting in the death of large numbers of bats. Indiana Bats are vulnerable to disturbance because they hibernate in large numbers in only a few caves (the largest hibernation caves support from 20,000 to 50,000 bats). Other threats that have contributed to the Indiana Bat's decline include commercialization of caves, loss of summer habitat, pesticides and other contaminants, and most recently, the disease white-nose syndrome. Indiana Bats are quite small, weighing only one-quarter of an ounce (about the weight of three pennies) although in flight they have a wingspan of 9 to 11 in. Their fur is dark-brown to black. They hibernate during winter in caves or, occasionally, in abandoned mines. During summer they roost under the peeling bark of dead and dying trees. Indiana Bats eat a variety of flying insects found along rivers or lakes and in uplands (USFWS, 2019). During hibernation, they require cool, humid caves with stable temperatures, under 50° F but above freezing. Very few caves within the range of the species have these conditions (USFWS, 2006).

Hibernation is an adaptation for survival during the cold winter months when no insects are available for bats to eat. Bats must store energy in the form of fat before hibernating. During the six months of hibernation the stored fat is their only source of energy. If bats are disturbed or cave temperatures increase, more energy is needed and hibernating bats may starve (USFWS, 2006).

After hibernation, Indiana Bats migrate to their summer habitat in wooded areas where they usually roost under loose tree bark on dead or dying trees. During summer, males roost alone or in small groups, while females roost in larger groups of up to 100 bats or more. Indiana Bats also forage in or along the edges of forested areas (USFWS, 2006).

Species Distribution

Indiana Bats are found over most of the eastern half of the United States. Almost half of all Indiana Bats (207,000 in 2005) hibernate in caves in southern Indiana. In 2005, other states which supported populations of over 40,000 included Missouri (65,000), Kentucky (62,000), Illinois (43,000) and New York (42,000). Other states within the current range of the Indiana Bat include Alabama, Arkansas, Connecticut, Iowa, Maryland, Michigan, New Jersey, North Carolina, Ohio, Oklahoma, Pennsylvania, Tennessee, Vermont, Virginia, and West Virginia. The 2005 population estimate is about 457,000 Indiana Bats, half as many as when the species was listed as endangered in 1967 (USFWS, 2006).

Prompted by declining populations caused by disturbance of bats during hibernation and modification of hibernacula, the Indiana Bat was listed in 1967 as “in danger of extinction” under the Endangered Species Preservation Act of 1966. It is listed as “endangered” under the current Endangered Species Act of 1973. Listing under the Endangered Species Act protects the Indiana Bat from take (harming, harassing, killing) and requires Federal agencies to work to conserve it (USFWS, 2006).

Distribution within Action Area

- Occurs statewide in Illinois except in Cook, DuPage, Kane, Lake, McHenry, and Will Counties in the northeast corner of the state
- Occurs statewide in Indiana
- Occurs in 41 counties in the southern half of Michigan and along the Lake Michigan shoreline

Critical Habitat

Critical habitat for the Indiana Bat was established and published in September of 1977 (42 FR 47840). These sites include existing mines and caves in Kentucky, Missouri, Tennessee, West Virginia, Illinois, and Indiana.

Life History

Indiana Bats mate during fall before they enter caves to hibernate. Females store the sperm through winter and become pregnant in spring soon after they emerge from the caves. After migrating to their summer areas, females roost under the peeling bark of dead and dying trees in groups of up to 100 or more. Such groups are called maternity colonies. Each female in the colony gives birth to only one pup per year. Young bats are nursed by the mother, who leaves the roost tree only to forage for food. The young stay with the maternity colony throughout their first summer (USFWS, 2006).

Current Stressors and Threats

- Human disturbance
  Indiana Bats, because they hibernate in large numbers in only a few caves, are extremely vulnerable to disturbance. During hibernation, they cluster in groups of up to 500 per square foot. Since the largest hibernation caves support from 20,000 to 50,000 bats, it is easy to see how a large part of the total population can be affected by a single event. Episodes of large numbers of Indiana Bat deaths have occurred due to human disturbance during hibernation (USFWS, 2006).
- Commercialization of caves
  The commercialization of caves – allowing visitors to tour caves during hibernation – drives bats away.
- Changes in cave structure
  Changes in the structure of caves, such as blocking an entrance, can change the temperature in a cave. A change of even a few degrees can make a cave unsuitable for hibernating bats. Some caves are fitted with gates to keep people out, but improper gating that prevents access by bats or alters air flow, temperature, or humidity can also be harmful. Properly constructed gates are beneficial because they keep people from disturbing hibernating bats while maintaining temperature and other requirements and allowing access for bats (USFWS, 2006).
- Habitat loss and fragmentation
  Indiana Bats use trees as roosting and foraging sites during summer months. Loss and fragmentation of forested habitats can also affect bat populations (USFWS, 2006).
- Pesticides and contaminants
  Insect-eating bats may seem to have an unlimited food supply, but in local areas, insects may not be plentiful because of pesticide use. This can also affect the quality of the bats' food supply. Many scientists believe that population declines occurring today might be due, in part, to pesticides and environmental contaminants. Bats may be affected by eating contaminated insects, drinking contaminated water, or absorbing the chemicals while feeding in areas that have been recently treated (USFWS, 2006).

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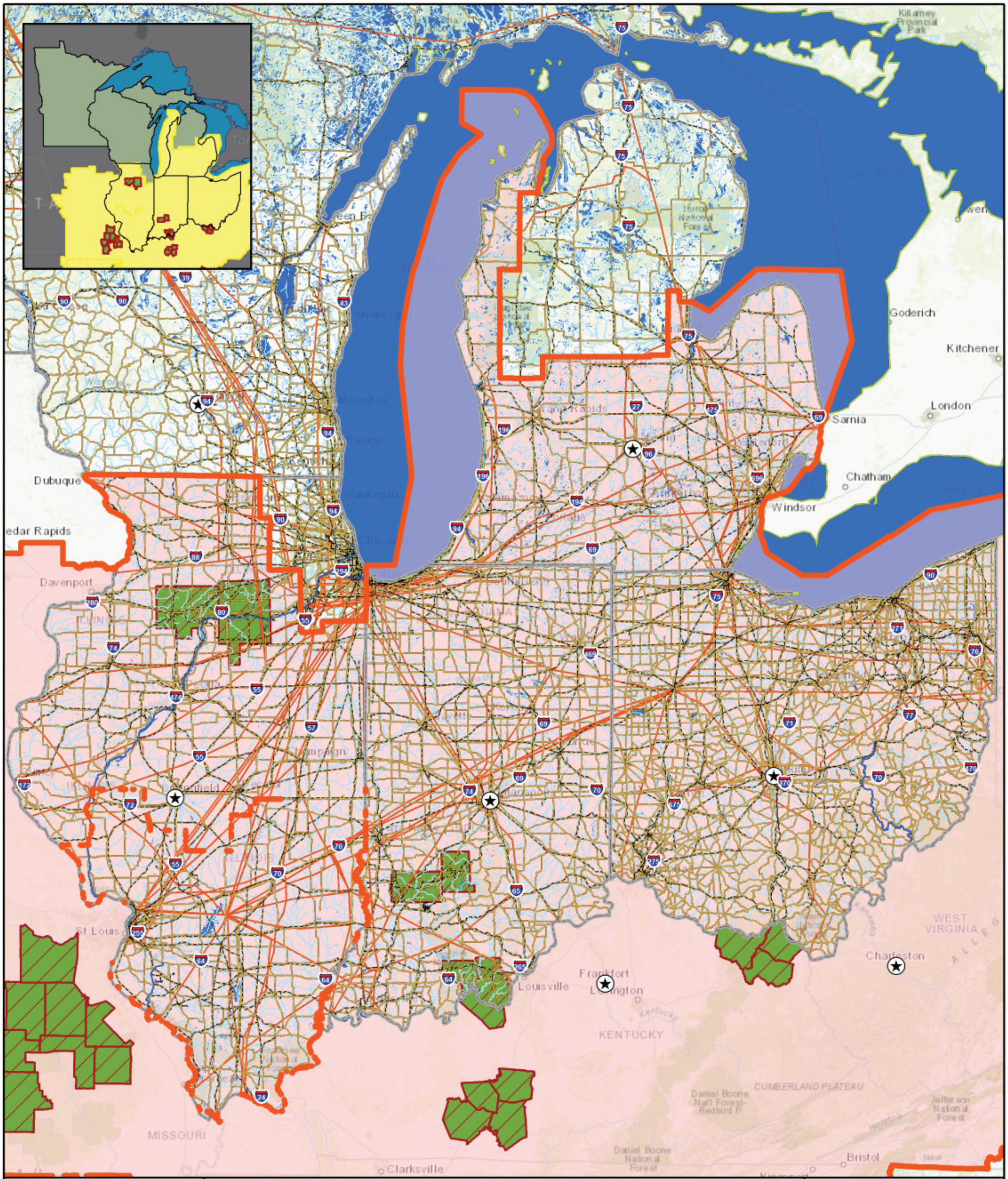

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Miles
0 20 40 80 120 160
Kilometers

INDIANA BAT (*MYOTIS SODALIS*) ACTION AREA OVERVIEW MAP

SCALE 1:6,500,000

- Petroleum Pipeline
- Major Road
- Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- Lakes & Ponds
- 1-Mile Coastal Inland Buffer
- Action Area
- Indiana Bat (*Myotis sodalis*) Critical Habitat
- Indiana Bat (*Myotis sodalis*) Counties of Occurrence

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Basemap courtesy of Esri.
Date: 5/24/2021
Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS
Projection: WGS 1984 Web Mercator

Little Brown Bat (*Myotis lucifugus)*

Federal Listing: Under Review. The U.S. Fish and Wildlife Service is currently conducting a discretionary review of the species.
State Listing within the AA: Endangered in Indiana and Ohio; Threatened in Wisconsin; Special Concern in Michigan and Minnesota

Species Description

The Little Brown Bat is a member of the genus *Myotis*. This bat weighs between 5.5 and 12.5g (0.19 to 0.44oz). Individual bats' weights vary seasonally and are least in the spring as bats emerge from hibernation. Adult forearm lengths range from 36 to 40mm (1.4 to 1.6in), and total body length is 8.0-9.5 cm (3.1-3.7 in). Adult Little Brown Bat wingspan is 222 to 269mm (8.75 to 10.5in). Body color ranges from pale tan to reddish to dark brown and is lighter on the ventral side. Feet have long toe hairs that extend to the tips of the toes. They also have an unusually long lifespan for a small mammal and may live 20 to 30 years (WIDNR, 2017).

Male and female Little Brown Bats begin to leave hibernacula in April, and often migrate great distances to reach their summer roosting sites and foraging grounds. A study in Kentucky showed that Little Brown Bats migrate 6 to 280 miles. Females begin forming maternity colonies in late April and early May. Little Brown Bats are born between early June and the end of July (but annual variation around this range is typically one to three weeks). Maternity colonies disperse in late July and August, after which bats visit several summer roosting sites before settling on a hibernaculum in which to hibernate from November through April. The Little Brown Bat is long-lived for its size, and lives over 10 years in most cases. Recent identification-band recoveries in Wisconsin found two male Little Brown Bats captured 18 years after banding, and one 25 years after banding. Little Brown Bats make both short- and long-distance migrations in the spring to their summer foraging ranges and maternity roosts, and they return in the fall to their hibernacula. Many return to the same site year after year (WIDNR, 2017).

Species Distribution

The species historical range included Alabama, Alaska, Arkansas, California, Colorado, Connecticut, Delaware, District of Columbia, Florida, Georgia, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin, and Wyoming (USFWS, 2021).

Before white-nose syndrome (WNS), thousands of Little Brown Bats would hibernate in one place together. With bats often huddled together during this time, it is easy to see how the fungus may have spread so quickly and continues to infect bats today. Now, most winter roost sites are home to no more than 10 or 100 bats for the winter. There are now only a handful of places that still have winter colonies with a few thousand Little Brown Bats. Conservation efforts to protect these remnant colonies are critical. Research to understand why some winter colonies manage to persist with WNS while most colonies experience such high mortality is also a high priority (Bat Conservation International, 2020).

The Little Brown Bat is found in abundance throughout the northern United States into Canada. It is present in lesser numbers in southern states and is absent from the southern Great Plains. Little Brown Bats are not territorial—they live in colonies numbering in the hundreds of thousands of individuals. Colonies aggregate at nesting sites called roosts. There are several different types of roosts that serve different purposes—day and night roosts provide habitat for bats when they are sleeping or resting. Hibernacula are a type of roost that is occupied in the winter months. Little Brown Bats choose buildings, caves, trees, rocks, and wood piles as roost sites. They may migrate hundreds of miles to get from their summer habitats to hibernacula. A variety of wild mammals, birds, and snakes will incorporate these bats into their diets, because the large colony sizes make them easy to catch. Domestic cats are a major predator of bats that roost near people (NWF, 2021).

Distribution within Action Area

ECOS only indicates the species is known or believed to occur in Ohio. NatureServe (2021) indicates the species may occur in all Action Area states. It is considered secure in Illinois, vulnerable in Minnesota and Wisconsin, imperiled in Indiana, and critically imperiled in Michigan and Ohio (NatureServe, 2021).

Critical Habitat

No critical habitat has been designated for the Little Brown Bat.

Life History

The life cycle of the Little Brown Bat begins at emergence from hibernation. Emerging males and females mate repeatedly and with multiple partners prior to flying to their summer roosting areas. The pregnant females group together in a nursery roost that is notable for its warm temperatures (pregnant females are not able to thermoregulate very efficiently). After fifty to sixty days gestation each female gives birth to a single pup. The pup will cling to the mother and even go out on her feeding flights tightly attached to her fur. Soon, though, the pup gets too large for these free rides and must remain in the nursery roost where it is cared for and fed by the mother. Pups are weaned in three or four weeks and then they join the females on their nightly forays and in both their day and night roosts. Females become sexually mature around nine months and males become sexually mature at one year of age. A Little Brown Bat, especially if it survives its first winter, may live twenty or even thirty years (PSU, 2014).

Current Stressors and Threats

- White nose syndrome
  No other threat is as severe and immediate as the disease, white nose syndrome. If this disease had not emerged, it is unlikely the Little Brown Bat would be experiencing such a dramatic population decline. Since symptoms were first observed in New York in 2006, white nose syndrome has spread rapidly from the Northeast to the Midwest and Southeast; an area that includes the core of the Little Brown Bat’s range where it was most common before this disease. Although there is uncertainty about the rate that white nose syndrome will spread throughout the species’ range, it is expected to spread throughout the United States in the foreseeable future (USFWS, 2015).
- Changes in cave structure
  Gates or other structures intended to exclude people from caves and mines not only restrict bat flight and movement, but also change airflow and internal cave and mine microclimates. A change of even a few degrees can make a cave unsuitable for hibernating bats.
- Human disturbance
  Cave-dwelling bats are vulnerable to human disturbance while hibernating. Arousal during hibernation causes bats to use up their already reduced energy stores, which may lead to individuals not surviving the winter (USFWS, 2015).
- Development
  Highway construction, commercial development, surface mining, and wind facility construction permanently remove habitat and are activities prevalent in many areas of this bat’s range.
- Forest management activities
  Forest management benefits Little Brown Bats by keeping areas forested rather than converted to other uses. But, depending on type and timing, forest management activities can cause mortality and temporarily remove or degrade roosting and foraging habitat.
- Wind facility construction
  Wind turbines kill bats, and, depending on the species, in very large numbers. Mortality has been documented for Little Brown Bats, although a small number have been found to date. However, there

are many wind projects within a large portion of the bat's range and many more are planned (USFWS, 2015).

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0 10 20 40 60
Miles
0 10 20 40 60 80
Kilometers

LITTLE BROWN BAT (*MYOTIS LUCIFUGUS*) ACTION AREA OVERVIEW MAP

SCALE 1:3,000,000

—	Petroleum Pipeline	—	Commercial Navigable Waterway	🟩	1-Mile Coastal Inland Buffer
—	Major Road	—	Rivers & Streams	🟨	Action Area
------	Railroad	🟦	Lakes & Ponds	▭	Little brown Bat (*Myotis lucifugus*) Counties of Occurrence

N

Basemap courtesy of Esri.

Date: 5/25/2021

Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS

Projection: WGS 1984 Web Mercator

Northern Bog Lemming (*Synaptomys borealis)*

Federal Listing: Under Review. The Northern Bog Lemming was petitioned for Federal listing under the Endangered Species Act in 2014, and a 90-day finding was issued in 2015 (80 FR 56423).
State Listing within the AA: Special Concern in Minnesota

Species Description

The Northern Bog Lemming closely resembles other microtine rodents with which it may share habitat. Grooved upper incisors, a very short tail (18-25 mm; 0.7-1.0 in), and grizzled grayish brown to chestnut colored pelage, with a buffy orange patch at the base of the ear, can help distinguish Bog Lemmings of the genus *Synaptomys* from other microtines, such as *Clethrionomys, Microtus,* and *Phenacomys.* The Northern Bog Lemming closely resembles the more common Southern Bog Lemming (*S. cooperi*) and both may be found at the same location. Female Northern Bog Lemmings have 4 pairs of mammae, while female Southern Bog Lemmings have 3 pairs. Species identification can only be confirmed by examining dental and skull characteristics. In the Northern Bog Lemming, lower molars lack distinct inward angles on the outer (labial) edge, the upper incisors frequently have labial spines, and the palate has a sharply pointed spine at its posterior end (MNDNR, 2021).

Species Distribution

Northern Bog Lemmings typically occur in open, wet habitats dominated by sphagnum moss, ericaceous shrubs, and graminoids (acid peatland and open rich peatland systems). Subspecies exhibit different habitat preferences including conifer forests, shrublands, alpine meadows, and dry sagebrush hillsides. In Minnesota, Northern Bog Lemmings have been found in open bog, shrub carr, and black spruce swamp (MNDNR, 2021).

The Northern Bog Lemming ranges across much of boreal North America from the southern two-thirds of Alaska south into northern Washington and east across Canada to the Atlantic coast. In the conterminous United States, it is found near the Canadian border in Washington, Idaho, Montana, North Dakota, Minnesota, New Hampshire, and Maine. Despite its extensive distribution, the Northern Bog Lemming is unpredictable in occurrence and nowhere is it considered common.

Distribution within Action Area

Minnesota is the only Action Area state in which Northern Bog Lemming occurs. In Minnesota, it was classified as a species of special concern in 1984 due to its rarity in the state. It was first reported in Lake of the Woods County in 1932, and since then less than a dozen occurrences have been documented in Roseau, Clearwater, Beltrami, Koochiching, Itasca, and St. Louis counties. The small number of documented locations in areas of apparently suitable habitat supports the species' listing as special concern.

Critical Habitat

No critical habitat has been designated for the Northern Bog Lemming.

Life History

Little is known about this rare species' habits. The diet of Northern Bog Lemmings consists of herbaceous vegetation, primarily grasses and sedges, but they also will eat snails, slugs, and other invertebrates. Small piles of clipped vegetation and bright green feces indicate the presence of Bog Lemmings. Northern Bog Lemmings are active throughout the year, during day and night. They construct well-defined runways or use those of other species. Globular nests of grass or sedge are hidden in short underground burrows, under logs, in sphagnum hummocks, or on the surface under the snow. The breeding season for Northern Bog Lemmings occurs from May through August. Gestation lasts approximately 3 weeks. Litters of up to 8 young are possible, with an average of 4 young per litter. One day after giving birth, females are capable of breeding again and young Northern Bog Lemmings are sexually mature at 5-6 weeks. Predators of Northern Bog Lemmings include hawks, owls, and weasels (MNDNR, 2021).

Current Stressors and Threats

During the period of Pleistocene glacial advance, Northern Bog Lemmings occurred as far south as Kansas. Today, their distribution has retreated northward into boreal bog and forest habitats. The species is patchily distributed, occurs in low numbers, and likely experiences little-to-no gene flow between populations. The current distribution of Northern Bog Lemmings may comprise isolated, relic populations that are now trapped in remnant post-glacial habitats. All Minnesota records for Northern Bog Lemmings are from peatland habitats in the Agassiz Lowlands, Littlefork-Vermillion Uplands, and Border Lakes ecological subsections. While this region has not experienced the level of habitat destruction and alteration observed in other parts of the state, harvesting of pulpwood, peat, and Christmas trees affects the habitats used by Northern Bog Lemmings. Delineating the distribution of Northern Bog Lemmings in Minnesota will be a priority of the Minnesota Biological Survey when surveys are conducted in the Agassiz Lowlands ecological subsection. Large tracts of suitable peatland habitat should be protected where the species is found to occur (MNDNR, 2021).

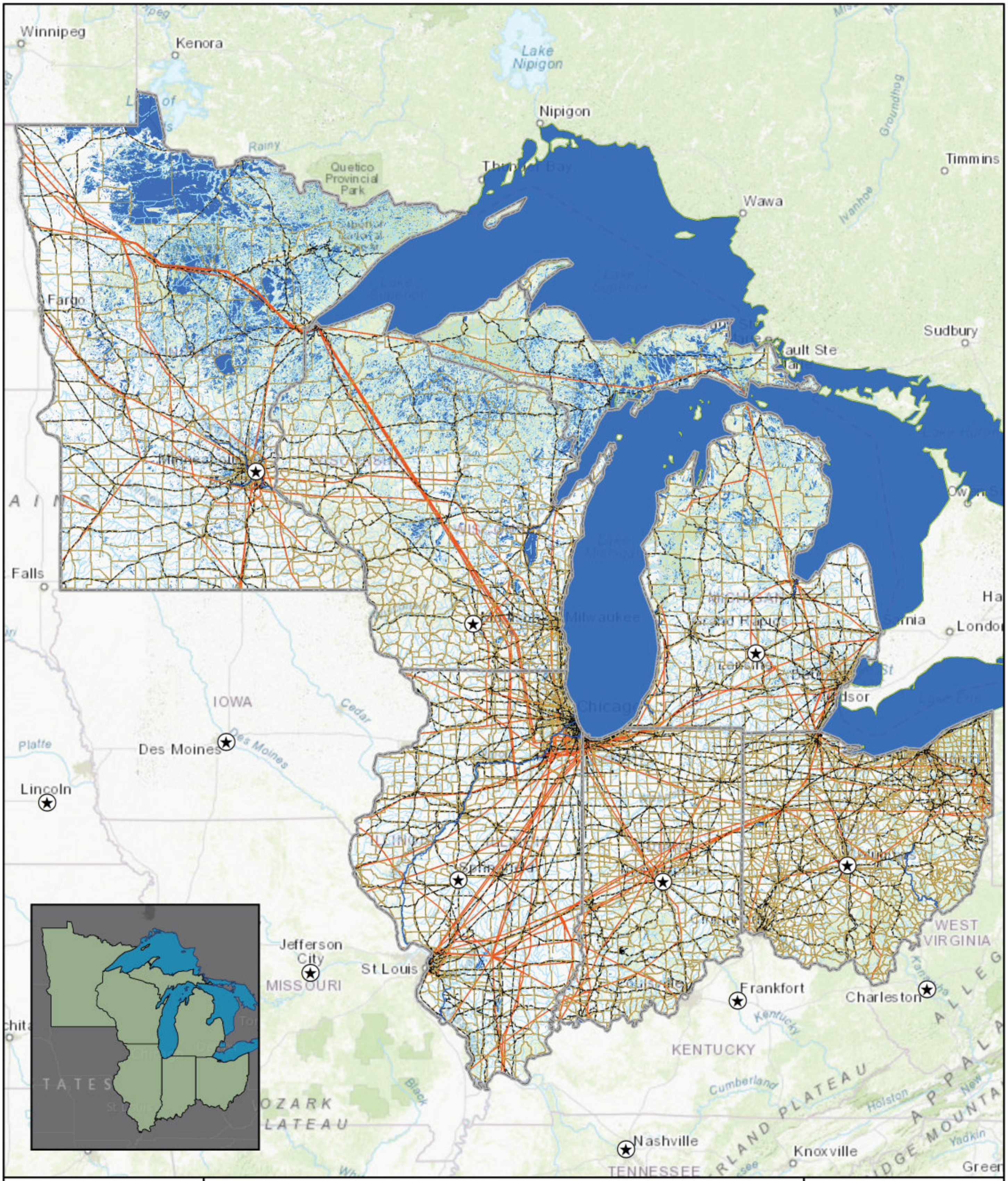
WildEarth Guardians list these threats in the petition document (2014):

- Altered hydrology and water chemistry
- Peat harvest
- Timber harvest and associated activities
- Loss of beavers
- Wildfire
- Snowmobiles
- Invasive Plants
- Mineral exploration
- Climate Change
- Life history factors

List of References

Center for Biological Diversity (CBD). (2014). Petition to list the Northern Bog Lemming (*Synaptomys borealis*) under the U.S. Endangered Species Act. 41pp.

Minnesota Department of Natural Resources (MNDNR). (2021). *Synaptomys borealis* (Northern Bog Lemming). Retrieved from https://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=AMAFF17020



0 30 60 120 180
Miles
0 30 60 120 180 240
Kilometers

NORTHERN BOG LEMMING (*SYNAPTOMYS BOREALIS*) ACTION AREA OVERVIEW MAP

SCALE 1:10,000,000

- Petroleum Pipeline
- Major Road
- ------ Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- 🟦 Lakes & Ponds
- 🟩 1-Mile Coastal Inland Buffer
- 🟨 Action Area
- ▭ Northern Bog Lemming (*Synaptomys borealis*) Counties of Occurrence

N

Basemap courtesy of Esri. Date: 5/25/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS Projection: WGS 1984 Web Mercator

Northern Long-Eared Bat (*Myotis septentrionalis*)

Federal Listing: Threatened
State Listing within the AA: Endangered in Indiana; Threatened in Illinois, Ohio, and Wisconsin; Special Concern in Michigan and Minnesota

Species Description

The Northern Long-Eared Bat is a medium-sized bat about 3 to 3.7in in length but with a wingspan of 9 to 10in. As its name suggests, this bat is distinguished by its long ears, particularly as compared to other bats in its genus, *Myotis*, which are actually bats noted for their small ears (*Myotis* means mouse-eared). The Northern Long-Eared Bat is found across much of the eastern and north central United States and all Canadian provinces from the Atlantic coast west to the southern Northwest Territories and eastern British Columbia. The species range includes 37 states. White-nose syndrome, a fungal disease known to affect bats, is currently the predominant threat to this bat, especially throughout the Northeast where the species has declined by up to 99 percent from pre-white-nose syndrome levels at many hibernation sites. Although the disease has not yet spread throughout the Northern Long-Eared Bats entire range (white-nose syndrome is currently found in at least 25 of 37 states where the Northern Long-Eared Bat occurs), it continues to spread. Experts expect that where it spreads, it will have the same impact as seen in the Northeast (USFWS, 2021).

Species Distribution

The Northern Long-Eared Bat is widely but sparsely distributed across forested regions of the eastern United States. It ranges across southern Canada and up to Newfoundland. It extends down into Florida, through the south-central states and through the Dakotas, into eastern British Columbia. In the Columbia Basin *M. septentrionalis* inhabits several different regions including Cranbrook, Invermere, Golden and Revelstoke forest districts. It has also been found scattered throughout eastern, central and northern British Columbia including the Peace River, Revelstoke and Liard River areas (Ollendorff, 2002).

The species historical range included Alabama, Arkansas, Connecticut, Delaware, District of Columbia, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Vermont, Virginia, West Virginia, Wisconsin, Wyoming (USFWS, 2015).

Distribution within Action Area

The Northern Long-Eared Bat is known or believed to occur statewide in all Action Area states.

Critical Habitat

No critical habitat has been designated for the Northern Long-Eared Bat.

Life History

Breeding begins in late summer or early fall when males begin to swarm near hibernacula. After copulation, females store sperm during hibernation until spring. In spring, they emerge from their hibernacula, ovulate and the stored sperm fertilizes an egg. This strategy is called delayed fertilization. Like most bats, Northern Long-Eared Bats emerge at dusk to feed. They primarily fly through the understory of forested areas feeding on moths, flies, leafhoppers, caddisflies, and beetles, which they catch while in flight using echolocation or by gleaning motionless insects from vegetation (USFWS, 2015).

During the summer, Northern Long-Eared Bats roost singly or in colonies underneath bark, in cavities or in crevices of both live trees and snags (dead trees). Males and non-reproductive females may also roost in cooler places, like caves and mines. Northern Long-Eared Bats seem to be flexible in selecting roosts, choosing roost trees based on suitability to retain bark or provide cavities or crevices. This bat has also been found rarely roosting in structures, like barns and sheds (USFWS, 2015).

Northern Long-Eared Bats spend winter hibernating in caves and mines, called hibernacula. They use areas in various sized caves or mines with constant temperatures, high humidity, and no air currents. Within hibernacula, surveyors find them hibernating most often in small crevices or cracks, often with only the nose and ears visible (USFWS, 2015).

Current Stressors and Threats

- White nose syndrome
  No other threat is as severe and immediate as the disease, white nose syndrome. If this disease had not emerged, it is unlikely the Little Brown Bat would be experiencing such a dramatic population decline. Since symptoms were first observed in New York in 2006, white nose syndrome has spread rapidly from the Northeast to the Midwest and Southeast; an area that includes the core of the Little Brown Bat's range where it was most common before this disease. Although there is uncertainty about the rate that white nose syndrome will spread throughout the species' range, it is expected to spread throughout the United States in the foreseeable future (USFWS, 2015).
- Changes in cave structure
  Gates or other structures intended to exclude people from caves and mines not only restrict bat flight and movement, but also change airflow and internal cave and mine microclimates. A change of even a few degrees can make a cave unsuitable for hibernating bats.
- Human disturbance
  Cave-dwelling bats are vulnerable to human disturbance while hibernating. Arousal during hibernation causes bats to use up their already reduced energy stores, which may lead to individuals not surviving the winter (USFWS, 2015).
- Development
  Highway construction, commercial development, surface mining, and wind facility construction permanently remove habitat and are activities prevalent in many areas of this bat's range.
- Forest management activities
  Forest management benefits Little Brown Bats by keeping areas forested rather than converted to other uses. But, depending on type and timing, forest management activities can cause mortality and temporarily remove or degrade roosting and foraging habitat.
- Wind facility construction
  Wind turbines kill bats, and, depending on the species, in very large numbers. Mortality has been documented for Little Brown Bats, although a small number have been found to date. However, there are many wind projects within a large portion of the bat's range and many more are planned (USFWS, 2015).

List of References

Ollendorff, J. (2002). Animal Diversity Web – *Myotis septentrionalis*. Retrieved from https://animaldiversity.org/accounts/Myotis_septentrionalis/

U.S. Fish & Wildlife Service (USFWS). (2015). Northern Long-Eared Bat (*Myotis septentrionalis*) fact sheet. Retrieved from https://www.fws.gov/midwest/endangered/mammals/nleb/nlebFactSheet.html

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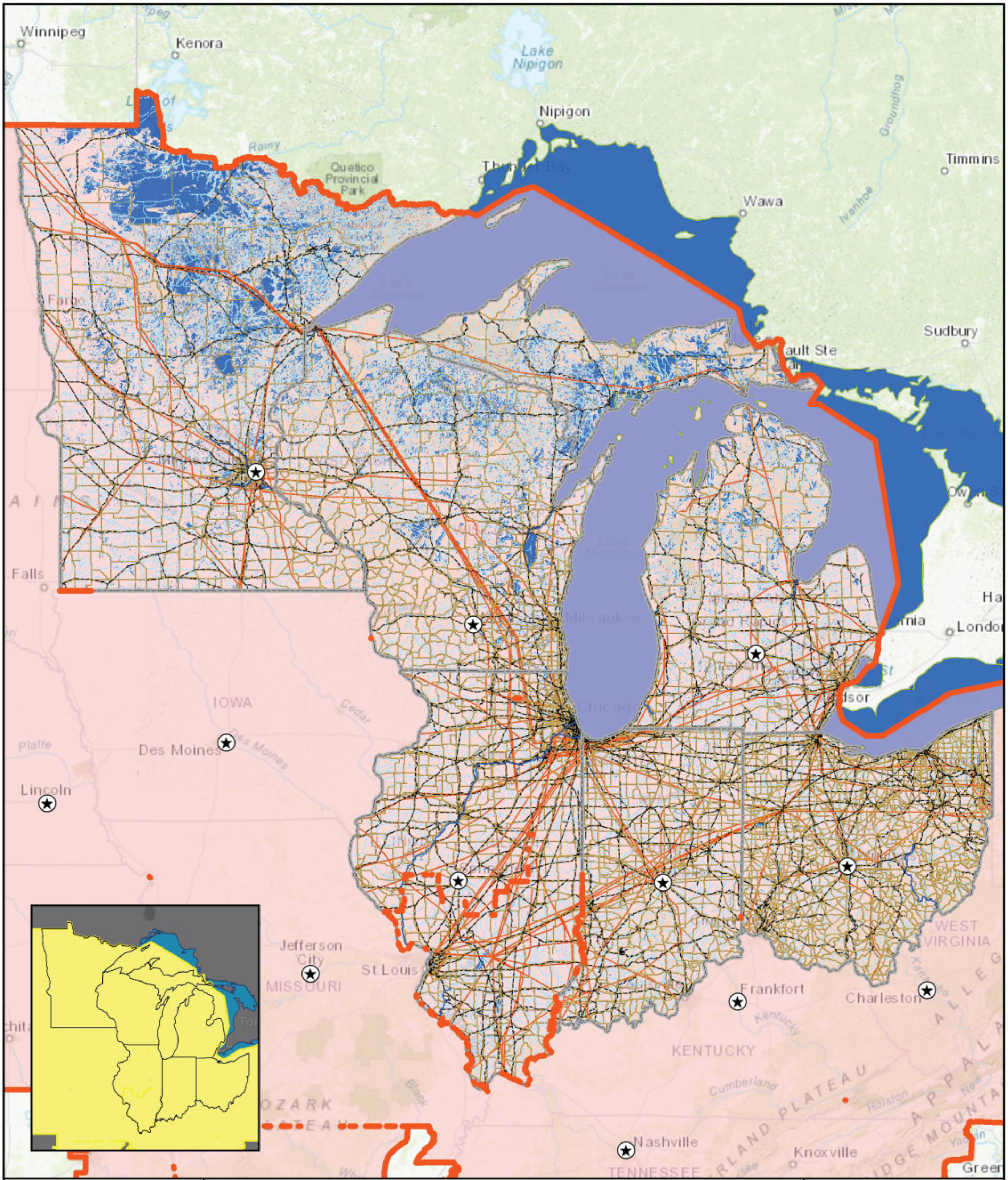


0 30 60 120 180
Miles
0 30 60 120 180 240
Kilometers

NORTHERN LONG-EARED BAT (*MYOTIS SEPTENTRIONALIS*) ACTION AREA OVERVIEW MAP

SCALE 1:10,000,000

— Petroleum Pipeline	— Commercial Navigable Waterway	🟩 1-Mile Coastal Inland Buffer
— Major Road	— Rivers & Streams	🟨 Action Area
------ Railroad	🟦 Lakes & Ponds	▭ Northern Long-eared Bat (*Myotis septentrionalis*) Counties of Occurrence

N

**** Critical Habitat is designated for this species; however, data is unavailable.***

Basemap courtesy of Esri.

Date: 5/25/2021

Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS

Projection: WGS 1984 Web Mercator

Plains Spotted Skunk (*Spilogale putorius interrupta)*

Federal Listing: Under Review. The Plains Spotted Skunk was petitioned for Federal listing under the Endangered Species Act in 2012, and a 90-day finding was issued in 2012 (77 FR 71759).
State Listing within the AA: Threatened in Minnesota

Species Description

The Plains Spotted Skunk is one of three recognized subspecies of the Eastern Spotted Skunk. Spotted Skunks are members of the Order Carnivora and Family Mephitidae. Little variation in skull or body measurements exists among the Plains Spotted Skunk subspecies. The Plains Spotted Skunk can be distinguished from other subspecies by the reduced amount of white on its body, particularly the entirely black tail. USFWS accepts the characterization of the Plains Spotted Skunk as a subspecies because of morphological distinction of its color pattern from other subspecies of Eastern Spotted Skunk. Both the Plains Spotted Skunk and Striped Skunk (*Mephitis mephitis)* have contrasting black and white markings; however, they are easily distinguished by size (Spotted Skunks are substantially smaller) and color pattern. The Plains Spotted Skunk is a small, slender mammal with short legs and a tail with prominent, long hairs. Body weight ranges from 300 to 1,300 g (0.75 to 2.75 lb), and total length ranges from 36 to 61 cm (14 to 23.75 in). In contrast, the striped skunk's average weight is 6,300 g (14 lb), and its length is 80 cm (31.5 in). The Plains Spotted Skunk is black overall with narrow white stripes and spots. Four stripes on the neck, back, and sides run longitudinally from the head to the middle of the body. The four white stripes break into patches or spots on the hindquarters. There is a white spot on the forehead and in front of each ear (77 FR 71759).

Species Distribution

Habitat associations of this subspecies are likely influenced by whether it is using a natural or human-dominated landscape. The subspecies lives in a wide range of habitats including forests, prairies, brushy areas, farmyards, and cultivated land. Regardless of habitat type used, the Plains Spotted Skunk requires extensive vegetative cover. Brushy borders along fields, fence rows, farm buildings, wood piles, heavily vegetated gullies, leaf litter, or downed logs may provide the required extensive cover, which primarily provides protection from predators. Plains Spotted Skunks are more likely to occur where the landscape is composed of a high proportion of forest cover, and they use oak-hickory forests more than old fields or glades. Within forest habitats skunks use young, dense forest stands or stands with downed logs and slash more often than mature stands with open understories and clean forest floors. Spotted skunks also require an early successional component to their habitat to provide cover and denning areas. Dens can be located above ground or below ground. In natural landscapes, Plains Spotted Skunks den in grassy banks and crevices or cavities under rock piles, hollow logs, and stumps. In landscapes dominated by humans, they den in shelterbelts, fencerows, farm buildings, haystacks, woodpiles, or corn cribs. Plains Spotted Skunks might dig their own dens, but they often use burrows excavated by other animals, such as Franklin's ground squirrel (*Spermophilus franklinii*), thirteen-lined ground squirrel (*S. tridecemlineatus*), woodchuck (*Marmota monax*), long-tailed weasel (*Mustela frenata*), striped skunk, and woodrats (*Neotoma* spp.) (77 FR 71759).

The Plains Spotted Skunk currently (and historically) occurs between the Mississippi River and the Continental Divide from Minnesota to the Gulf of Mexico. Historical records indicate that the Plains Spotted Skunk was broadly distributed across its range through the early to mid-1900s and was one of the most common mesocarnivores (a carnivore whose diet consists of 50 to 70 percent meat) where suitable habitat occurred. Likewise, harvest records in the Midwest indicate that population levels in most States were at their highest through the mid-1900s, during which harvest in most years exceeded 100,000 Plains Spotted Skunks. More contemporary records consistently show that the Plains Spotted Skunk underwent declines in the mid- to late 1900s. Declines occurred first in Missouri and Oklahoma in the late 1930s and early 1940s, followed by Nebraska in the mid-1940s, and Kansas, Iowa, and Minnesota in the mid- to late 1940s.

Distribution within Action Area
Minnesota is the only Action Area state in which the Plains Spotted Skunk occurs (Eastern Spotted Skunk Cooperative Study Group, 2018). Though the last effort of live-trapping to survey for the Eastern Spotted Skunk was done in 1995, Minnesota requests that citizens who see a spotted skunk report to the state's DNR. Periodically, request for recent sightings is sent out to groups of people that are most likely to have encountered them: farmers, trappers, fur-buyers, and wildlife managers. Since 2013, only six individual spotted skunks have been sighted in the state. If an Eastern Spotted Skunk is verified, Minnesota DNR may conduct surveys around the area of sighting to determine if a population exists.

Critical Habitat
No critical habitat has been designated for the Plains Spotted Skunk.

Life History
Eastern Spotted Skunks spend the winter in dens, but they are not true hibernators and may awaken on mild days to feed. They are social, non-territorial animals, and different skunks may use the same den site on different days. Mating usually takes place in April, and litters of 4-6 young are born in July. The young are weaned after about 54 days. This species is mainly nocturnal, and escapes detection by climbing a tree or freezing in place (their color pattern is thought to camouflage them during moonlit nights). If an Eastern Spotted Skunk feels threatened it will balance on its forefeet with its hind legs and tail in the air, directed towards the threat. From this position, the skunk can aim and accurately spray the intruder with musk (MNDNR, 2021). During most of the year, individual Plains Spotted Skunks remain in an area of approximately 40 hectares (ha) (98.8 acres (ac)), but the home range can vary based on habitat quality and food availability. The home range can vary seasonally as well; in spring, the range of males can expand to as much as 1,040 ha (2,569.9 ac). The Plains Spotted Skunk is omnivorous but is primarily an insectivore and feeds on insects during all seasons of the year. The proportion of different types of food items varies seasonally. Arthropods are the major dietary component during summer and autumn, with grasshoppers, crickets, ground beetles, and scarab beetles being the preferred food. In the winter, small mammals, including eastern cottontail (*Sylvilagus floridanus*), voles (*Microtus pennsylvanicus* and *M. ochrogaster*), and rats (*Rattus norvegicus*), are the dominant food source. Other foods include birds, eggs, wild ducks that are injured or killed by hunters, fruit, corn, lizards, snakes, crayfish, salamanders, and mushrooms (77 FR 71759).

Current Stressors and Threats
Eastern Spotted Skunk habitat management concerns consist of several major themes including decline of early successional forest, loss of woody cover and habitat fragmentation. These issues have historical roots in changes of land use patterns and management over the last 100 years. Based on the historical and current land use patterns, habitat loss and fragmentation are continued threats to the Eastern Spotted Skunk (Eastern Spotted Skunk Cooperative Study Group, 2018). Despite intensive efforts to locate them, a maximum of six Eastern Spotted Skunks have been documented in the last 20 years in Minnesota. Reasons for the population decline are unclear, but the consolidation of farms, the modernization of farming practices, and the use of pesticides may have been contributing factors. Additionally, changes in grain handling practices and modifications of building and storage facilities to exclude skunks and rodents eliminated many den sites and reduced food sources for skunks. These relatively slow changes, however, are unlikely to be the sole cause of this species' swift decline (MNDNR, 2021).

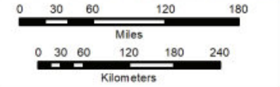
The Eastern Spotted Skunk Cooperative Study Group Conservation Plan (2018) details these stressors and threats:

- Conversion to agricultural landscapes and loss of forest habitats
- Altered disturbance and fire regimes, including managed fire
- Small and fragmented population dynamics
- Disease

List of References

Eastern Spotted Skunk Cooperative Study Group. 2018. Eastern Spotted Skunk conservation plan. 45pp.

Minnesota Department of Natural Resources (MNDNR). (2021). *Spilogale putorius* (Eastern Spotted Skunk). Retrieved from https://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=AMAJF05010



PLAINS SPOTTED SKUNK (*SPILOGALE PUTORIUS INTERRUPTA*) ACTION AREA OVERVIEW MAP

SCALE 1:10,000,000

- Petroleum Pipeline
- Major Road
- Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- ▇ Lakes & Ponds
- 🟩 1-Mile Coastal Inland Buffer
- 🟨 Action Area
- ▭ Plains Spotted Skunk (*Spilogale putorius interrupta*) Counties of Occurrence

N

Basemap courtesy of Esri.

Date: 5/25/2021

Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS

Projection: WGS 1984 Web Mercator

Prairie Gray Fox (*Urocyon cinereoargenteus spp. ocythous)*

Federal Listing: Under Review. The Prairie Gray Fox was petitioned for Federal listing under the Endangered Species Act in 2012, and a 90-day finding was issued in 2012 (77 FR 71759).
State Listing within the AA: Species of Concern in Ohio, but different subspecies than petitioned.

Species Description

The following characteristics describe the Gray Fox species in general, as they are similar to the characteristics of the PGF subspecies. The Gray Fox has a distinguishable appearance with gray fur on its upper body; reddish fur on its neck, the sides of the belly, and inner legs; and white on the rest of its underbody. The guard hairs (long, course hairs that protect soft underfur) are banded with white, gray, and black, which gives the fox's fur a grizzled appearance. It has a black tipped tail and a coarse dorsal mane of black-tipped hairs at the base of its tail. Gray Fox are also distinguished from other canids by their widely separated temporal ridges that come together posteriorly in a U-shaped form. Gray Fox are smaller than the Red Fox *(Vulpes vulpes),* with a total length of 80 to 112.5 cm (31.5 to 44. 3 in), weight of 3 to 7 kilograms (6.6 to 15.4 lb), and males are slightly larger than females. The size of Gray Fox varies with geographic location, with individuals in the northern part of the range larger than those in the south (77 FR 71759).

Species Distribution

Gray Fox dens are usually located in wooded areas and include underground burrows, cavities in trees or logs, wood-piles, and rock outcrops or cavities under rocks. Gray Fox are generally associated with wooded habitats. Gray Fox use oak-hickory forests almost exclusively in southern Missouri, and are frequently found in dense stands of young trees during the day. Gray Fox use woody cover in deciduous or pine forest, but they also use edge habitat and early old-fields (open habitats that are transitioning from field to forest and are dominated by forbs, grass, and shrubs and small trees. The Gray Fox tends to select against agricultural areas. (77 FR 71759).

The Gray Fox has a wide distribution, from the Canadian border at Manitoba to Quebec, and southward through the eastern and southern United States, and to northern Colombia and Venezuela. The Gray Fox is absent from the northwestern United States and the Great Plains in the United States (COESWIC 2016). The PGF subspecies ranges primarily west of the Mississippi and Illinois Rivers through portions of the central plain States. The historical range for this subspecies included western Wisconsin, Minnesota, Iowa, Missouri, Arkansas, and the eastern sections of North and South Dakota, Nebraska, Kansas, and Oklahoma in the United States, and the southernmost sections of Ontario and Manitoba, Canada (77 FR 71759).

Distribution within Action Area

The Prairie Gray Fox is known or believed to occur in Minnesota and Wisconsin; no specific county listings are available.

Critical Habitat

No critical habitat has been designated for the Prairie Gray Fox.

Life History

Gray Fox will use dens year-round, but predominantly when young are born. Gray Fox mate at different times of the year, depending on their geographic location. For example, for the PGF, breeding lasts from late January through February in southern Illinois and from late January through March in Wisconsin. The average litter size for the Gray Fox is 3.8 pups per female, with litters ranging from 1 to 7 pups. Gray Fox are more active at night, with activity at sunrise sharply decreasing and increasing again at sunset. The Gray Fox is primarily an opportunistic carnivore, with mammals composing most of its diet in the Midwest. Although rabbits have been found to be one of their primary food sources, they routinely feed on small rodents and other mammals, birds, and reptiles. In the summer, invertebrates have been found to be more important food items, while in the fall, the Gray Fox consumes more fruit and sometimes corn. A notable characteristic of the Gray Fox is their ability to climb trees; Gray Fox are capable of climbing a tree trunk using their claws to grasp and pull themselves up or bounding from branch to branch. This behavior is used during foraging, predator avoidance, or resting (77 FR 71759).

Current Stressors and Threats

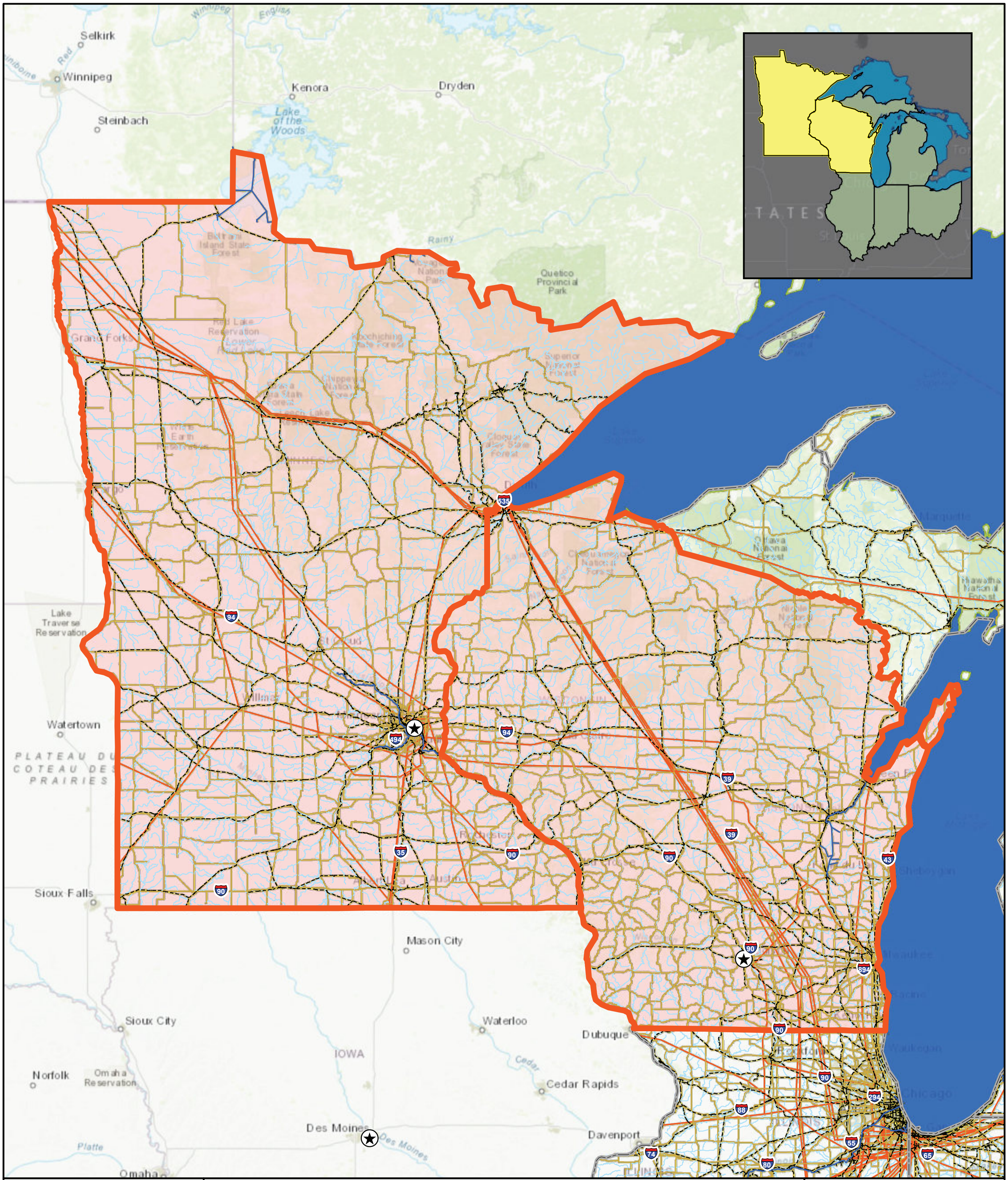
The petition asserts that PGF numbers have declined in many of the States within its range. The average Statewide indices between the 1980 and 1981 surveys showed a decline in Minnesota from 2.4 to 1.9, and in Oklahoma from 2.0 to 1.0. The Statewide indices for Kansas, Nebraska, North Dakota, South Dakota, and Wisconsin were zero in both 1980 and 1981. There was an increase in the numbers of Gray Fox between 1980 and 1981 in Illinois; however, all of the scent stations recorded were outside the range of the PGF subspecies, so they were likely a different subspecies. The petitioners cite these numbers when asserting that the PGF was rare to absent in the plains States by 1980. The petitioners cite the Minnesota Department of Natural Resources' annual carnivore scent station survey as including Gray Fox in their “fox” numbers; however, USFWS can find no indication in this reference that Gray Fox were counted during those surveys. The petitioners state that the number of Gray Fox in Wisconsin, as observed by the Wisconsin Department of Natural Resources during routine field work, was comparable to the badger, which is listed by the State as endangered. The report does indicate that the number of Gray Fox observed in 2010 was 0.78 observations per respondent, which is higher than the long-term average (during the 23 years of the study) of 0.42 observations per respondent. The petitioners attribute this decline to the loss of preferred habitat and the increase in agricultural habitat, which Gray Fox avoid. Although the evidence included in the petition and within USFWS files shows a decline in the population of the PGF for several States, there are no studies included that specifically indicate what the population of the PGF was prior to human settlement or how much the population has declined rangewide.

A COSEWIC (2015) Threats Calculator exercise identified the following threats:

- Hunting and trapping
  Hunting and trapping are considered a high threat to the Gray Fox. While Gray Fox have the ability to sustain high harvest pressure in the core range, incidental capture in the low density populations likely is limiting. The species is legally trapped and/or hunted in the US.
- Residential and commercial development
  Urbanization was cited as a threat to Gray Fox in California, but is unclear if it is a threat in the Prairie subspecies region.
- Roads
  Mortality from vehicles is a possible threat. Gray Fox are susceptible to roadkill mortality due to their large home range size, large dispersal distances and association with rural landscapes.
- Disease and predation
  Diseases such as canine distemper and rabies are fatal to Gray Fox. Coyotes (*Canis latrans*) prey upon Gray Fox. Over 50% of radio-tagged Gray Foxes in California were killed by Coyotes. Small populations of Gray Fox may be particularly susceptible to Coyote predation (COSEWIC, 2015).

List of References

COSEWIC. (2016). COSEWIC assessment and status report on the Gray Fox *Urocyon cinereoargenteus* in Canada. Ottawa, Ontario, Canada. 54pp.



0 20 40 80 120
Miles
0 20 40 80 120 160
Kilometers

PRAIRIE GRAY FOX (*UROCYON CINEREOARGENTEUS SSP. OCYTHOUSA*) ACTION AREA OVERVIEW MAP

SCALE 1:6,596,118

Petroleum Pipeline
Major Road
Railroad
Commercial Navigable Waterway
Rivers & Streams
Lakes & Ponds
1-Mile Coastal Inland Buffer
Prairie Gray Fox (*Urocyon cinereoargenteus ssp. ocythous*) States of Occurrence
Action Area

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Basemap courtesy of Esri.

Date: 7/2/2021

Spatial data courtesy of: US EPA, HIFLD, ESRI, NPMS, US EIA

Projection: WGS 1984 Web Mercator

Tricolored Bat (*Perimyotis subflavus)*

Federal Listing: Under Review. The Tricolored Bat was petitioned for Federal listing under the Endangered Species Act in 2016, and a 90-day finding was issued in 2017 (82 FR 60362).
State Listing within the AA: Endangered in Indiana and Ohio; Threatened in Wisconsin; Special Concern in Michigan and Minnesota

Species Description

The Tricolored Bat, formerly known as the Eastern Pipistrelle (*Pipistrellus subflavus*), is a small bat weighing 0.2 to 0.3 oz (5 to 8 g) with a wingspan of 8 to 10 in (21 to 26 cm). The term "tricolored" refers to the bat's yellowish-brown coat that is dark at the base, yellowish-brown in the middle, and dark at the tips. The wing membranes are blackish, but the face and ears have a pinkish color. An obvious identifying characteristic of this species is the pink color of the skin on the radius bone. The feet are also relatively large compared to its body size (USFWS, 2017).

Tricolored Bats hibernate in caves, mines, and tunnels. While this species is often found hibernating in the same sites as large populations of other bats, such as Little Brown Bats (*Myotis lucifugus*) and Northern Myotis (*M. septentrionalis*), Tricolored Bats tend to occupy the deeper portions of the hibernaculum where temperatures and humidity are higher. In the summer, Tricolored Bats generally roost singly, often in trees, but some males and non-reproductive females also roost in their winter hibernaculum (MNDNR, 2021).

Species Distribution

The Tricolored Bat is distributed throughout the eastern United States, ranging as far west as Nebraska, Kansas, Oklahoma, and Texas, and from southern Canada south to Honduras. States/US Territories in which this population is known to or is believed to occur include 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, West Virginia, Wisconsin, and Wyoming (USFWS, 2021).

Distribution within Action Area

The Tricolored Bat is known or believed to occur in all Action Area states; no specific county listings are available.

Critical Habitat

No critical habitat has been designated for the Tricolored Bat.

Life History

Tricolored Bats hibernate from October into April. During this time, they enter a state of torpor in which their body temperature drops to that of the surrounding air temperature. Human activity in caves where bats are hibernating can be detrimental, causing disturbed bats to awaken frequently during the winter. Such disturbance may result in bats emerging from the hibernaculum early, before there is an adequate supply of insects for them to feed on, or they may fail to awaken altogether. Disturbance during hibernation is especially damaging to juveniles, who are already less likely to survive the winter because they have had less time than adults to accumulate fat reserves. Tricolored Bats mate in the fall, and females give birth to litters, usually of two young, in the spring. While the young are growing, the mothers roost in small maternity colonies. After about four weeks, the young are able to fly and will accompany their mothers on foraging flights. They become independent after another week or two. Tricolored Bats forage early in the evening and may catch up to half their body weight in insects each hour. They forage mainly over water, and tend to avoid deep woods or open fields. Tricolored Bats eat moths, flies, beetles, and ants (MNDNR, 2021).

Current Stressors and Threats

- White nose syndrome
  No other threat is as severe and immediate as the disease, white nose syndrome. If this disease had not emerged, it is unlikely the Little Brown Bat would be experiencing such a dramatic population decline. Since symptoms were first observed in New York in 2006, white nose syndrome has spread rapidly from the Northeast to the Midwest and Southeast; an area that includes the core of the Little Brown Bat's range where it was most common before this disease. Although there is uncertainty about the rate that white nose syndrome will spread throughout the species' range, it is expected to spread throughout the United States in the foreseeable future (USFWS, 2015).
- Changes in cave structure
  Gates or other structures intended to exclude people from caves and mines not only restrict bat flight and movement, but also change airflow and internal cave and mine microclimates. A change of even a few degrees can make a cave unsuitable for hibernating bats.
- Human disturbance
  Cave-dwelling bats are vulnerable to human disturbance while hibernating. Arousal during hibernation causes bats to use up their already reduced energy stores, which may lead to individuals not surviving the winter (USFWS, 2015).
- Development
  Highway construction, commercial development, surface mining, and wind facility construction permanently remove habitat and are activities prevalent in many areas of this bat's range.
- Forest management activities
  Forest management benefits Little Brown Bats by keeping areas forested rather than converted to other uses. But, depending on type and timing, forest management activities can cause mortality and temporarily remove or degrade roosting and foraging habitat.
- Wind facility construction
  Wind turbines kill bats, and, depending on the species, in very large numbers. Mortality has been documented for Little Brown Bats, although a small number have been found to date. However, there are many wind projects within a large portion of the bat's range and many more are planned (USFWS, 2015).

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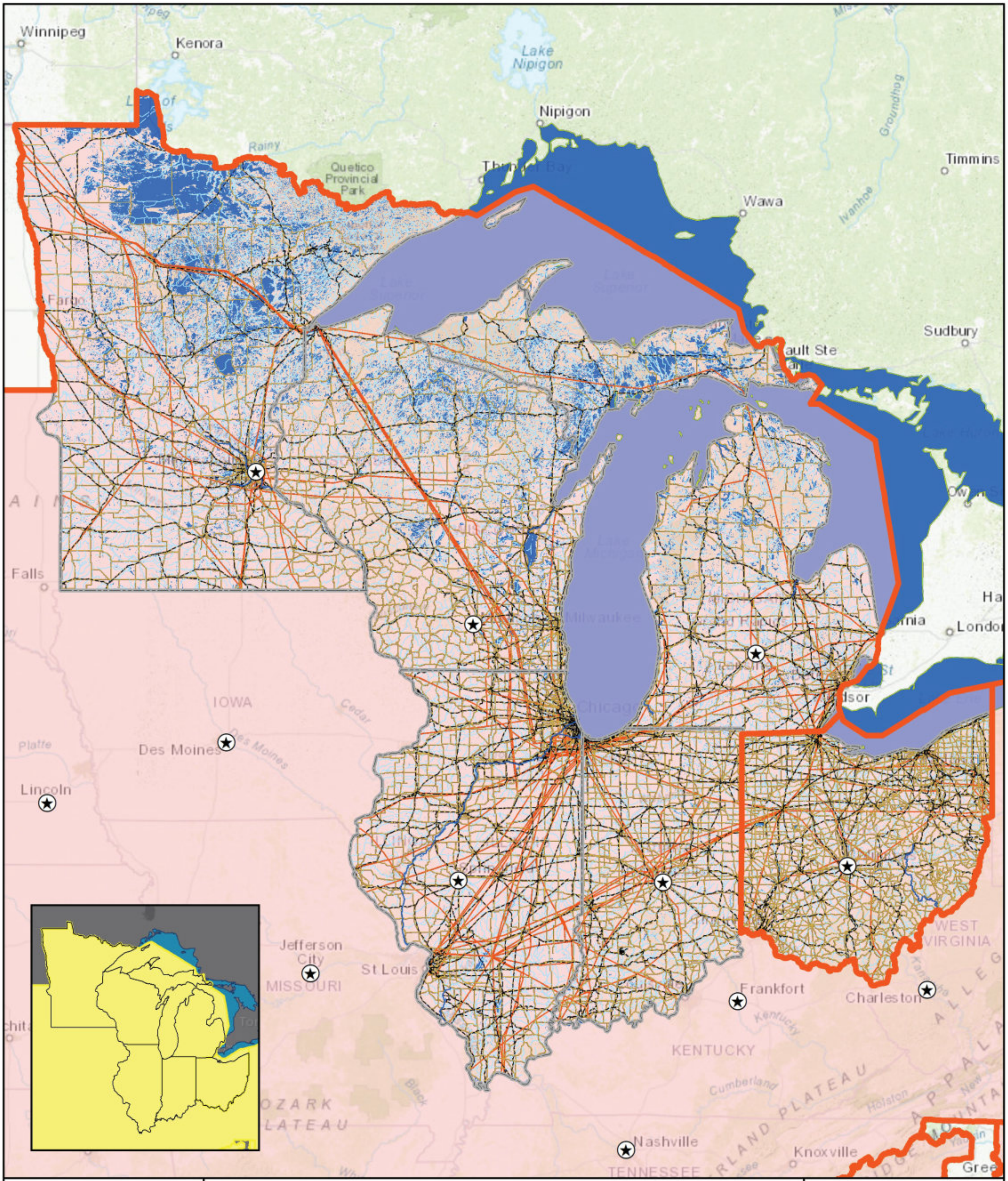

0 30 60 120 180
Miles
0 30 60 120 180 240
Kilometers

TRICOLORED BAT (*PERIMYOTIS SUBFLAVUS*)
ACTION AREA OVERVIEW MAP

SCALE 1:10,000,000

- Petroleum Pipeline
- Major Road
- Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- Lakes & Ponds
- 1-Mile Coastal Inland Buffer
- Action
- Tricolored Bat (*Perimyotis subflavus*) Counties of Occurrence

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Basemap courtesy of Esri. Date: 5/25/2021 Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS Projection: WGS 1984 Web Mercator

BIRDS

Eastern Black Rail (*Laterallus jamaicensis ssp. jamaicensis*)

Federal Listing: Threatened
State Listing within the AA: Endangered in Illinois and Indiana

Subspecies Description

The EBR, subspecies of Black Rail, is the smallest rail in North America. Adults range from 10-15 cm in total length and have a wingspan of 22-28 cm. EBRs weigh 35 g on average and are larger but have less brightly colored plumage than California black rails (mean mass = 29 g). Males and females are similar in size, and adults are generally pale to blackish gray, with a small blackish bill and bright red eyes. The underparts from chin to abdomen are uniformly colored but are lighter on the chin and throat. The nape and upper back are chestnut and the remaining back, uppertail feathers, and remiges (wing flight feathers) are dark gray to blackish with small white spots and sometimes washed with chestnut-brown. The lower abdomen, undertail feathers and flanks are blackish streaked with narrow white and dark gray barring, washed with chestnut. Overall, males are darker and have pale to medium gray throats, while females are lighter and have pale gray to white throats. The tarsi (lower legs) and toes are a brownish gray or gray to blackish-brown. Juvenile black rails are similar in appearance to adults, but have duller plumage and fewer and smaller white spots (USFWS, 2019).

Species Distribution

The Eastern Black Rail is a wetland dependent bird primarily associated with herbaceous, persistent, emergent wetland plant cover. The subspecies requires dense overhead cover and soils that are moist to saturated (occasionally dry) and interspersed with or adjacent to very shallow water (typically ≤ 3 cm). The substrate of ideal habitat is generally considered to be moist soil with scattered small pools. In the interior US EBR utilize wet sedge meadows with dense coverage of sedges and cattail (USFWS, 2021).

In the United States, EBR are found in both coastal and interior areas, but the majority of detections are from coastal sites. Approximately 90% of documented breeding-season occurrence records occurred at coastal locations. Interior records accounted for less than 10% of total occurrences and over 60% of the interior records occurred before 1950. Interior areas are undersampled compared to coastal habitats and expanding survey networks to include more interior habitats is a research priority. However, interior records have always been relatively uncommon throughout the subspecies' documented occurrence history in the United States when compared to the relative frequency and quantity of coastal occurrence records during the same time frame. The 2016 "coastal" assessment of 23 states along the Atlantic and Gulf Coasts of the United States covers a large area of the subspecies' range, both geographically and in terms of the areas presumed to support the highest abundances of EBR and is the most comprehensive treatment of the subspecies completed to date. A similar species assessment was completed in 2012 for an additional 15 states in the interior United States. The 2012 interior assessment concluded that EBR are currently vagrants (casual or accidental vagrants) in Arkansas, Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Nebraska, New Mexico, Ohio, and Wisconsin. Some of these states have conducted marshbird surveys following the 2012 assessment, which have yielded few additional detections of EBR in Nebraska and South Dakota. There appear to be small non-vagrant populations in Kansas and Colorado (USFWS, 2019).

Distribution within Action Area

EBR is considered a vagrant in all states within the Action Area.

Critical Habitat

No critical habitat has been designated for the Eastern Black Rail.

Life History

EBR have four life stages: egg, chick, juvenile (hatch-year), and adult. The egg stage lasts for approximately 26 days (7 days of egg-laying and 19 days of incubation) depending on the clutch size. Adult females lay one egg per day and have an average clutch size of seven eggs (4-13). Both sexes incubate and when one parent is at the nest the other is presumably foraging. Adults may aggressively defend the nest site by raising their wings and charging potential predators. Eggs are laid in a bowl constructed of live and dead fine-stemmed emergent grasses, rushes, or other herbaceous plant species, often with a canopy and a ramp. Nests are typically well hidden in a dense clump of vegetation over moist soil or shallow water. There is evidence of Eastern Black Rail pairs having two successful nests in a season (double brooding); however, whether or not double brooding is common is unknown. EBR egg-laying and incubation primarily occur from May to August with some early nesting in March and April. Once an egg hatches, the chick stage begins and lasts for approximately 1.5 months until the chick enters the juvenile stage. Hatching is synchronous and chicks remain in the nest until all eggs have hatched. The downy chicks are precocial and typically leave the nest within 24 hours of hatching but stay with the parents in the area of the parental territory and often return to the nest site to roost for the evening. Chicks are brooded at least for the first few days and are fed bill-to-bill by both parents, but sometimes only the female; brood division may occur for foraging and brooding. The chick stage occurs from May through September. The juvenile (hatch-year) stage begins when a chick has fledged and is independent from the parents. Juveniles undergo a partial post-juvenile (also known as pre-formative or first pre-basic) molt and obtain immature plumage by approximately 3 months of age. This molt takes place between June and November on the breeding grounds. A partial first prebreeding (or first pre-alternate) molt takes place prior to the breeding season between February and April of the following calendar year. The juvenile stage may last up to 10.5 months, until an individual obtains its first breeding plumage and becomes sexually mature at approximately 1 year of age. Eastern Black Rails reach the adult life stage the spring after hatch year once sexually mature. Adults presumably breed each year and are probably monogamous. Adults undergo a complete post-breeding molt (also known as a definitive pre-basic molt) each year between July and September on the breeding grounds. Breeding Eastern Black Rails are territorial, but the extent and nature of this behavior is poorly known due to birds frequently shifting call sites over a short time period as well as ceasing to call when nesting begins. The nature of migration for the subspecies is poorly understood. The species' lifespan is not known (USFWS, 2019).

Current Stressors and Threats

Eastern Black Rail populations are affected by a variety of factors. However, due to its wide geographic range, the suite of factors affecting the subspecies may vary regionally. Despite these regional differences, their numbers are impacted by the loss, degradation, and fragmentation of wetland habitats resulting from conversion of wetlands to agricultural or urban land uses, sea level rise along the coast, and ground- and surface-water withdrawals across the range. Incompatible land management practices may also have negative impacts on the Eastern Black Rail, i.e., poorly timed and planned prescribed fires, excessive grazing, and/or certain mechanical treatments, particularly when they are conducted during the breeding season or the flightless molt period. Stochastic events, such as flood events and hurricanes, may have significant impacts on populations of Eastern Black Rail. For example, extensive flooding from major hurricanes has been documented at occupied sites during the subspecies' flightless molt period, potentially impacting multiple individuals. When considering the future risk factors to the Eastern Black Rail, there is a complex interaction of threats and other factors having synergistic effects on the subspecies (USFWS, 2021).

The SSA (USFWS, 2019) lists the following as factors influencing viability:

- Habitat fragmentation and conversion
- Altered plant communities
- Altered hydrology
- Groundwater declines
- Groundwater-related subsidence

- Drainage modifications
- Land management (fire, haying and mowing, grazing, impounded wetlands)
- Climate change (changes in temperature and precipitation, sea level rise and tidal flooding, wildfire patterns)
- Oil/chemical spills and environmental contaminants
- Predation (domestic cats, red fire ant)

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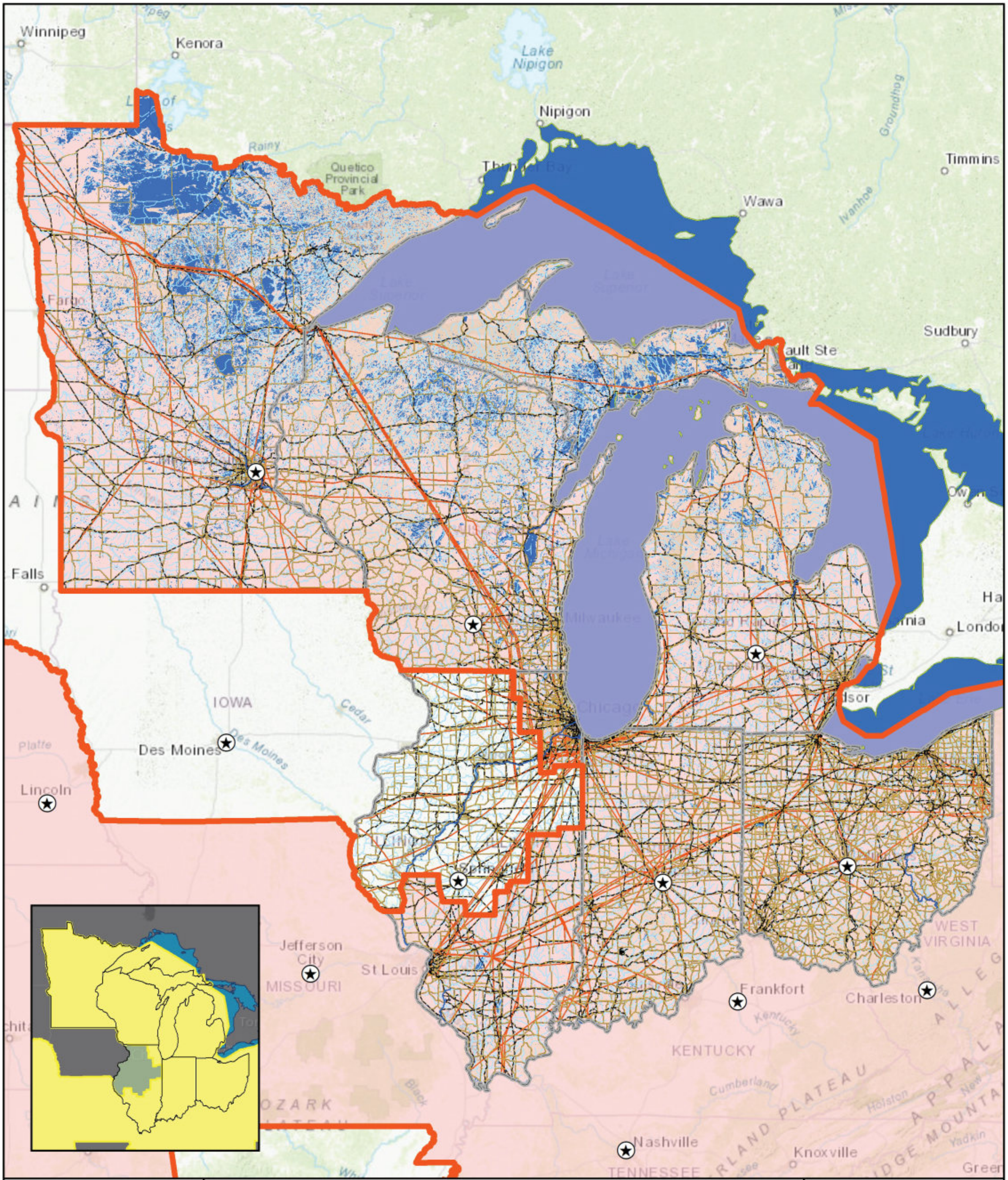

0 25 50 100 150
Miles
0 25 50 100 150 200
Kilometers

EASTERN BLACK RAIL (*LATERALLUS JAMAICENSIS SSP.*)
ACTION AREA OVERVIEW MAP

SCALE 1:10,000,000

- Petroleum Pipeline
- Major Road
- ------ Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- 🟦 Lakes & Ponds
- 🟩 1-Mile Coastal Inland Buffer
- 🟨 Action Area
- 🟥 Eastern Black Rail (*Lateralllus jamaicensis ssp.*) Counties of Occurence

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Basemap courtesy of Esri.

Date: 5/25/2021

Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS

Projection: WGS 1984 Web Mercator

Golden-Winged Warbler (*Vermivora chrysoptera)*

Federal Listing: Under Review. The Golden-Winged Warbler was petitioned for Federal listing under the Endangered Species Act in 2010, and a 90-day finding was issued in 2011 (76 FR 31920).
State Listing within the AA: Endangered in Indiana and Ohio; Special Concern in Wisconsin

Species Description

Classic GWWs are gray-backed and whitish-bellied, with a yellow crown and large yellow wing patches; males have a black and females a gray facial mask and throat. Although GWW is described as a distinct species in the 7th Edition of the Check-list of North American Birds, it is closely related to and hybridizes with Blue-Winged Warbler (*V. cyanoptera*). Phenotypically distinct first-generation hybrids (Brewster's Warbler) display the dominant plumage characters of a white belly and reduced head patterning; backcrosses between hybrids and Golden-Winged or Blue-Winged Warblers were thought to produce the distinct Lawrence's Warbler, which expressed recessive traits of a yellow belly and more extensive head patterning. However, many individuals which appear at first glance to be clearly one species can, on closer inspection, show color flushes typical of the other. In addition, recent mitochondrial DNA (mtDNA) sequencing work reveals that genetic mixing appears to be much more extensive than is suggested by the identification of classical Brewster's and Lawrence's forms, producing an array of introgressed birds (i.e., that exhibit plumage intermediate between the parental types but do not conform to either the Brewster's or Lawrence's classification) as well as "cryptic hybrids" that resemble the parental types phenotypically but which carry genes of the other species. Since birds that appear phenotypically pure may occasionally sing the song characteristic of the other species; visual confirmation of heard birds is necessary, especially in zones of known overlap and hybridization (Roth et al., 2019).

Species Distribution

GWW is a Nearctic/Neotropical long-distance migrant songbird that breeds from mainly in the Great Lakes and St. Lawrence/Champlain states and provinces from Manitoba to Vermont and in the Appalachian Mountains from New York to Tennessee. It spends the northern hemisphere winter in tropical habitats from Central America to the northern Andes of Colombia and Venezuela. Although specific connectivity between breeding and non-breeding populations has yet to be determined, it is possible that at least some individuals make annual round trips of more than 6,000 miles (9600 km). Wintering habitat includes humid evergreen and semi-deciduous forest and edge (Mexico/Honduras); forest canopy and edges, openings of tall second-growth or semi-open forests or mid-elevation undisturbed wet forest (Costa Rica); young woodlands and forest borders (Panama); subtropical lower montane wet forest (northern Colombia); relatively high elevation (1600 m) transitional forest (southwestern Colombia; and undisturbed pre-montane rainforest (1000 m) on the Pacific slopes (western Colombia). Although GWW utilizes mature forest throughout its annual cycle, even during the breeding season, disturbed patches of habitat within a forested matrix are important for nesting. There appear to be three essential components to GWW nesting habitat— grassy and herbaceous openings, shrubs or tree saplings (generally <10 cm diameter), and taller deciduous trees. GWW habitat thus has a characteristic gestalt- faily open patches of herbaceous vegetation and shrubs of different heights either on the edge of a forested patch, associated with a group of trees in an opening of an otherwise forested landscape, or interspersed with forest trees-either young early successional tress or mature canopy trees. For USFWS Midwest Region 3, which contains all AA states, detailed habitat use by state can be found in Roth et al., 2019.

For nearly 150 years, the known breeding range of GWW has been changing substantially. Currently, the northern portion of the range—the Great Lakes population segment—extends from the extreme eastern edge of Saskatchewan through west-central Manitoba, southern Ontario, and extreme southwestern Quebec and then southward into northern Minnesota, Wisconsin, Michigan, and the St. Lawrence River Valley, with a few individuals in Vermont and rarely New Hampshire. The eastern portion of the range—the Appalachian population segment—extends from the southern Appalachians (northern Georgia, western North Carolina, and eastern Tennessee) northeastward through eastern Kentucky, western Virginia, and

West Virginia into Pennsylvania and southern New York, with a few scattered individuals in Connecticut. The Great Lakes population is now separated from the Appalachian population by the near complete absence of GWW in Illinois, Indiana, Ohio, and central New York (Roth et al., 2019).

Distribution within Action Area
Minnesota, Wisconsin, and Michigan currently harbor an estimated 76% of the total global population of breeding GWW. Densities increase dramatically from southeast to northwest across with 5%, 24%, and 47% of the estimated population in Michigan, Wisconsin, and Minnesota, respectively. GWW has been extirpated as a breeding species from Missouri, Iowa, Illinois, and Indiana, where habitat loss has been more concentrated, is virtually extirpated from Ohio, and risks extinction from Michigan and Wisconsin by 2100. See Roth et al. 2019 for detailed status information for each state in the AA.

Critical Habitat
No critical habitat has been designated for the Golden-Winged Warbler.

Life History
Territoriality is one of the most intensively studied components of GWW behavior, and territorial boundaries often are used to infer habitat preference. Traditionally, territorial boundaries have been demarcated largely by mapping singing perches of territorial males, and consequently mapped boundaries of breeding territories frequently follow a forest edge or a row of taller trees along an old fence line. Perches, usually the tallest available trees, are used repeatedly for song display and foraging. Where scattered trees are available throughout shrubby habitat (as in aspen clearcuts with canopy tree retention), defended territories often do not include the stand edges. Recent studies indicate that male GWW are also highly territorial during the resident non-breeding (wintering) season in the Neotropics. The species is single-brooded, with the exception of renesting after early failure of first nests or late second nests by bigamous males. Females appear to select the nest site—usually on the ground, often at the base of leafy herbaceous growth (e.g., Solidago) and well-concealed by leafy vegetation or in some cases by tussock grass or sedge, and sometimes within dense patches of shrubby growth (e.g., Rubus). Often the nest site includes a taller and thicker stem on which the adults descend to the nest when visiting or feeding nestlings. Clutch size ranges for 4-6 and varies in parasitism from Cowbirds. Recently fledged birds wander widely and utilize many different habitat community types. Virtually nothing is known about dispersal behavior in GWW. The resident non-breeding season (wintering season or Neotropical stationary non-breeding season) can last over seven months, with some individuals arriving as early as late September and maintaining territories until early May. Although the resident non-breeding season is the longest portion of the annual cycle, until very recently very little was known about the ecology and conservation status of GWW during this important period (Roth et al., 2019).

Current Stressors and Threats
Golden-Winged Warbler population declines have been attributed to a variety of potential sources, including loss of breeding season habitat, interactions with Blue-Winged Warbler (both competition and hybridization), Brown-Headed Cowbird brood parasitism, and land use changes on the Neotropical wintering grounds. All of these threats, with the possible exception of cowbird parasitism, likely contribute to population-level declines, and the relative impact of each as a limiting factor remains unclear. Threats to the species appear to vary considerably across regions, although loss of early successional habitat has been identified as the principal rangewide breeding season threat, compounded in some areas by hybridization with Blue-Winged Warbler (Roth et al., 2019). Threats are thoroughly explored in Roth et al., 2019 and include:

- Natural succession and disturbance regime change
- Development and land use change
- Public and private forested land policy
- Interactions with Blue-Winged Warbler
- Brood parasitism

- Climate change
- Migratory obstacles
- Non-breeding season habitat loss

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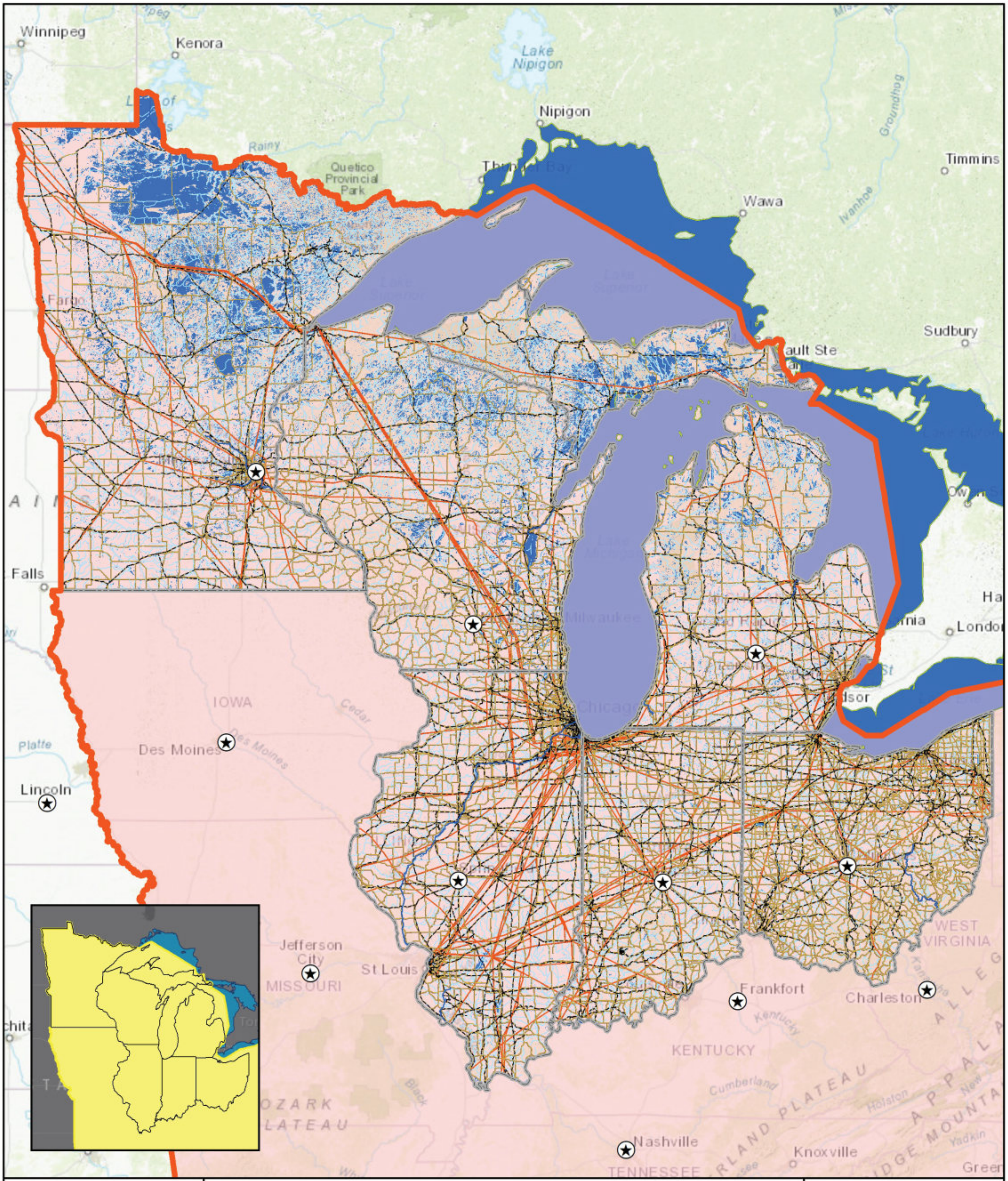


GOLDEN-WINGED WARBLER (*VERMIVORA CHRYSOPTERA*) ACTION AREA OVERVIEW MAP

SCALE 1:10,000,000

Basemap courtesy of Esri.

Date: 5/25/2021

Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS

Projection: WGS 1984 Web Mercator

Piping Plover (*Charadrius melodus*)

Federal Listing: Endangered (Great Lakes watershed DPS), Threatened (Atlantic Coast and Northern Great Plains populations)
State Listing within the AA: Endangered in Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin

Species Description

The Piping Plover, named for its melodic call, is a small North American shorebird approximately 17 cm (6.7 in) in length that weighs 40-65 g (1.4-2.3 oz) and has a wing span measuring about 38 cm (15 in). Light sand-colored upper plumage and white undersides blend in well with the Piping Plover's principal beach habitats. During the breeding season, the legs and bill are bright orange and the bill has a black tip. Other distinctive markings include a single black band across the upper breast and a smaller black band across the forehead. In adult females, the breast band is often thin or incomplete, and plumage is frequently duller than in adult males. During winter, the legs pale, the bill turns black, and darker markings are lost. Chicks have speckled gray, buff, brown, and white down. The coloration of fledged young resembles that of adults in winter. Juveniles acquire adult plumage the spring after they fledge (USFWS, 2003).

Species Distribution

Piping Plovers use numerous areas within breeding and wintering habitats for foraging, including wet sand in the wash zone, intertidal ocean beach, wrack lines, washover passes, mud, sand and algal flats, and shorelines of streams, ephemeral ponds, lagoons, and salt marshes Areas used by Piping Plovers for foraging depend on availability of habitat types, prey abundance, stage of breeding cycle, and human disturbance. Piping Plovers select open, sparsely vegetated sandy habitats for nesting, foraging, and rearing young throughout their breeding range. On Lake Michigan, Piping Plover nest sites occur on sand spits or sand beaches associated with wide, unforested systems of dunes and swales or in the flat pans located behind the primary dune. Michigan breeding areas on Lake Superior are generally simpler morphologically, consisting of a single, large dune dominated by marram grass associated with a beach more than 30 m (100 ft) wide. Nesting on both Great Lakes often occurs adjacent to rivers or ephemeral ponds that function as alternate feeding sites for chicks (USFWS, 2003).

Piping Plovers once nested on Great Lakes beaches in Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, Wisconsin, and Ontario, Canada. Historically, Michigan may have had 215 pairs or more; Ontario and Illinois likely supported the next largest populations (152-162 and 125-130, respectively). Indiana, Ohio, and Wisconsin were estimated to have 100 or fewer breeding pairs each, and Minnesota, New York, and Pennsylvania fewer than 30. Piping Plovers were extirpated from Great Lakes beaches in Illinois, Indiana, New York, Ohio, Pennsylvania and Ontario by the late 1970s, although occasional nesting has occurred since then. In 2017, the Great Lakes Piping Plover population reached a high since listing, at 76 breeding pairs (152 breeding individuals). Of these, 52 pairs were found nesting in Michigan and 24 were found in other Great Lakes states (and provinces) - including eight pairs in Wisconsin and fourteen in Ontario, Canada. Outside the core Great Lakes Piping Plover breeding areas in Michigan, Wisconsin and Ontario, a pair was discovered at Illinois Beach State Park, Lake County, Illinois in 2009 but unfortunately was unsuccessful. However, birds returned to Illinois, breeding successfully in 2015. Great Lakes Piping Plovers returned to New York in 2015 and 2016 as well but had limited breeding success. Breeding pairs of Great Lakes Piping Plovers returned to Pennsylvania in 2017 and nested again in 2018 (USFWS, 2020).

The wintering ranges of the three breeding populations of the Piping Plover overlap and extend from North Carolina to Florida on the Atlantic Coast and from the Florida Gulf Coast west to Texas and into Mexico, the West Indies and the Bahamas. The amount of population mixing that occurs on the wintering grounds is not known. Piping Plovers banded in Michigan have been sighted in both Atlantic and Gulf coast states, suggesting a strong eastward component to migration and dispersal throughout the wintering range by this population. Other recent sightings of plovers banded in Michigan have been made in southern Virginia and the Bahamas.

Distribution within Action Area
The Piping Plover is known or believed to occur in the Great Lakes watershed in all states within the Action Area, with critical habitat occurring in all states as well.

Critical Habitat
Designated May 7, 2001 (66 FR 22938). Includes 35 units along approximately 201 miles of shoreline in Minnesota, Wisconsin, Michigan, Illinois, Indiana, Ohio, Pennsylvania, and New York.

Life History
In the Great Lakes region, Piping Plovers breed and raise young on the shores of the Great Lakes. They migrate along an unknown flight path to the Atlantic and Gulf coasts of southern North America and Central America. Piping Plovers are migratory shorebirds that spend approximately 3-4 months a year on breeding grounds. In the Great Lakes region, birds begin arriving on breeding grounds in late April, and most nests are initiated by mid to late May. Courtship behavior includes aerial displays, digging of several nest scrapes, and a ritualized stone-tossing display. Finished nest cups are shallow depressions approximately 6 cm (2.3 in) in diameter and 2 cm (0.8 in) deep, usually lined with light-colored pebbles and shell fragments less than 1 cm (0.4 in) in diameter. Nest territories are actively defended by both adults. Females lay an egg approximately every other day; clutches are complete at three or four eggs. Both sexes share incubation duties that last 25-31 days. Adults may re-nest up to four times if nests are destroyed, but in the Great Lakes region, they usually re-nest only once per breeding season. At Great Lakes nesting sites, eggs typically hatch from late May to late July. Precocial chicks usually hatch within one half to one day of each other and are able to feed themselves within a few hours. Brooding responsibilities are shared by both parents, although females may desert broods as soon as 1-2 weeks after eggs hatch. Adults and chicks rely on their cryptic coloration to avoid predators. Adults also use distraction displays (feigning injury, false brooding) to lure intruders away from their territories. In Michigan, chicks fledge approximately 21-30 days after hatching. Although Piping Plovers typically produce one brood per year, they have produced two broods at some Atlantic Coast sites and in the Great Lakes. Piping Plovers depart Great Lakes breeding areas from mid-July to early September. Adult females typically depart first, followed in order by unpaired males, males with fledglings, and unaccompanied young. Piping Plovers begin arriving on the wintering grounds in July, with some late-nesting birds arriving in September. A few individuals can be found on the wintering grounds throughout the year, but sightings are rare in late May, June, and early July. Migration is poorly understood, but most Piping Plovers probably migrate non-stop from interior breeding areas to wintering grounds. Piping Plovers begin departing the wintering grounds in mid-February, although peak migration departure occurs in March. Males and females may migrate separately, although they arrive simultaneously at major breeding sites. Males may then disperse to satellite breeding areas alone or accompanied by a female. Piping Plovers feed primarily on exposed beach substrates by pecking for invertebrates one centimeter (0.4 in) or less below the surface. Diet generally consists of invertebrates, including insects, marine worms, crustaceans, and mollusks (USFWS, 2003).

Current Stressors and Threats
Hunting during the late 19th and early 20th centuries likely led to initial declines of the Atlantic Piping Plover population. The role hunting played in the decline of Piping Plovers in the Great Lakes region remains uncertain. Increasing habitat loss, recreational pressure, predation, and contaminants are likely responsible for continued population declines since the 1940s. Scientific collecting may also have contributed to reduction of breeding pairs in the early 1940s. These factors, with the exception of scientific collecting, are among those that presently threaten the Great Lakes population throughout its range (USFWS, 2003). The Recovery Plan discusses these threats:

- Habitat destruction and modification (shoreline development, inlet dredging and artificial structures)
- Predation (nest failure)
- Disturbance by humans and pets (motorized vehicles and other recreation on beaches)
- Contaminants

List of References

U.S. Fish & Wildlife Service (USFWS). (2003). Recovery plan for the Great Lakes Piping Plover (*Charadrius melodus*). Fort Snelling, Minnesota. 141pp.

U.S. Fish & Wildlife Service (USFWS). (2009). Piping Plover (*Charadrius melodus*) 5-year review: summary and evaluation. Hadley, Massachusetts and East Lansing, Michigan. 206pp.

U.S. Fish & Wildlife Service (USFWS). (2020). Piping Plover (*Charadrius melodus*) 5-year review: summary and evaluation. East Lansing, Michigan and Hadley, Massachusetts. 163pp.

0 25 50 100 150
Miles
0 25 50 100 150 200
Kilometers

PIPING PLOVER (*CHARADRIUS MELODUS*)
ACTION AREA OVERVIEW MAP

SCALE 1:8,000,000

- Petroleum Pipeline
- Major Road
- Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- Lakes & Ponds
- 1-Mile Coastal Inland Buffer
- Action Area
- Piping Plover (*Charadrius melodus*) Critical Habitat
- Piping Plover (*Charadrius melodus*) Counties of Occurrence

N

**** Critical Habitat is designated for this species; however, data is unavailable.***

Basemap courtesy of Esri.

Date: 5/24/2021

Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS

Projection: WGS 1984 Web Mercator

Rufa Red Knot (*Calidris canutus rufa*)

Federal Listing: Threatened
State Listing within the AA: Endangered in Indiana; Threatened in Illinois and Ohio

Subspecies Description

The RRK is a medium-sized shorebird about 9 to 11 in (23 to 28 cm) in length. The Red Knot is easily recognized during the breeding season by its distinctive rufous (red) plumage (feathers). The face, prominent stripe above the eye, breast, and upper belly are a rich rufous-red to a brick or salmon red, sometimes with a few scattered light feathers mixed in. The feathers of the lower belly and under the tail are whitish with dark flecks. Upperparts are dark brown with white and rufous feather edges; outer primary feathers are dark brown to black. Females are similar in color to males, though the rufous colors are typically less intense, with more buff or light gray on the dorsal (back) parts (USFWS, 2020).

Species Distribution

The RRK migrates annually between its breeding grounds in the central Canadian Arctic and four wintering regions: the Southeast United States and through the Caribbean; the Western Gulf of Mexico from Mississippi through Central America; northern Brazil and extending west along the northern coast of South America; and Tierra del Fuego at the southern tip of South America (mainly in Chile) and extending north along the Patagonian coast of Argentina (USFWS, 2020). The RRK is a regular, normally “rare” (near-annual but usually single individuals or very small flocks of 2 to 5 birds) spring and fall migrant along the shores of the Great Lakes, and a “casual” (less than annual) migrant inland throughout the Mississippi Flyway. Information for states in the AA from the listing supplemental document are summarized below (USFWS, 2014).

Distribution within Action Area

<u>Minnesota</u>

The Red Knot is a rare, low-density migrant annually recorded somewhere in the State, most frequently at Park Point, Duluth and along the larger inland lakeshores such as Upper Red Lake, Leech Lake, Mille Lacs, and Lake of the Woods. Occasionally, this species appears at sewage treatment plants in the southern third of the State and at other wetlands in the prairie region.

<u>Wisconsin</u>

The Red Knot is an annual but rare to “uncommon” (annual occurrence but not always encountered daily, seldom more than 10 birds) migrant, mainly recorded from the Great Lakes shorelines in spring, and from both the Great Lakes shorelines and inland sites in fall, mainly on State or Federal wildlife refuges. Although annually found along the Lake Michigan shoreline in fall, no one locale regularly concentrates the birds.

<u>Michigan</u>

The Red Knot is a regular, low-density spring migrant on the shores of the Great Lakes, more frequently recorded in fall on Lakes Erie and Lake Michigan. The only specific site where the species is recorded annually is at the Point Mouillee State Game Area on the western shore of Lake Erie. Another likely regular site, but not birded as frequently, is Tawas Point State Park.

<u>Illinois</u>

The Red Knot is an “irregular” (less than annual) spring migrant and a regular, low-density fall migrant along the shores of Lake Michigan. Inland, this species is a casual spring migrant and an irregular, low-density fall migrant, occurring mainly in the vicinity of major reservoirs such as Rend Lake and Carlyle Lake and at refuges in the Illinois River Valley.

Indiana

The Red Knot is a regular, low-density fall migrant along the Lake Michigan shoreline from Michigan City to Gary and casual inland. It is a very rare spring migrant in the northern two-thirds of the State with only a handful of records in 100 years.

Ohio

The Red Knot is usually a rare spring migrant with most records clustered in the two western Lake Erie counties of Ottawa and Lucas. Although most reports document 2 to 8 birds, on rare occasions significant numbers have occurred including, 150 at Bay Point, Ottawa County, and 49 at Ottawa NWR on May 17, 1980. It is possible that both Gulf coast wintering birds and Atlantic coast migrants mix in Ohio in the July to September period. Fall migration is more widespread along the southern Lake Erie shoreline, with birds occurring along the entire shoreline from Toledo in the west to the Pennsylvania line in the east.

Critical Habitat

No critical habitat has been designated for the Rufa Red Knot.

Life History

Detailed information on the life history, biology, and current status of the RRK is found in the supplemental listing document (USFWS, 2014) and summarized here. During both the northbound (spring) and southbound (fall) migrations, Red Knots use key staging and stopover areas to rest and feed. The RRKs typical life span is at least 7 years, with the oldest known wild bird at least 21 years old. Age of first breeding is at least 2 years. Red Knots generally nest in dry, slightly elevated tundra locations, often on windswept slopes with little vegetation. Best available information indicates nest sites are within 600 feet of a freshwater wetland, and, although nests are typically within 31 miles (50 kilometers [km]) of the ocean, knots do not typically use saltwater habitats on the breeding grounds. However, the total number of RRK studied to date is small and highly concentrated on just one island. Thus, it is possible that a greater diversity of nesting and foraging habitats is utilized across the breeding range but not yet documented. Nests may be scraped into patches of mountain avens (*Dryas octopetala*) plants, or in low spreading vegetation on hummocky ground containing lichens, leaves, and moss. After the eggs hatch, Red Knot chicks and adults quickly move away from high nesting terrain to lower, freshwater wetland habitats. On the breeding grounds, the Red Knot's diet consists mostly of terrestrial invertebrates such as insects and other arthropods. However, early in the breeding season, before insects and other macroinvertebrates are active and accessible, RRK will eat grass shoots, seeds, and other vegetable matter. Pair bonds form soon after the birds arrive on the breeding grounds, in late May or early June, and remain intact until shortly after the eggs hatch. Female RRK lay only one clutch per season and, as far as is known, do not lay a replacement clutch if the first is lost. Some knots are thought to be able to lay a second clutch if the first is lost early in incubation, though not later. The usual clutch size is four eggs, though three-egg clutches have been recorded. The incubation period lasts approximately 22 days from the last egg laid to the last egg hatched, and both sexes participate equally in egg incubation. Young are precocial, leaving the nest within 24 hours of hatching and foraging for themselves. Females are thought to leave the breeding grounds and start moving south soon after the chicks hatch in mid-July. Thereafter, parental care is provided solely by the males, but about 25 days later (around August 10) males also abandon the newly fledged juveniles and move south. Not long after, they are followed by the juveniles. Each year some Red Knots make one of the longest distance migrations known in the animal kingdom, traveling up to 19,000 miles (30,000 km) annually. Red Knots undertake long flights that may span thousands of miles without stopping. As RRK prepare to depart on long migratory flights, they undergo several physiological changes. Before takeoff, the birds accumulate and store large amounts of fat to fuel migration and undergo substantial changes in metabolic rates. In addition, the leg muscles, gizzard, stomach, intestines, and liver all decrease in size, while the pectoral (chest) muscles and heart increase in size. Due to these physiological changes, RRK arriving from lengthy migrations are not able to feed maximally until their digestive systems regenerate, a process that may take several days. Because stopovers are time-constrained, RRK requires stopovers rich in easily digested food to achieve adequate weight gain that fuels both the next migratory flight and, upon arrival in the Arctic, a body transformation to breeding condition. At some stages of migration, very high proportions of entire shorebird populations may use a single migration staging site to prepare for long flights. Large proportions of the RRK rangewide population can occur together at a small number of nonbreeding locations, leaving populations vulnerable to loss of key resources. For example, Delaware Bay provides the final Atlantic coast stopover for an estimated 50 to 80 percent of all RRK making their way to the arctic breeding grounds each spring. Although birds from all four wintering populations mix in Delaware Bay, several lines of evidence suggest that birds from the Southern wintering region are more reliant on this staging area relative to birds that winter elsewhere across the range. Individual Red Knots show moderate fidelity to particular migration staging areas between years. Coastal habitats used by RRK in migration and wintering areas are similar in character, generally coastal marine and estuarine habitats with large areas of exposed intertidal sediments. Migration and wintering habitats include both high-energy ocean- or bayfront areas, as well as tidal flats in more sheltered bays and lagoons. Preferred wintering and migration habitats are muddy or sandy coastal areas, specifically, bays and estuaries, tidal flats, and unimproved tidal inlets. Across all six subspecies, RRK is a specialized molluscivore, eating hard-shelled mollusks, sometimes supplemented with easily accessed softer invertebrate prey, such as shrimp- and crab-like organisms, marine worms, and horseshoe crab eggs (USFWS, 2014).

Current Stressors and Threats

In the final listing rule, the Service determined that the RRK is threatened under the ESA due to the following primary threats (USFWS, 2020):

- Loss of breeding and nonbreeding habitat (including sea level rise, coastal engineering, coastal development, and arctic ecosystem change)
- Likely effects related to disruption of natural predator cycles on the breeding grounds
- Reduced prey availability throughout the nonbreeding range
- Increasing frequency and severity of asynchronies (mismatches) in the timing of the birds' annual migratory cycle relative to favorable food and weather conditions

Secondary threats include:

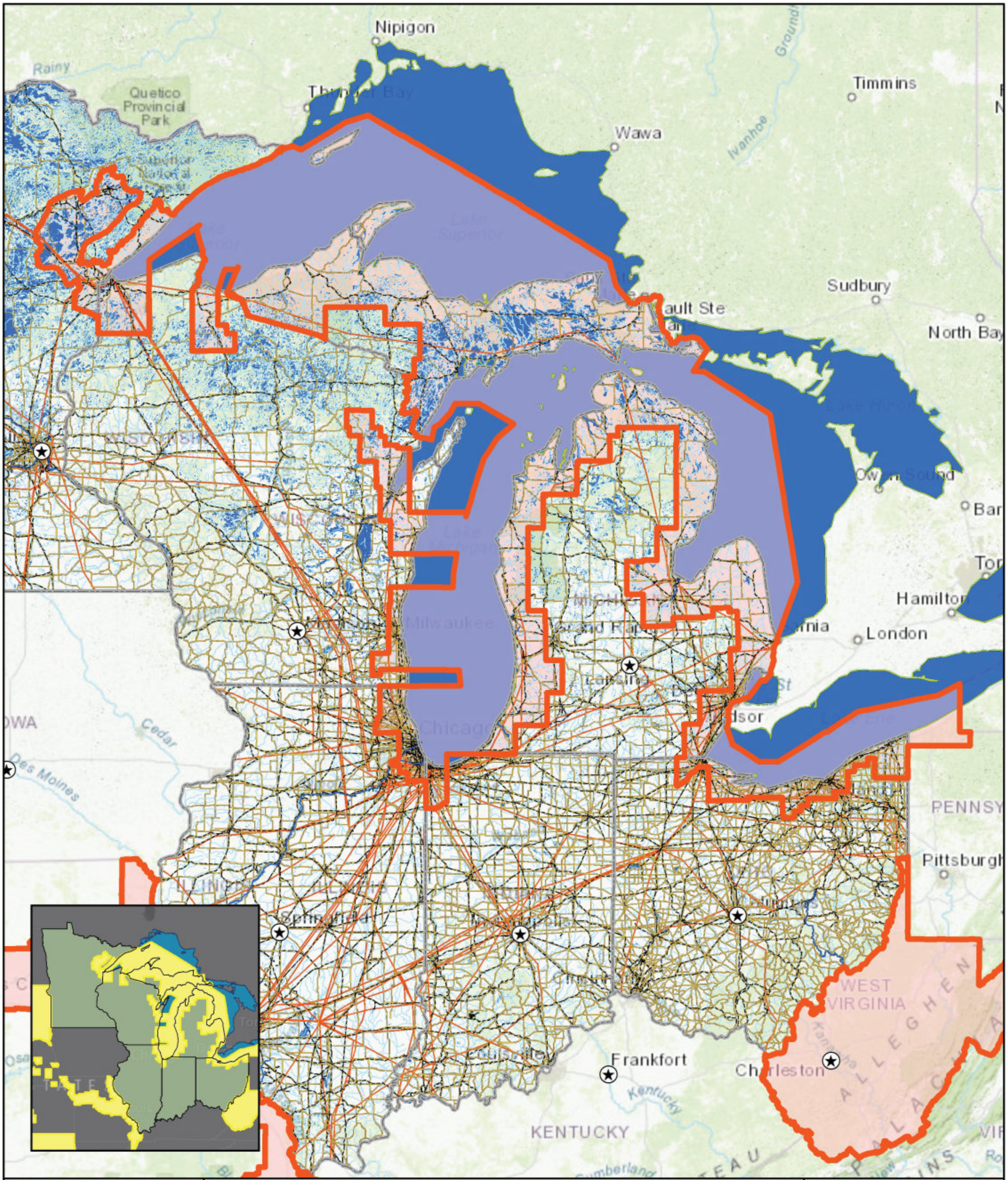
- Hunting in nonbreeding areas
- Predation in nonbreeding areas
- Harmful algal blooms
- Human disturbance
- Oil spills
- Wind energy development, especially near the coasts.

List of References

U.S. Fish & Wildlife Service (USFWS). (2014). Rufa Red Knot background information and threats assessment. Supplement to Endangered and Threatened Wildlife and Plants; Final Threatened Status for the Rufa Red Knot (*Calidris canutus rufa*) (79 FR 73706). Pleasantville, New Jersey. 383pp.

U.S. Fish & Wildlife Service (USFWS). (2019). Recovery outline for the Rufa Red Knot (*Calidris canutus rufa*). Galloway, New Jersey. 33pp.

U.S. Fish & Wildlife Service (USFWS). (2020). Species status assessment report for the Rufa Red Knot (*Calidris canutus rufa*). Version 1.1. Galloway, New Jersey. 55pp.



0 25 50 100 150
Miles
0 25 50 100 150 200
Kilometers

RUFA RED KNOT (*CALIDIRIS CANUTUS RUFA*) ACTION AREA OVERVIEW MAP

SCALE 1:8,500,000

- Petroleum Pipeline
- Major Road
- Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- Lakes & Ponds
- 1-Mile Coastal Inland Buffer
- Action Area
- Rufa Red Knot (*Calidiris canutus rufa*) Counties of Occurrence

N

Basemap courtesy of Esri.

Date: 5/25/2021

Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS

Projection: WGS 1984 Web Mercator

Whooping Crane (*Grus americana*)

Federal Listing: Endangered (Wherever found, except where listed as an experimental population)
State Listing within the AA: Endangered in Indiana

Endangered (32 FR 4001)
Florida Experimental Population (58 FR 5561)
Rocky Mountain Experimental Population (62 FR 3892)
Eastern Migratory Experimental Population (66 FR 14107)

All cranes within the Rocky Mountain, Florida non-migratory and Eastern migratory non-essential, experimental population areas are fully protected as a threatened species (instead of endangered), but other provisions of the Endangered Species Act are relaxed to allow for greater management flexibility as well as positive public support (USFWS, 2019)

Species Description

The Whooping Crane is the tallest North American bird. Males, which may approach 1.5 m in height, are larger than females. Adults are snowy white except for black primary feathers on the wings and a bare red face and crown. The bill is a dark olive-gray, which becomes lighter during the breeding season. The eyes are yellow and the legs and feet are gray-black. Immature cranes are a reddish cinnamon color that results in a mottled appearance as the white feather bases extend. The juvenile plumage is gradually replaced through the winter months and becomes predominantly white by the following spring as the dark red crown and face appear. Yearlings achieve the typical adult appearance by late in their second summer or fall (USFWS, 2019)

Species Distribution

Historic: The historic range of the Whooping Crane once extended from the Arctic coast south to central Mexico, and from Utah east to New Jersey, into South Carolina, Georgia, and Florida. The historic breeding range once extended across the north-central United States and in the Canadian provinces, Manitoba, Saskatchewan, and Alberta. A separate non-migratory breeding population occurred in southwestern Louisiana. Aransas/Wood Buffalo Population**:** The current nesting range of the self-sustaining natural wild population is restricted to Wood Buffalo National Park in Saskatchewan, Canada and the current wintering grounds of this population are restricted to the Texas Gulf Coast at Aransas National Wildlife Refuge and vicinity. is experiencing a gradual positive population trend overall, although some years exhibit stationary or negative results. Rocky Mountain Experiment: In 1975, an effort to establish a second, self-sustaining migratory flock was initiated by transferring wild Whooping Crane eggs from Wood Buffalo National Park to the nests of greater sandhill cranes at Grays Lake National Wildlife Refuge in Idaho. This Rocky Mountain population peaked at only 33 birds in 1985. The experiment terminated in 1989 because the birds were not pairing and the mortality rate was too high to establish a self-sustaining population. In 1997, the remaining birds in the population were designated as experimental, non-essential to allow for greater management flexibility and to begin pilot studies on developing future reintroduction methods. In 2001, there were only two remaining Whooping Cranes in this population. Captive Populations: As of March, 2001, there were 120 captive Whooping Cranes held at six facilities. Four facilities: Patuxent Wildlife Research Center, International Crane Foundation, Calgary Zoo, and San Antonio Zoo have successful breeding programs. Currently, the remaining facilities, Lowry Park Zoo and Audubon Institute house cranes for rehabilitative and educational purposes. Chicks produced at the captive facility either remain in captivity to maintain the health and genetic diversity of the captive flock, or are reared for release to the wild in the experimental reintroduction programs. Florida Experimental Nonessential Population: An experimental reintroduction of Whooping Cranes in Florida was initiated in 1993 to establish a non-migratory population at Kissimmee Prairie. A nonmigratory population avoids the hazards of migration, and by inhabiting a more geographically limited area than migratory cranes, individuals can more easily find compatible mates.

Distribution within Action Area

Eastern Migratory Population: A second experimental non-essential population was reintroduced to eastern North America in 2001. The intent was establish a migratory flock which would summer and breed in central Wisconsin, migrate across the seven states and winter in west-central Florida. The birds are taught the migration route after being conditioned to follow costumed pilots in ultralight aircraft. Following this success with Sandhill Cranes, the first attempt to lead Whooping Cranes was made in 2001. The program has been successful, and approximately 90 Whooping Cranes now make the trip between Florida and Wisconsin annually. Some of these cranes can be found in the AA as they migrate (USFWS 2019).

Critical Habitat

Critical Habitat for the Whooping Crane was designated on May 15, 1978 (43 FR 20938) for nine locations in the U.S.: Alamosa and Monte Vista NWRs in CO; Grays Lake NWR in ID; Bosque del Apache NWR in NM; Quivira NWR and Cheyenne Bottoms SWMA in KS; an 80-mile (mi) stretch of the Platte River in NE; Salt Plains NWR in OK; and ANWR and vicinity in TX. With the extirpation of the Rocky Mountain re-introduced Whooping Crane population, the four locations in CO, ID, and NM were removed from the list of designated critical habitat areas on July 21, 1997 (62 FR 38932-38939) (USFWS, 2012).

Life History

Whooping Crane life span is estimated to be 22 to 24 years in the wild. They are omnivorous feeders, feeding on insects, frogs, rodents, small birds, minnows, and berries in the summer. In the winter, they focus on predominantly animal foods, especially blue crabs and clams. They also forage for acorns, snails, crayfish and insects in upland areas. Whooping Cranes are monogamous and form life-long pair bonds but will remate following the death of a mate. Wild, non-experimental, Whooping Cranes return to the same breeding territory in Wood Buffalo National Park, Canada, in April and nest in the same general area each year. They construct nests of bulrush and lay one to three eggs, (usually two) in late April and early May. The incubation period is about 29 to 31 days. Whooping Cranes will renest if the first clutch is lost or destroyed before mid-incubation. Both sexes share incubation and brood-rearing duties. Despite the fact that most pairs lay two eggs, seldom does more than one chick reach fledging. Autumn migration begins in mid-September, and most birds arrive on the wintering grounds of Aransas National Wildlife Refuge on the Texas Gulf Coast by late-October to mid-November. Whooping Cranes migrate singly, in pairs, in family groups or in small flocks, and are sometimes accompanied by sandhill cranes. They are diurnal migrants, stopping regularly to rest and feed, and use traditional migration staging areas. On the wintering grounds, pairs and family groups occupy and defend territories. Subadults and unpaired adult Whooping Cranes form separate flocks that use the same habitat but remain outside occupied territories. Subadults tend to winter in the area where they were raised their first year, and paired cranes often locate their first winter territories near their parents' winter territory. Spring migration is preceded by dancing, unison calling, and frequent flying. Family groups and pairs are the first to leave the refuge in late-March to mid-April. Juveniles and subadults return to summer in the vicinity of their natal area, but are chased away by the adults during migration or shortly after arrival on the breeding grounds. Only one out of four hatched chicks survive to reach the wintering grounds. Whooping Cranes generally do not produce fertile eggs until age 4 (USFWS, 2019)

The nesting area in Wood Buffalo National Park is a poorly drained region interspersed with numerous potholes. Bulrush is the dominant emergent in the potholes used for nesting. On the wintering grounds at Aransas National Wildlife Refuge in Texas, Whooping Cranes use the salt marshes that are dominated by salt grass, saltwort, smooth cordgrass, glasswort, and sea ox-eye. They also forage in the interior portions of the refuge, which are gently rolling, sandy, and are characterized by oak brush, grassland, swales, and ponds. Typical plants include live oak, redbay, Bermuda grass, and bluestem. The non-migratory, Florida release site at Kissimmee Prairie includes flat, open palmetto prairie interspersed with shallow wetlands and lakes. The primary release site has shallow wetlands characterized by pickerel weed, nupher, and maiden cane. Other habitats include dry prairie and flatwoods with saw palmetto, various grasses, scattered slash pine, and scattered strands of cypress. Areas selected for the proposed eastern migratory experimental population closely mimic habitat of the naturally occurring wild population in Canada and Texas (USFWS, 2019).

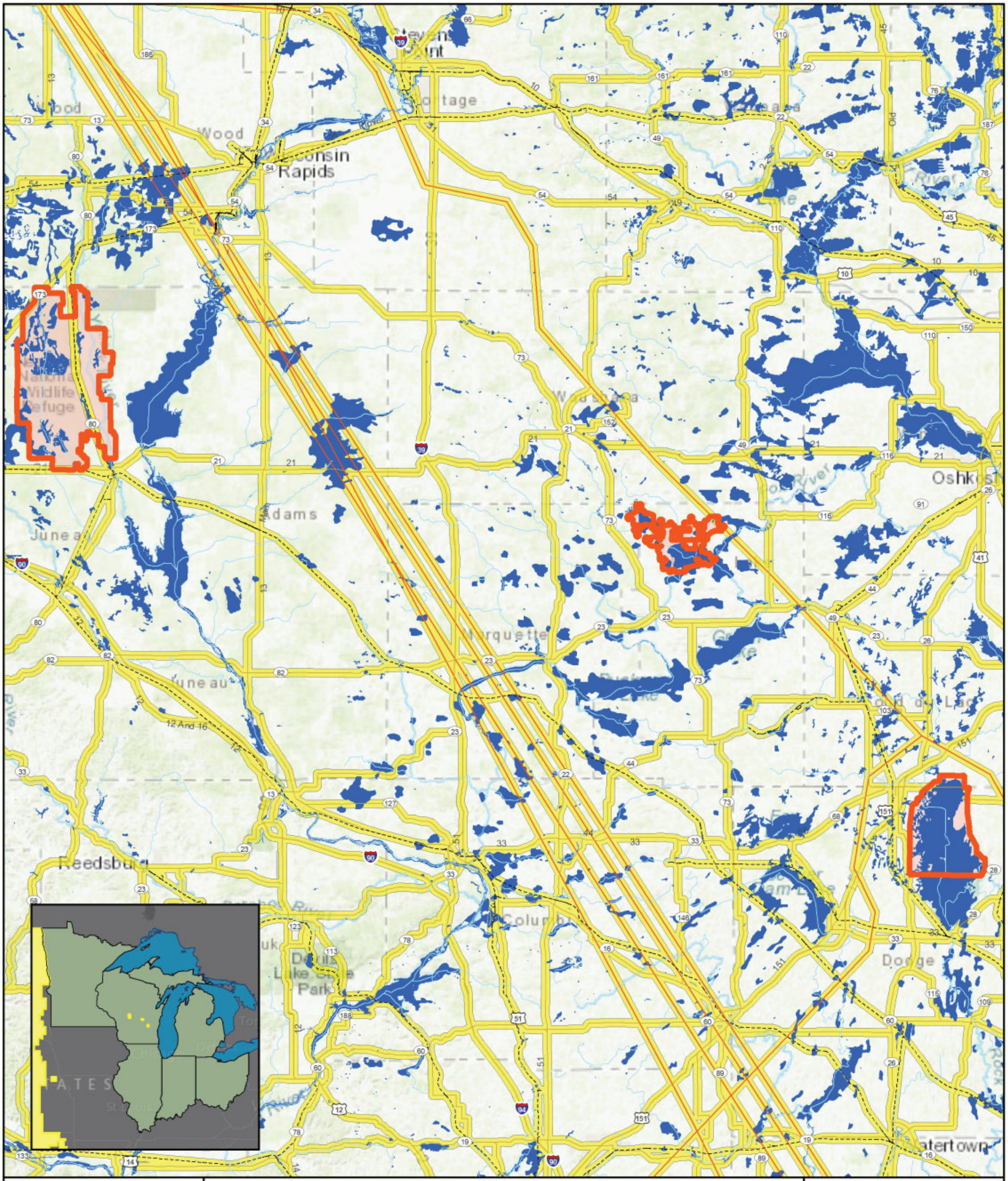
Current Stressors and Threats

The Whooping Crane population, estimated at 500 to 700 individuals in 1870 declined to only 16 individuals in the migratory population by 1941 as a consequence of hunting and specimen collection, human disturbance, and conversion of the primary nesting habitat to hay, pastureland, and grain production. The main threat to Whooping Cranes in the wild is the potential of a hurricane or contaminant spill destroying their wintering habitat on the Texas coast. Collisions with power lines and fences are known hazards to wild Whooping Cranes. The primary threats to captive birds are disease and parasites. Bobcat predation has been the main cause of mortality in the Florida experimental population (USFWS, 2019)

List of References

U.S. Fish & Wildlife Service (USFWS). (2012). Whooping Crane (*Grus americana*) 5-year review: summary and evaluation. Austwell, Texas and Corpus Christi, Texas. 44pp.

U.S. Fish & Wildlife Service (USFWS). (2019). Whooping Crane (*Grus americana*) species status and fact sheet. Retrieved from https://www.fws.gov/northflorida/whoopingcrane/whoopingcrane-fact-2001.htm



0 3.5 7 14 21
Miles
0 3.5 7 14 21 28
Kilometers

WHOOPING CRANE (*GRUS AMERICANA*)
ACTION AREA OVERVIEW MAP

SCALE 1:1,000,000

- Petroleum Pipeline
- Major Road
- Railroad
- Commercial Navigable Waterway
- Rivers & Streams
- Lakes & Ponds
- 1-Mile Coastal Inland Buffer
- Action Area
- Whooping Crane (*Grus americana*) Counties of Occurrence

N

Basemap courtesy of Esri.

Date: 5/25/2021

Spatial data courtesy of: USEPA, HIFLD, ESRI, NPMS

Projection: WGS 1984 Web Mercator