

Michigan Endangered Species Determination Key

Standing Analysis

July 2022 (version 3.0)

Introduction

This standing analysis supports the “All-species Michigan Endangered Species Determination Key” (Dkey) delivered by the U.S. Fish and Wildlife Service (Service)’s Information for Planning and Consultation (IPaC) system. The Service’s Michigan Ecological Services Field Office (MIFO) developed this DKey to streamline the process of reviewing certain routine and predictable projects that are not likely to result in adverse effects (or take) of Federally threatened and endangered species in Michigan.

In Fiscal Year 2019, the MIFO received over 1,270 projects that it reviewed and determined would not significantly affect or result in the prohibited take of species or habitats listed under the Endangered Species Act (ESA) of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*). The routine nature of the review of various Federal and non-Federal projects provides an opportunity for the MIFO to programmatically evaluate the effects of common activities on threatened and endangered species. Most incoming projects overlap with the Area of Influence (AOI) of multiple listed species in Michigan. The availability of a DKey covering all threatened and endangered species and critical habitats in Michigan will eliminate the need for the MIFO to individually review large numbers of projects and will provide Federal Action Agencies, consultants, and project proponents an immediate and consistent response to their requests for consultation, technical assistance, or conservation planning assistance.

To use this Dkey, applicants enter their project area in IPaC, and the program determines whether the project’s geographic extent intersects AOI of any Federally listed species. The applicant will have the option to complete an available determination key, including this Dkey, for those species for which their project area intersects an AOI. The Dkey starts by asking a series of questions to determine if the project qualifies for the Dkey (see [General Exclusions](#) below). If they don’t qualify for the Dkey, they will be notified that they must consider effects to threatened and endangered species outside of the Dkey. If the user’s project qualifies for the Dkey, they will receive questions based on the specific species that may be present in the action area. Depending on how they answer the questions and the corresponding determinations that are reached, they will receive an output letter from IPaC. For Federal projects that reach a “not likely to adversely affect (NLAA)” determination, there is a 30 day “verification period” to allow the Service to review the project details and ensure the action meets the criteria for a NLAA determination. Output letters will indicate that if the project proponent does not hear otherwise within that timeframe, the NLAA determination is verified and they can proceed with their action as described in the IPaC report and concurrence verification letter. This verification period allows the Michigan Ecological Services Field Office to apply local knowledge to evaluation of the action and ensure actions do not have unanticipated impacts. Thus, there may be a small subset of actions for which the Michigan Ecological Services Field Office may request additional information during this timeframe to verify the effects determination reached through the DKey. There is no verification period for non-Federal projects or for “no effect” determinations. If the user gets a “may affect” determination for any species, they are advised to contact the Michigan Field Office to complete consultation outside of the Dkey. All output

letters include reinitiation language as follows: “The Service recommends that your agency contact the Service or re-evaluate the project in IPaC if: 1) the scope or location of the proposed Action is changed; 2) new information reveals that the action may affect listed species or designated critical habitat in a manner or to an extent not previously considered; 3) the Action is modified in a manner that causes effects to listed species or designated critical habitat; or 4) a new species is listed or critical habitat designated. If any of the above conditions occur, additional consultation with the Service should take place before project changes are final or resources committed”.

Proposed Action

The proposed Action is the compilation of many different types of projects that depending on their size and specific location often do not significantly affect any Federally listed threatened or endangered species or critical habitats in Michigan. Common project types include, but are not limited to, the following:

- Vegetation management, including mowing, forestry activities, prescribed burning and harvest
- Construction, maintenance, operation, and/or removal of:
 - Roads and trails
 - Communication towers
 - Transmission and utility lines
 - Bridges and culverts
 - Oil and gas pipelines
 - Solar power facilities
 - Hydroelectric facilities/dams
 - Mines/quarries
 - Canals/levees/dikes
- Commercial, residential and recreational developments
- Agricultural activities
- Site/habitat restoration/enhancement
- Shoreline protection/beach nourishment
- Dredging and filling of wetlands/waterbodies
- Military operations

General Exclusions:

To use this standing analysis and receive a conclusion from IPaC through the DKey, projects may NOT include the following:

1. Long-term (i.e., greater than 10 years) permits, plans or other actions (e.g., FERC licenses)
2. Construction or operation of wind turbines
3. Projects for which there are less than 30 days prior to action occurring
4. Construction of a communications tower that don't use proper lighting, is located within three miles of dedicated conservation lands, has guy wires, or is over 450 feet in height
5. Water withdrawals greater than 10,000 gallons/day, or
6. Aerial or other broad application of chemicals

To ensure compliance with the ESA, project-specific consultation (or other programmatic consultation, if applicable) with the Service may be necessary for projects including the actions listed above. Those projects would not necessarily result in significant adverse effects to listed species or habitats.

Additionally, to use this standing analysis and receive a conclusion from IPaC, projects must include the species/taxon-specific conservation measures detailed below, as appropriate ([Species-Specific Conservation Measures](#)).

Action Area

The Action Area is the entire State of Michigan. Because the DKey is intended for use by future projects, we cannot identify the specific action areas of individual projects.

Covered Species/Habitats

Species and habitats covered by the Michigan Endangered Species DKey include all Federally listed species and critical habitats that occur within the state, as follows¹:

Animals

- *Birds*
 - Whooping Crane (*Grus americana*)- NEP
 - Piping Plover (*Charadrius melodus*)- E
 - Rufa Red Knot (*Calidris canutus rufa*)- T
- *Freshwater Mussels*
 - Clubshell (*Pleurobema clava*)- E
 - Northern Riffleshell (*Epioblasma torulosa rangiana*)- E
 - Rayed Bean (*Villosa fabalis*)- E
 - Snuffbox (*Epioblasma triquetra*)- E
- *Insects*
 - Hine's Emerald Dragonfly (*Somatochlora hineana*)- E
 - Hungerford's Crawling Water Beetle (*Brychius hungerfordi*)- E
 - Karner Blue Butterfly (*Lycaeides melissa samuelis*)- E
 - Mitchell's Satyr (*Neonympha mitchelli mitchelli*)- E
 - Poweshiek Skipperling (*Oarisma poweshiek*)- E
 - Monarch butterfly (*Danaus plexippus*) - Candidate
- *Mammals*
 - Canada Lynx (*Lynx canadensis*)- T
 - Gray Wolf (*Canis lupus*)- E
 - Indiana Bat (*Myotis sodalis*)- E
 - Northern Long-eared Bat (*Myotis septentrionalis*)- T
- *Reptiles*
 - Copperbelly Water Snake (*Nerodia erythogaster neglecta*)- T
 - Eastern Massasauga Rattlesnake (*Sistrurus catenatus*)- T

¹T = threatened, E = endangered, CH = critical habitat, NEP = nonessential experimental population

Plants

- American Hart's-Tongue Fern (*Asplenium scolopendrium* var. *americana*)- T
- Dwarf Lake Iris (*Iris lacustris*)- T
- Eastern Prairie Fringed Orchid (*Platanthera leucophaea*)- T
- Houghton's Goldenrod (*Solidago houghtonii*)- T
- Lakeside Daisy (*Hymenoxys herbacea*)- T
- Michigan Monkey-Flower (*Mimulus michiganensis*)- E
- Pitcher's Thistle (*Cirsium pitcheri*)- T

Critical Habitats (CH)

- Hine's Emerald Dragonfly CH
- Piping Plover CH
- Poweshiek Skipperling CH

Species Descriptions/Status within the Action Area

Nonessential Experimental Population of Whooping Crane (*Grus americana*)

The whooping crane breeds, migrates, winters, and forages in a variety of wetland and other habitats, including coastal marshes and estuaries, inland marshes, lakes, ponds, wet meadows and rivers, and agricultural fields. Bulrush is the dominant vegetation type in the potholes used for nesting, although cattail, sedge, musk-grass, and other aquatic plants are common. Nest sites are primarily located in shallow diatom ponds that contain bulrush. During migration, whooping cranes use a variety of habitats; however wetland mosaics appear to be the most suitable. For feeding, whooping cranes primarily use shallow, seasonally and semi permanently flooded palustrine wetlands for roosting, and various cropland and emergent wetlands.

The whooping crane has been Federally listed as endangered since 1967 due to habitat loss and over-hunting. Wild whooping cranes currently exist in two flocks, a non-migratory flock in Florida, and a migratory flock that summers in Wood Buffalo National Park in Canada and winters near and at Aransas National Wildlife Refuge in Texas along the Gulf coast. It is possible that all or most of these birds could be wiped out from a single event such as a hurricane, disease outbreak, toxic spill, or prolonged drought, making the species vulnerable to extinction. To ensure that the whooping crane survives, the International Whooping Crane Recovery Team recommended that an additional flock of whooping cranes be established that is separate from the single remaining natural wild migratory population. On June 26, 2001, the Service published a final rule in the Federal Register to establish a Nonessential Experimental Population (NEP) within a 20-state area in the eastern U.S., which includes Michigan.

For the purposes of section 7 of the ESA, we treat NEPs as threatened species when the NEP is located within a National Wildlife Refuge (NWR) or National Park (NP), and therefore section 7(a)(1) and the consultation requirements of section 7(a)(2) of the ESA apply in NWRs and NPs. Section 7(a)(1) requires all Federal agencies to use their authorities to conserve listed species. Section 7(a)(2) requires that Federal agencies consult with the Service before authorizing, funding, or carrying out any activity that would likely jeopardize the continued existence of a listed species or adversely modify its critical habitat.

For Federal projects outside a NWR or NP, we treat the population as proposed for listing and only two provisions of section 7 would apply: section 7(a)(1) and section 7(a)(4). In these instances, NEPs provide additional flexibility because Federal agencies are not required to consult with us under section 7(a)(2). Section 7(a)(4) requires Federal agencies to confer with the Service on actions that are likely to jeopardize the continued existence of a proposed species. The results of a conference are advisory in nature and do not restrict agencies from carrying out, funding, or authorizing activities.

For purposes of section 9 of the ESA, individual species within a NEP area are treated as threatened regardless of the species' designation elsewhere in its range. Under section 4(d) of the ESA, we have greater discretion in developing management programs and special regulations for threatened species than we have for endangered species. Section 4(d) of the ESA allows us to adopt whatever regulations are necessary to provide for the conservation of a threatened species. The special 4(d) rule contains the prohibitions and exemptions necessary and appropriate to conserve that species. Because of the flexibility, regulations issued under a 4(d) rule are generally compatible with routine human activities in the reintroduction area. For whooping crane in the NEP in Michigan, purposeful take is prohibited under the special rule; actions that cause take that is accidental and occurred incidentally to an otherwise lawful activity that was being carried out in full compliance with all applicable laws and regulations, is not prohibited under the ESA. In the case of an intentional actions (e.g., intentional shooting), the full protection of the ESA could apply.

For additional information on the whooping crane, including a five-year status review and recovery plan, please see the [species profile](#).

Piping Plover (Charadrius melodus)

The piping plover is a small shorebird that nests in three separate geographic populations in the U.S.: the Great Plains states, the shores of the Great Lakes, and the shores of the Atlantic coast. Birds from all populations winter on the southern Atlantic and Gulf coasts in the U.S.

In the Great Lakes, piping plovers nest, feed, and rear their young in open, sparsely vegetated sandy areas, including sand spits and sand beaches with wide, unforested dunes and swales or in the flat pans behind the primary dune. Piping plovers begin arriving in Michigan in late April, and most mated pairs are nesting by mid to late May. Eggs typically hatch from late May to late July, with chicks fledging 21 to 30 days after hatching. Although piping plovers typically produce one brood per year, they sometimes bring off two broods during a summer. Piping plovers feed on exposed beach surfaces by pecking for invertebrates that are 1/2 inch or less below the surface. They feed mostly during the day and eat insects, marine worms, crustaceans, and mollusks as well as eggs and larvae of flies and beetles. Most adults depart for their wintering grounds by mid-August. Young birds hatched during the summer start their migration a few weeks later than adults, and most are gone from the Great Lakes by late August.

The Great Lakes population of the piping plover was listed as endangered in 1986. An active recovery program in Michigan, aided by many volunteers, has helped the plover population to steadily increase. In 2019, there were 71 breeding pairs (142 individuals) (USFWS unpubl. data 2020). Of these, 49 pairs nested in Michigan, while 22 pairs were found outside the state, including one pair in Chicago, Illinois, one pair in Pennsylvania, ten pairs in Wisconsin, and nine pairs in Ontario, Canada. A single breeding pair discovered in 2007 in the Great Lakes region of

Canada represented the first confirmed piping plover nest there in over 30 years. In 2019, a pair of piping plovers had their first successful nesting site at Montrose Beach in Chicago, Illinois in more than 60 years.

The species remains extremely vulnerable to extinction from factors that include disease, habitat destruction, and unpredictable changes in the environment. Recent studies of Great Lakes Piping Plovers indicate that predation and human-caused disturbance also continue to negatively affect the population. During 2019, as many as 11 adults were lost due to predation by merlins, snowy owls, and off-leash dogs (USFWS unpubl. data 2020).

For additional information on the piping plover, including a recent five-year status review and recovery plan, check out the [species profile](#).

Under the terms of a court order, the Service designated CH for the Great Lakes breeding population of the piping plover on May 7, 2001. This includes 35 units in 8 states, including 23 units in Michigan:

- St. Louis County, Minnesota
- Douglas, Ashland, Marinette, and Manitowoc Counties, Wisconsin
- Lake County, Illinois
- Porter County, Indiana
- Erie and Lake Counties, Ohio
- Erie County, Pennsylvania
- Oswego and Jefferson Counties, New York
- Alger, Schoolcraft, Luce, Mackinac, Chippewa, Iosco, Presque Isle, Cheboygan, Emmet, Charlevoix, Leelanau, Benzie, Mason and Muskegon Counties, Michigan.

The final CH designation includes approximately 201 miles (325 km) of mainland and island shoreline for the Great Lakes breeding population in these 26 counties. Within the 35 critical habitat units, only the areas that contain the primary constituent elements of piping plover habitat, as described above, are designated as CH. See <https://www.fws.gov/species-publication-action/etwp-final-determination-critical-habitat-great-lakes-breeding> for more information about piping plover CH in Michigan.

Rufa Red Knot (Calidris canutus rufa)

The rufa red knot is a migratory shorebird that breeds in the Canadian Arctic and winters in parts of the United States, the Caribbean, and South America. Some red knots fly more than 9,300 miles from south to north every spring and repeat the trip in reverse every autumn, making this bird one of the longest-distance migrants in the animal kingdom. Major migration stopover areas occur along the Gulf coast and Atlantic coasts of North and South America. However, red knots have been regularly sighted in inland areas of the United States within the Atlantic and central flyways, including the coasts of the Great Lakes in Michigan.

The Service listed the rufa subspecies of red knot as threatened under the ESA on December 11, 2014. The reason for listing was due to loss of both breeding and nonbreeding habitat; likely effects related to disruption of natural predator cycles on the breeding grounds; reduced prey availability throughout the nonbreeding range; and increasing frequency and severity of asynchronies (mismatches) in the timing of the birds' annual migratory cycle relative to favorable food and weather conditions.

For additional information on the rufa red knot, including a recovery outline, please see the [species profile](#).

Federally Listed Freshwater Mussel in Michigan

The Michigan Freshwater Mussel Survey Protocols and Relocation Procedures (<https://www.fws.gov/media/michigan-freshwater-mussel-survey-protocols-and-relocation-procedures-rivers-and-streams>) provide project proponents with guidance to minimize impacts to mussel species that are currently identified as threatened or endangered by the USFWS. These protocols are designed to document the potential presence or absence of state or Federally listed mussel species as well as provide guidance for survey and relocation activities to minimize impacts to native mussels in Michigan.

As part of the Michigan Freshwater Mussel Survey Protocols and Relocation Procedures Michigan rivers and streams have been grouped according to existing knowledge of mussel distribution and individual species conservation status. The Mussel Protocol Stream Groups are designed to document the potential presence or absence of state or Federally listed mussel species. The layer was created by modeling the habitat suitability for each mussel species and may not correspond directly with a documented location for a listed mussel. A segment may be predicted as suitable for a number of mussel species, so the stream group number was assigned to the most restrictive of the potential mussel species present. The watersheds have associated mussel species data and can be queried to generate a species list. These stream groups determine the necessary level of coordination by project proponents with the USFWS as well as the appropriate survey protocol applicable to the project site. Below are the stream groupings, which are available via Michigan Natural Features Inventory Mussel Map Viewer (<https://mnfi.anr.msu.edu/resources/michigan-mussels>). The Mussel Map Viewer is an interactive tool to allow users to explore listed native mussels across the Michigan landscape. Watershed level species lists are available alongside the Mussel Protocol Stream Groups.

- Group 1: Stream and rivers known to support mussels considered to be special concern by the State, but lacking mussel occurrence data at the project site.
- Group 2: Streams and rivers known to support populations of State threatened and endangered mussels.
- Group 3a: Small and medium streams and rivers with a drainage area less than 300 mi² that support populations of Federally listed mussels.
- Group 3b: Large rivers (drainage area greater than 300 mi²) that support populations of Federally listed mussels.

Clubshell (Pleurobema clava)

The clubshell is a freshwater mussel that prefers clean, loose sand and gravel in medium to small rivers and streams. Clubshells will bury themselves in the bottom substrate to depths of up to four inches. Reproduction requires a stable, undisturbed habitat and a sufficient population of fish hosts to complete the mussel's larval development. The striped shiner (*Notropis chrysocephalus*), central stoneroller (*Campostoma anomalum*), blackside darter (*Percina maculata*), and logperch (*Percina caprodes*) have been capable of serving as hosts of the clubshell under laboratory conditions.

Clubshell was listed as endangered in 1993. The clubshell was once found from Michigan to Alabama, and from Illinois to West Virginia. Clubshell originally inhabited 100 streams across

this range; however, the current distribution is limited to 13 extant populations occurring in 21 streams. Of those 13 populations, only 7 show signs of successful reproduction. The distribution of clubshell is very limited in Michigan and only occurs in the East Branch of the West Fork of the St. Joseph River, Maumee drainage. Reasons for its decline in the upper Ohio and Wabasha watersheds have been principally due to pollution from agricultural runoff and industrial wastes, and extensive impoundments for navigation. These are thought to be also responsible for its decline elsewhere as well. An added threat now is the zebra mussel, a fast-spreading exotic species accidentally introduced in ballast water from the Caspian Sea area. These tiny mussels reproduce in enormous numbers which tend to cover and suffocate native mussels. In the St. Joseph watershed, water quality degradation as a result of land-based activities such as agriculture and development is a major threat. These types of activities result in excess sedimentation and pollutants that may affect clubshell survival, growth, and reproduction. It is likely that there are barriers within the watershed that also have altered habitat, hydrology, temperature, and sediment transport, limiting the range of clubshell as well as potentially directly affecting certain localized populations. Lastly, instream activities such as bridge and road construction also have the potential to impact localized populations of clubshell.

For additional information on the clubshell mussel, including a recent five-year status review, please see the [species profile](#).

Northern Riffleshell (Epioblasma torulosa rangiana)

This mussel is found in a wide variety of streams, including large streams and small rivers, where it buries itself in firmly packed sand or gravel in riffle areas. It is also found in Lake Erie. Like all freshwater mussels, northern riffleshell require a stable, undisturbed habitat and a sufficient population of host fish for reproduction. The mottled sculpin (*Cottus bairdi*), banded darter (*Etheostoma zonale*), bluebreast darter (*Etheostoma camurum*), and brown trout (*Salmo trutta*) are potential host species (Watters 1996).

Northern riffleshell was listed as endangered in 1993. Historically, the northern riffleshell was found in the Ohio river drainage in Illinois, Indiana, Kentucky, Ohio, Pennsylvania, and west Virginia, and into southeastern Michigan and southwestern Ontario. Of the 54 streams once known to be occupied by northern riffleshell, it is known to currently occur in 13 populations, 4 of which are stable and recruiting. Of the four recruiting populations, three are apparently large and occur in the Allegheny River, French Creek, and East Branch Sydenham River. A fourth, smaller population occurs, as of 2006, in the AuSable River. In Michigan the current status of northern riffleshell is unknown with only shells found during a 2007/2008 survey of the Detroit River and Lake St. Clair. It is possible that these populations are extirpated as a result of the introduction of nonnative zebra and quagga mussels (USFWS 2019). Numerous threats persist for the remaining northern riffleshell populations, including invasive species, the effects of small population sizes, habitat alteration, land-use changes, changing precipitation and temperature patterns, and point and non-point source pollution.

For additional information on the northern riffleshell mussel, including a recent five-year status review, please see the [species profile](#).

Rayed Bean (Villosa fabalis)

The rayed bean generally lives in smaller, headwater creeks, but it is sometimes found in large rivers and wave-washed areas of glacial lakes. It prefers gravel or sand substrates, and is often

found in and around roots of aquatic vegetation. Adults spend their entire lives partially or completely buried in substrate, filtering water through their gills to remove algae, bacteria, detritus, microscopic animals, and dissolved organic material for food. Juvenile mussels, called glochidia, use fish as hosts, allowing the species to move upstream and populate habitats it could not otherwise reach. At the time of listing, the Tippecanoe darter (*Etheostoma tippecanoe*) was the only reported known host fish for the rayed bean. Gibson et al. (2011) also verified the spotted darter (*Etheostoma maculatum*) as a suitable host fish (USFWS 2018a).

Rayed bean was listed as endangered in 2012. The rayed bean historically was found across a wide expanse that included parts of the Midwest and eastern United States, north to Ontario, Canada. Once found in at least 115 streams, canals, and lakes, the rayed bean now occurs in only 31 streams and one lake; a 73 percent reduction in the number of occupied streams and lakes. The species has been extirpated from Illinois, Kentucky, and Virginia but is still found in Indiana, Michigan, New York, Ohio, Pennsylvania, and Ontario, Canada. After extirpation from Tennessee and West Virginia, reintroductions have restored the rayed bean to these states. Major threats to rayed bean are modification and destruction of river and stream habitat, 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.

In addition, there are other emerging threats such as disease and climate change. Little is known about diseases in freshwater mussels (Grizzle and Brunner 2007, USFWS 2018a). However, mussel die-offs have been documented in streams within the range of rayed bean, some researchers believe that disease may be a factor contributing to the die-offs (USFWS 2018a).

For additional information on the rayed bean mussel, including a recent five-year status review, please see the [species profile](#).

Snuffbox (Epioblasma triquetra)

The snuffbox is usually found in small- to medium-sized creeks, inhabiting areas with a swift current, although it is also found in Lake Erie and some larger rivers. Adults often burrow deep in sand, gravel or cobble substrates, except when they are spawning or the females are attempting to attract host fish, including log perch. They are suspension feeders, typically feeding on algae, bacteria, detritus, microscopic animals, and dissolved organic material.

Snuffbox was listed as endangered in 2012. Snuffbox was historically known from 211 streams and lakes in 18 states and Canada (USFWS 2018b). The current distribution has been reduced to only 84 streams in 14 states (Alabama, Arkansas, Illinois, Indiana, Kentucky, Michigan, Minnesota, Missouri, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, Wisconsin) and Ontario, Canada (USFWS 2018b, USFWS unpubl. data 2020). Currently there are 7 stronghold populations, 24 significant populations, and 51 marginal populations of snuffbox. Two new element occurrences were detected in new streams in Michigan in 2019 and therefore have not been evaluated yet (USFWS unpubl. data 2020). Most populations are small and geographically isolated from one another, further increasing their risk of extinction.

Habitat loss and degradation continues to be one of the major threats to snuffbox (USFWS 2018b). Water quality degradation from point and non-point sources including agricultural runoff, municipal effluents, industrial sources, and spills continue to contribute sediment, organic compounds, heavy metals, pesticides, and a wide variety of newly emerging contaminants to the

aquatic environment. Other factors contributing to the reduction in range include dredging and channelization, oil and gas production (including water withdrawal), and sand and gravel mining, and development. Exotic species, including the zebra mussel, Asian clam, round goby, and black carp, threaten the snuffbox, or its host fish, or both, through mechanisms such as habitat modification, competition, and predation (USFWS 2018b).

For additional information on the snuffbox mussel, including a recent five-year status review, please see the [species profile](#).

Hine's Emerald Dragonfly (Somatochlora hineana)

The Hine's emerald dragonfly lives in calcareous (high in calcium carbonate) spring-fed marshes and sedge meadows overlaying dolomite bedrock. Adults males defend small breeding territories, pursuing and mating with females who enter. The female lays eggs by repeatedly plunging the tip of her body into shallow water. Later in the season or the following spring, immature dragonflies, called nymphs, hatch from the eggs. The nymph lives in the water for two to four years, eating smaller aquatic insects and shedding its skin many times. The nymph then crawls out of the water and sheds its skin a final time, emerging as a flying adult. The adults may live only four to five weeks.

The principal threat to the species is habitat destruction and alteration. Commercial and residential development, quarrying, landfills, roadways, construction of pipelines, and filling of wetlands could decrease the area of suitable habitat available to the species and fragment populations (USFWS 2001). Changes in surface and sub-surface hydrology could also be detrimental to this species. Alteration of hydrologic regimes could adversely affect the larval and breeding habitat of the species by changing water temperature, flow, chemistry, and volume. Municipal and private wells, addition of impervious surfaces, and alteration of surface drainage patterns could all cause reductions in the suitability of habitat or the outright loss of suitable larval and breeding habitat.

The Hine's emerald dragonfly was listed as endangered on January 26, 1995 (60 FR 5267). 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. Hine's emerald dragonfly was first discovered in Michigan at seven sites in 1997 (Steffens 1997). Known sites in the state are in both the Upper and Lower Peninsulas. Most are near the Straits of Mackinac, with the exception of the Menominee County site. The species is known from 20 sites in six counties in Michigan. Ten of these sites occur on the Hiawatha National Forest, and five sites are owned and managed by the Michigan Department of Natural Resources.

For additional information on the Hine's emerald dragonfly, including a recent five-year status review, please see the [species profile](#).

Critical habitat for the species was first designated on September 5, 2007 (72 FR 51101) and later revised on April 23, 2010 (75 FR 21393). A total of 37 units, encompassing approximately 26,531.8 acres (10,737 hectares) 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, were included in the designation. These are lands of wet meadows, groundwater seeps, and associated wetlands that lie over dolomite bedrock and provide breeding and foraging

habitat for the dragonfly. For more information on CH for Hine's emerald dragonfly in Michigan, see <https://www.fws.gov/species-publication-action/final-revised-critical-habitat-hines-emerald-dragonfly-somatochlora>.

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

Hungerford's crawling water beetles (HCWB) are found in the cool riffles of clean, slightly alkaline streams. All streams where this beetle has been found have moderate to fast water flow, good stream aeration, inorganic substrate, and alkaline water conditions. The highest densities of HCWB have been found below beaver dams or immediately below structures (e.g., culverts) that provide similar conditions.

Adults appear to be generalists in their food choice, feeding on algae including *Chara*, *Cladophora*, and *Dichotomosiphon*, as well as the epiphytic diatom *Cocconeis* (Grant and Vande Kopple 2009). The diet of adults may also change seasonally (Grant and Vande Kopple 2003). Larvae appear to prefer the alga *Dichotomosiphon tuberosus* (Grant and Vande Kopple 2009). *Dichotomosiphon*, although widespread, is not common. Its presence may be an important factor in determining the distribution of HCWB (Grant and Vande Kopple 2009).

At the time of listing in 1994, HCWB was known to occur in only three streams range wide. Currently, it is known to occur in 13 streams, with ten of these streams in northern Michigan and three in Ontario, Canada. It is unknown whether HCWB has a wider distribution or if the species' status is stable, increasing or decreasing. Species of *Brychius* tend to be highly localized and difficult to collect. Even when present, it is possible to sample an area and collect no specimens (Mousseau 2004; Grant et al. 2011). Additional surveys are necessary to determine the extent of HCWB's distribution. There is reason to believe HCWB may be more widely distributed than the streams where it has been previously documented. The types of streams inhabited by this species do not appear to be rare. In fact, streams similar to those in which the species is found appear to be common in northern Michigan and other surrounding states.

Hungerford's crawling water beetle was added to the List of Endangered and Threatened Wildlife and Plants on April 6, 1994 (59 FR 10580). The primary threat to the species is modification of its habitat. Actions that are potentially harmful include dredging, channelization, bank stabilization, and impoundment. Fish introductions or removals may also pose a threat to the species. The introduction of brown trout, for example, can result in increased predation of HCWB. Other management practices, such as the use of chemical treatments, may also be harmful to this rare beetle.

For additional information on the Hungerford's crawling water beetle, including a recovery plan and recent biological opinions, please see the [species profile](#).

Karner Blue Butterfly (*Lycaeides melissa samuelis*)

The Karner blue butterfly was historically associated with native barrens and savanna ecosystems, but is now found in remnant barrens, savannas, highway and utility rights-of-way, gaps within forest stands, young forest stands, trails, and military camps that occur on the landscapes previously occupied by native prairie and savannas. The larvae are dependent upon wild lupine (*Lupinus perennis*), the only known larval food source, while wild adults use a variety of wild flowers for nectar.

The Karner blue butterfly was Federally listed as an endangered species in 1992. The butterfly is most widespread in Wisconsin, but is also found in portions of Indiana, Michigan, Minnesota, New Hampshire, New York, and Ohio. It may also be present in Illinois. Habitat throughout the range of the Karner blue butterfly has been lost as a result of land development and lack of natural disturbance, primarily wildfire. Such disturbance helps maintain the butterfly's habitat by setting back encroaching forests and encouraging lupine and flowering plant growth. Additionally, the Karner blue butterfly's rarity and beauty make it a desirable addition to butterfly collections. Because butterfly numbers are so low, the collection of even a few individuals could harm the species' populations.

For additional information on the Karner blue butterfly, including a recent five-year status assessment, please see the [species profile](#).

Mitchell's Satyr (Neonympha mitchelli mitchelli)

In Michigan and Indiana, Mitchell's satyrs are found exclusively in prairie fens and open parts of rich tamarack swamps. These systems are a mosaic of open, shrubby, and forested communities, with peat soils and alkaline groundwater seeps. Thin-leaved sedges usually dominate the ground layer in the fens. Mitchell's satyr butterflies are rarely found in open fens without trees or tamarack swamps without openings.

The greatest threat to Mitchell's satyr is direct destruction and modification of its habitat. Prairie fens supporting Mitchell's satyr have disappeared or been altered for agricultural or urban development, which has led to species extirpation and further isolation of populations. Hydrological disruptions also constitute a serious threat, as groundwater diversion, pollution, warming of water sources, and other groundwater alterations lead to less-than-optimal habitat conditions. Offsite activities that affect groundwater flowing into prairie fens could inadvertently impact Mitchell's satyr. For example, a prairie fen's recharge source may be located near or far away from the fen, in a different watershed, county or state. As such, no matter the distance, altering the fen's groundwater source will affect the quality, quantity, or flow of groundwater into the fen (Abbas 2011). Groundwater alteration leads to, among other things, drying of the fen and/or facilitating encroachment of invasive species.

Invasive species, such as buckthorn, hybrid cattail, narrowleaf cattail, multiflora rose, purple loosestrife, reed canary grass, and others, represent additional threats and can be a significant management problem. Removal of these plants is required at many occupied sites to maintain suitable habitat conditions.

Satyr populations in the northern part of the range have decreased drastically; however, multiple new populations of what appears to be Mitchell's satyr continue to be discovered in the southeastern U.S. (Alabama, Mississippi, and Virginia). Ongoing genetics research will confirm and compare the taxonomy of the southern butterflies.

For additional information on the Mitchell's satyr, including the recovery plan, please see the [species profile](#).

Poweshiek Skipperling (Oarisma poweshiek)

The Poweshiek skipperling is an endemic tallgrass prairie butterfly species. Historically, this species occurred in Illinois, Indiana, Iowa, Michigan, Minnesota, North Dakota, South Dakota, Wisconsin, and Manitoba, Canada. However, the butterfly's range has contracted significantly in the last decade, and can now only be found only at a few sites in a single Michigan county, in

very limited numbers at one site in Wisconsin, and in Canada at the single Manitoba site. In Michigan, the skipperling occurs exclusively in prairie fens, specifically in peat domes within larger prairie fen complexes in a community typically composed of multiple, distinct zones of vegetation, some of which contain prairie grasses and forbs (Cuthrell and Slaughter 2012). In other locales (outside of Michigan), the species has or currently occurs in mesic prairies (Pogue et al. 2015; Selby 2016). Also within Michigan, Poweshiek skipperlings are rarely found a great distance from either prairie dropseed or mat muhly (Cuthrell and Slaughter 2012).

Poweshiek skipperling was listed as endangered in 2014. Habitat for this species been affected by altered hydrology, water pollution, sedimentation, invasive species, fire suppression, cattle grazing, and filling for development or dredging to create ponds or lakes (Kost and Hyde 2009). As a result, prairie fens are now very rare and those that remain require management to maintain appropriate habitat that supports native fen biota. Management of Poweshiek skipperling habitat is needed to maintain the basic high-quality native prairie conditions on which the species depends. Management is needed to prevent secondary succession to woody habitat types; to control invasive species; and, to ensure sufficient abundance and diversity of nectar plants. Control of invasive plants species is required to maintain important qualities of habitat, but care must be taken to ensure that treatments do not have adverse effects.

For additional information on the Poweshiek skipperling, including a recent five-year status assessment, check out the [species profile](#).

CH for the Poweshiek skipperling was designated on October 1, 2015. CH comprises approximately 25,900 acres in 56 units in Iowa, Michigan, Minnesota, North Dakota, South Dakota and Wisconsin. See <https://fws.gov/species/poweshiek-skipperling-oarisma-poweshiek> for more information about CH for the Poweshiek skipperling in MI.

Monarch butterfly (Danaus plexippus)

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 of the wings. Adult monarchs are sexually dimorphic, with males having narrower wing venation and scent patches. The bright coloring of a monarch serves as a warning to predators that eating them can be toxic.

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 chemicals (cardenolides) as a defense against predators. The larva then pupates into a chrysalis before emerging 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.

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. 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.

For additional information on the monarch, check out the [species profile](#).

Canada Lynx (Lynx canadensis)

Canada lynx and snowshoe hares are strongly associated with moist, cool, boreal spruce-fir forests. Landscapes with high snowshoe hare densities are optimal for lynx survival and reproduction, and research suggests that hare densities consistently at or above 0.5 hares per hectare (0.2 hares/acre) are needed to support persistent lynx populations. Hares are most abundant in young regenerating or mature multistoried forests with dense understory vegetation that provides food and cover. In the northern contiguous U.S., boreal forests become naturally patchy and marginal for lynx as they transition to temperate forest types that support lower hare densities. Such forests cannot support lynx populations, even though snowshoe hares may still be present. Snow also influences lynx distribution, and populations typically occur where continuous snow cover lasts four months or longer. Such areas are believed to provide lynx with a seasonal competitive advantage over other terrestrial hare predators like bobcats and coyotes.

Lynx are broadly distributed across most of Canada and Alaska, which combined encompass about 98% of the species breeding range. The contiguous U.S. distinct population segment (DPS) accounts for the other two percent, and includes resident breeding populations in northern Maine, northeastern Minnesota, northwestern Montana/northern Idaho, and north-central Washington. An introduced population also occurs in western Colorado, and several other areas may have historically supported small resident populations (e.g., northern New Hampshire, Isle Royale, Michigan, northeastern Washington, and the Greater Yellowstone area of southwestern Montana and northwestern Wyoming). Lynx also have occurred temporarily in many other states, typically during irruptions (mass dispersal events) from Canada, when northern hare populations underwent dramatic cyclic declines roughly every 10 years. The Contiguous U.S. DPS of lynx was listed as threatened in 2000 because regulations on some Federal lands at that time were inadequate to ensure the conservation of lynx populations and habitats.

Currently, the best available information, including historic records and recent surveys, indicates that Canada lynx, if present in Michigan, are likely limited to a small number of dispersing individuals in the Upper Peninsula. There is no indication of recent or current lynx breeding within the state. Verified sightings of lynx in Michigan are infrequent and dispersed. In 2003, a lynx was incidentally captured in a bobcat trap on the Hiawatha National Forest, and in 2010 a lynx was observed on Sugar Island near Sault Ste. Marie. Most recently, a Canada lynx was trapped in the Lower Peninsula in early 2019, and was subsequently released in Schoolcraft County. Detection of a very low number of dispersing individuals may be difficult, however project assessment for potential effects to lynx in the Upper Peninsula may be prudent.

For additional information on the Canada lynx, please see the [species profile](#).

Gray Wolf (Canis lupus)

Gray wolves are highly social animals that live in groups, called packs, which typically include a breeding pair, their offspring, and other non-breeding adults. Wolves are capable of mating by age one or two and sometimes form a lifelong bond. On average, four to five pups are born in early spring and are cared for by the entire pack. For the first six weeks, pups are reared in dens. Dens are often used year after year, but wolves may also dig new ones or use some other type of

shelter, such as a cave. After a year or two, young wolves often leave their packs to try to find a mate and form a pack or join other existing packs. Wolf packs occupy and defend territories, which range in size from less than 50 square miles to more than 1,000 square miles, depending on habitat and seasonal movements of available prey. Wolves travel over large areas to hunt, as far as 30 miles in a day. Although they usually trot along at five miles per hour, wolves can run as fast as 40 miles per hour for short distances.

Wolves occur throughout Michigan's Upper Peninsula, and efforts to reintroduce a population of 20-30 wolves to Isle Royale were initiated in 2018. On November 3, 2020, the Service issued a final rule (effective January 4, 2021) removing from the List of Endangered and Threatened Wildlife the gray wolf entities in the lower 48 United States and Mexico, except for the Mexican wolf (*C. l. baileyi*), that will remain listed (85 FR 69778). On February 10, 2022, a district court vacated and remanded the delisting rule, resulting in return to the List of Endangered and Threatened Wildlife.

For additional information on the gray wolf, please see the [species profile](#).

Indiana Bat (Myotis sodalis)

Indiana bats may summer in a wide range of habitats, from highly altered landscapes to intact forests. Roost trees vary considerably in size. Although trees used by Indiana bat maternity colonies are typically greater than 9 inches diameter at breast height (dbh), those used by males and non-reproductive females or as alternate roosts for maternity colonies may be as small as 5 inches dbh. Indiana bats typically roost beneath peeling bark but may also use cracks or crevices. As such, roost trees tend to be dead or dying trees with some bark remaining, or live trees with naturally exfoliating bark, such as shagbark hickory (*Carya ovata*); see Appendix III for more information. Rarely do Indiana bats roost in structures, such as barns, sheds, or bridges. During winter, the species hibernates in caves, abandoned mine portals or similar structures.

The Indiana bat was listed as endangered in 1967 due to episodes of people disturbing hibernating bats in caves during winter, which resulted in the death of substantial numbers of bats. Indiana bats are vulnerable to disturbance because they hibernate in large numbers in only a few sites, with major hibernacula supporting 20,000 to 50,000 bats. Since its listing, the range-wide Indiana bat population has declined by nearly 60%. Several threats are believed to have contributed to the Indiana bat's decline, including the commercialization of caves, loss and degradation of forested habitat, pesticides and other contaminants, and most recently, the disease white-nose syndrome.

Indiana bats have been documented at many sites in Lower Michigan and are believed to range throughout the southern five county tiers, as well as parts of the thumb and the western coastal counties up to (and including) the Leelanau peninsula. Indiana bats that summer in Michigan roost in trees in riparian, bottomland, and upland forests from approximately April through September. Michigan is home to a single known Indiana bat hibernaculum: a hydroelectric dam in Manistee County. Although the dam supports about 20,000 hibernating bats, Indiana bats comprise less than 1% of the winter population. Research suggests that the majority of the Indiana bats that summer in Michigan migrate to hibernacula in nearby states, including Indiana and Kentucky. See the Appendices for more information on suitable Indiana bat habitat in Michigan.

For additional information on the Indiana bat, including a recent five-year status review, please see out the [species profile](#).

Northern Long-eared Bat (Myotis septentrionalis)

Northern long-eared bats spend winter hibernating in caves, mines, or similar structures, preferring areas with constant temperatures, high humidity, and no air currents. During the summer, the species typically roosts underneath bark or in cavities, crevices, or hollows of both live and dead trees and/or snags (typically ≥ 3 inches dbh; see Appendix IV). On occasion, northern long-eared bats will roost in manmade structures, such as barns and sheds. These bats forage for insects in upland and lowland woodlots and tree-lined corridors.

The northern long-eared bat is one of the species most impacted by white-nose syndrome. Due to declines caused by white-nose syndrome and continued spread of the disease, the northern long-eared bat was listed as threatened under the ESA on April 2, 2015. The Service also developed a final 4(d) rule, which published in the Federal Register on January 14, 2016. The 4(d) rule specifically defines the take prohibitions for the species.

On March 23, 2022, the Service published a proposal to reclassify the northern long-eared bat as endangered under the Endangered Species Act. Following a court order by the U.S. District Court for the District of Columbia, the Service must complete a new final listing determination for the NLEB by November 2022 (Case 1:15-cv-00477, March 1, 2021). The proposed reclassification, if finalized, would remove the current 4(d) rule for the northern long-eared bat, as these rules may be applied only to threatened species.

The northern long-eared bat has been documented in many Michigan counties and is believed to range throughout the entire state. The species is present in the state year-round, migrating between summer and winter habitat during the spring and fall. Many northern long-eared bat hibernacula have been documented in Michigan, most of which are abandoned mines located in the western Upper Peninsula. See the Appendices for more information on suitable northern long-eared bat habitat in Michigan.

For additional information on the northern long-eared bat, please see the [species profile](#).

Copperbelly Water Snake (Nerodia erythrogaster neglecta)

Copperbelly water snakes require a mosaic of shallow wetlands or floodplain wetlands surrounded by forested uplands. Seasonally flooded wetlands without fish are favored foraging areas, and copperbellies frequently move from one wetland to another. The species feeds primarily on amphibians, mostly frogs and tadpoles, and requires shallow wetlands along the edges of larger wetlands complexes where they can hunt for frogs, as well as multiple wetland types and adjacent uplands. Copperbellies hibernate, often in crayfish burrows, in forested wetlands and immediately adjacent forested uplands. They remain underground from late October until late April.

The copperbelly water snake is found in two geographically separated areas. The northern distinct population segment (DPS) includes southern Michigan, northeastern Indiana and northwestern Ohio. This DPS was listed as threatened under the ESA in 1997. The southern DPS is not Federally listed. Over the last 20 years, surveys have shown a continuing decline in the overall number of snakes in the northern DPS. At present, only five small sub-populations persist within the tri-state area, including Hillsdale County in Michigan. Threats to copperbelly

watersnake include habitat fragmentation and loss, predation, persecution, and emerging stressors such as climate change and disease.

For additional information on the copperbelly watersnake, including a recent five-year status assessment, please see the [species profile](#).

Eastern Massasauga Rattlesnake (Sistrurus catenatus)

The Eastern massasauga rattlesnake (EMR)'s habitat is typically associated with open to forested wetlands and adjacent uplands. During colder months (generally October through April), EMR hibernate below the frostline in crayfish or small mammal burrows, tree root networks or rock crevices in areas where the water table is near the surface (areas where the soil is saturated but not inundated) and with consistent hydrology to support overwinter survival. Hibernacula are typically near wetland edges, or slightly upland (typically within 500 meters of regulated wetland). EMR stay in the area around their hibernacula until overnight temperatures warm up enough for them to move to their active season range.

The Service listed the EMR as a threatened species under the ESA on September 30, 2016. Once common across its range, the EMR has declined dramatically since the mid-1970s as a result of habitat loss and fragmentation, a lack of proper habitat management, and eradication by humans. The most prominent threats include habitat loss and fragmentation through development and vegetative succession, mortality of individuals as a result of roads, hydrologic alteration resulting in drought or flooding, persecution, collection, and post-emergent prescribed fire, mowing, and disking. Disease is a relatively recent threat with still unknown consequences. The effects of threats on extinction risk to EMR populations were included in model evaluations (Faust *et al.* 2011), while the Species Status Assessment (Szymanski *et al.* 2016) considered the total number of sites range wide where specific threats were reported.

Michigan currently supports more EMR populations than any other state or province, although the species has declined within the state. The range within Michigan includes most of the Lower Peninsula and Bois Blanc Island in Mackinac County (Lake Huron). The EMR is highly secretive and cryptic in nature, and can persist in low densities, which makes them difficult to detect. Further, there are extensive areas of the state that have never been surveyed for EMR. To assist project proponents in determining the likelihood of EMR presence in their project areas, the Service has identified occupied and likely occupied habitat using a tiered system in Michigan. Tiered habitat is based on the proximity to a known element occurrence and the suitability of the habitat according to available spatial data and population modeling. Tier 1 habitat are those areas known to be occupied or highly likely to be occupied by EMR. Tier 2 habitat includes areas with high potential habitat (and may be occupied by EMR). Projects can also be "within the known range" of EMR. Areas within the known range but outside of Tier 1 and Tier 2 are considered less likely to be occupied. However, it is likely that there are additional and yet-unknown occurrences throughout the Lower Peninsula of Michigan.

For additional information on the eastern massasauga, including a recent Species Status Assessment and draft recovery plan, please see the [species profile](#).

American Hart's-Tongue Fern (Asplenium scolopendrium var. americana)

American hart's-tongue fern is found in close association with outcrops of dolomitic limestone, in coulees, gorges and in cool limestone sinkholes in mature hardwood forests. It requires high

humidity and deep shade provided by mature forest canopies or overhanging rock cliffs. It prefers soils high in magnesium.

Although American hart's-tongue is found over a very wide area, from Alabama to Canada, its populations tend to be very small and isolated due to its unique habitat. Because of its natural rarity, it is particularly vulnerable to disturbance. Many activities threaten the American hart's-tongue. Quarrying, recreation, and residential development have all destroyed these plants and their habitat. Canadian populations are threatened by lumbering and the development of land for ski resorts and country estates, among other activities. By removing shade trees, logging raises light levels and lowers humidity, decimating any American hart's-tongue ferns in that area. The Service officially listed American hart's-tongue on July 14, 1989.

In Michigan, all known American hart's-tongue populations occur on prominent highlands of the Niagara escarpment in the eastern Upper Peninsula, typically in relatively young forest dominated by sugar maple. It is commonly found in association with northern holly fern (*Polystichum lonchitis*), common polypody (*P. virginianum*), maidenhair spleetwort (*Asplenium trichomanes*), fragile fern (*Cystopteris fragilis*), and herb-robert (*Geranium robertianum*).

For additional information on the Hart's-tongue fern, including a recent Species Status Assessment, please see the [species profile](#).

Dwarf Lake Iris (Iris lacustris)

Occurring close to Great Lakes shorelines in cool, moist lakeshore air, dwarf lake iris is found on sand or in thin soil over limestone-rich gravel or bedrock. Habitat is along old beach ridges or behind open dunes. Changing water levels can open new habitat for the plants.

Dwarf lake iris was added to the U.S. List of Endangered and Threatened Wildlife and Plants in 1988. Dwarf lake iris only grows around the Great Lakes and occurs near the northern shores of Lakes Huron and Michigan in Michigan, Wisconsin, and Ontario, Canada. The lakeshore habitat of dwarf lake iris has been greatly reduced by shoreline development. Residential and vacation homes as well as associated road-widening, chemical spraying and salting, and off-road vehicle use have caused disturbance and destruction of habitat.

For additional information on the dwarf lake iris, including a recovery plan, please see the [species profile](#).

Eastern Prairie Fringed Orchid (Platanthera leucophaea)

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. It requires full sun for optimum growth and flowering and a grassy habitat with little or no woody encroachment. 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. This orchid is a perennial herb that grows from an underground tuber. Flowering begins from late June to early July, and lasts for 7 to 10 days. Blossoms often rise just above the height of the surrounding grasses and sedges. The more exposed flower clusters are more likely to be visited by the hawkmoth pollinators, though they are also at greater risk of being eaten by deer. Seed capsules mature over the growing season and are dispersed by the wind from late August through September.

Historically, eastern prairie fringed orchid was found in more than 20 Michigan counties, including the southern Lower Peninsula and Cheboygan County. Following extensive habitat loss, it now persists in fewer than 10 counties and is largely limited to the remnant lakeplain prairies of Saginaw Bay and western Lake Erie. Since the 1980s, inventories have demonstrated a continued decline of the orchid within known habitats, likely as a result of high lake levels and drought.

The eastern prairie fringed orchid was listed as threatened on September 28, 1989. Early decline was attributed to loss of habitat, mainly conversion of natural habitats to cropland and pasture. Habitat loss, including from the drainage and development of wetlands, is a continued threat to the species. Other current threats include succession to woody vegetation, competition from non-native species, and over-collection.

For additional information on the eastern prairie fringed orchid, please see the [species profile](#).

Houghton's Goldenrod (Solidago houghtonii)

Houghton's goldenrod typically grows on moist sandy beaches and shallow depressions between low sand ridges along the shoreline, called interdunal wetlands. Fluctuating water levels of the Great Lakes play a role in maintaining this unique goldenrod. During high water years, colonies of Houghton's goldenrod may be submerged. When water levels recede, some plants survive the inundation and new seedlings establish on the moist sand. Other plants that often grow with Houghton's goldenrod include Grass-of-Parnassus, Kalm's lobelia, shrubby cinquefoil, twigrush, and other goldenrods.

Houghton's goldenrod occurs almost exclusively on Great Lakes shoreline, growing primarily along the northern shores of Lakes Michigan and Huron in the Straits region. Most populations occur in Chippewa, western Mackinac, northern Emmet, Cheboygan, and northern Presque Isle counties. There are also interior populations in Mackinac County (a few miles from the Great Lakes shoreline). Interior populations in Kalkaska and Crawford Counties have been determined to be another species, *S. vossii* (Laureto and Pringle 2010).

Houghton's goldenrod was listed as threatened on July 18, 1988 (53 FR 27134). High lake levels are a potential threat to some population that occur along Great Lakes shorelines, particularly in recent years. Residential development continues to be a threat, especially along the shores of Lake Huron in Cheboygan and Presque Isle Counties, Michigan. Invasive species, including *Phragmites australis* (common reed) and *Typha spp.* (cattails) threaten some populations (Leopold and Weber 2019).

For additional information on Houghton's goldenrod, including a recent five-year status review, please see the [species profile](#).

Lakeside Daisy (Hymenoxys herbacea)

Lakeside daisy is a long-lived perennial daisy that grows on alvars, a type of limestone with little plant cover, in full sunlight. All individuals within a given population tend to bloom about the same time, typically in late spring. After about a week, the double notched petals fade before falling. Seed dispersal takes place about a month later. Lakeside daisy also reproduces vegetatively by rhizomatous growth.

Lakeside daisy is an endemic restricted to the Great Lakes area, within which it is one of the region's rarest plants, naturally occurring at only a handful of sites. In the U.S., it is known only

from the Marblehead Peninsula area in northern Ohio, three restored populations in northern Illinois (where it was known historically from two sites), and a single, extremely small colony in Michigan's Upper Peninsula. In Ontario, Canada, where lakeside daisy is most abundant, it occurs along much of the southern coast of Manitoulin Island and in several restricted areas near the tip of the Bruce Peninsula.

The lakeside daisy was listed as threatened on June 23, 1988. The wide area encompassing known lakeside daisy sites suggests that the species was once widespread in prairie habitats throughout the Midwest and along Huron's northern shore. Fire suppression practices have eliminated the wildfires which once regularly cleared prairie grasslands of the encroaching woods. Now the expansion of shrubs and trees threatens the daisy, which needs full sun to survive. Limestone quarrying, which has increased in recent years, destroys the daisy's habitat. Finally, collectors may also pose a threat, since the daisy is now found in just a handful of sites.

For additional information on lakeside daisy, please see the [species profile](#).

Michigan Monkey-Flower (Mimulus michiganensis)

The Michigan monkey-flower (MMF) is a rare Michigan endemic plant with a range restricted to Great Lakes shorelines in the Mackinac Straits and Grand Traverse regions. It is semi-aquatic and forms mats over mucky soil and sand saturated or covered by cold, flowing spring water.

The MMF was listed as endangered on June 21, 1990 (55 FR 25596-25599). The greatest threat to MMF is direct destruction and modification of its habitat. The MMF's habitat has been developed for recreational and residential purposes, which has led to severe impacts to and, in some cases, extirpation of historical populations. Hydrological disruptions also constitute a serious threat, as water diversion, warming of water sources, and other groundwater alterations lead to less-than-optimal habitat conditions.

Consequently, this species may be inadvertently impacted by offsite activities. Populations of MMF are particularly vulnerable to extirpation due to low numbers and limited capability for sexual reproduction. Additionally, periodic high-water levels of the Great Lakes and strong winter storms impact MMF habitat that occurs near the Great Lakes shoreline by redirecting seepage streams and opening the overstory by felling cedars. However, opening of the overstory may also benefit MMF by allowing for colonization.

Invasive species, including forget-me-not (*Myosotis scorpioides*), coltsfoot (*Tussilago farfara*), reed canary grass (*Phalaris arundinacea*), and Canada thistle (*Cirsium arvense*) represent an additional threat. Some of the MMF colonies at the Maple River site are in pockets of habitat with up to 99% invasive species (Canada thistle and forget-me-not), with only scattered MMF stems remaining. Coltsfoot and reed canary grass are known to occur at or in the vicinity of other MMF sites.

For additional information on the MMF, including a recent five-year status review, please see out the [species profile](#).

Pitcher's Thistle (Cirsium pitcheri)

Pitcher's thistle is a native thistle occurring on the open sand dunes and low open beach ridges of Great Lakes shoreline. It is most often found in near-shore plant communities but it can grow in all non-forested areas of a dune system. It is now found in Indiana, Michigan, Wisconsin, and

Ontario, Canada. Pitcher's thistle was extirpated from Illinois but has been reintroduced in Lake County.

Pitcher's thistle was added to the List of Endangered and Threatened Wildlife and Plants on July 18, 1988 (53 FR 27137). The primary threats are invasive plants and recreational use of the dunes, but there is continued concern regarding the potential impact of seed-eating weevils. Surveys have been done in portions of the range, indicating increased abundance and potential stability in parts of the range (i.e., Upper Peninsula of Michigan) and decreased abundance or even extirpation of previously known populations in other parts of the range (i.e., southern Michigan).

Survey work by Michigan Natural Features Inventory in 2012-2016 has shown that the Pitcher's thistle population in Michigan may be larger than previously believed and could exceed 1,000,000 individuals (Slaughter and Cuthrell 2017). Conversely, research on the invasive weevil species (*Larinus planus* and *Rhinocyllus conicus*) in recent years has shown cause for concern, with demonstrated declines in population growth rates that could lead to localized extinctions of some populations (Havens et al. 2012a). More information is needed in order to assess the magnitude and extent of this threat.

For additional information on Pitcher's thistle, including a recent five-year status review, please see the [species profile](#).

Specific Conservation Measures

In addition to the general exclusions, this section details species- or taxon-specific exclusions and/or conservation measures that must be met in order to use this standing analysis and receive a conclusion from IPaC through the DKey. To ensure compliance with the ESA, project-specific consultation (or other programmatic consultation, if applicable) with the Service may be necessary for projects that cannot make a "no effect" determination for any listed species that may occur in the project area and cannot apply the following conservation measures. Such projects would not necessarily result in significant adverse effects to Federally listed species or their habitats.

Whooping Crane

Projects that intersect the whooping crane NEP AOI must not occur within a National Wildlife Refuge or National Park. For Federal projects for which the action agency cannot conclude "no effect" to whooping crane within NWRs or NPs, agencies must consult with the Service outside of the determination key. Outside of NWRs or NPs, agencies must confirm that their project is not likely to jeopardize the continued existence of whooping crane. If they cannot confirm no jeopardy, they must conference to complete their section 7 requirement outside of the determination key.

Piping Plover and Piping Plover Critical Habitat

Projects that intersect the piping plover AOI, occur within ¼ mile onshore and ¼ mile offshore of Great Lakes shoreline, and contain suitable piping plover habitat; or intersect piping plover critical habitat containing the primary constituent elements, must not result in:

1. Any changes to the quality, quantity, or availability² of suitable piping plover habitat³ during the breeding season (April 15 through August 15) or to CH at any time of year
2. Any permanent changes to suitable piping plover habitat⁴ or CH
3. Increased activity⁵ within suitable piping plover habitat or CH

If the project does not occur in suitable habitat along the Great Lakes shoreline, or if the critical habitat doesn't contain the physical and biological features essential to the conservation of piping plover (for details, refer to 66 FR 22938), piping plovers are not likely to be present in the action area. As such, adverse effects are discountable. Projects that increase human disturbance or potential for predation need further evaluation and do not qualify for the Dkey.

Rufa Red Knot

Projects that intersect the rufa red knot AOI and occur within 0.25 mi of a Great Lakes shoreline or inland wetland buffer must not:

1. Permanently modify beaches, dunes, mudflats, peat banks, sandbars, shoals, or other red knot habitats⁶ during the red knot migration windows (May 15 through June 15 in the spring OR July 1 through September 30 in the fall)
2. Result in increased human disturbance or predation⁷ during the red knot migration windows (May 15 through June 15 in the spring OR July 1 through September 30 in the fall)

During migration, habitat loss, disturbance and increased predation could result in adverse effects and warrant additional evaluation separate from the DKey. If these actions occur outside of the migration window, adverse effects are discountable.

Freshwater Mussels

Projects that intersect the AOI for rayed bean, northern riffleshell, snuffbox, or clubshell mussels must have no permanent effects on local hydrology. If any portion of the project area intersects a Group 3 stream or the 0.5-mi area upstream of a Group 3 stream, the project must not:

²For example, beach grooming, boardwalk actions, breakwaters, development, dredge deposition, etc.

³Piping plover habitat consists of Great Lakes islands and mainland shorelines that support, or have the potential to support, open, sparsely vegetated sandy habitats, such as sand spits or sand beaches that are associated with wide, non-forested systems of dunes and inter-dune wetlands.

⁴In this context, we define permanent to be effects lasting in duration more than 3 weeks

⁵For example, human disturbance, dog activity, or an increase in potential predators such as merlins, or mammalian predators.

⁶For example, the following actions may modify red knot habitat: groins, jetties, sea walls, revetments, bulkheads, rip-rap, beach nourishment, nearshore dredging, dredge spoil disposal, sand mining/borrowing, beach bulldozing, sandbagging, sand fencing, vegetation planting/alteration/removal, deliberate or possible introduction of non-native vegetation, beach raking/mechanized grooming, boardwalks, aquaculture development.

⁷For example, the action is likely to indirectly increase access or use of red knot habitats by humans and/or predators at times of year that the birds are typically present (e.g., commercial/residential development, beach access structures, boardwalks, pavilions, bridges/roads/ferries/trails, marinas, posts or other avian predator perches, structures or habitat features likely to encourage predator nesting/denning, trash cans or other predator attractants, feral cat colonies, policy changes likely to increase human use).

1. Have any direct impacts to a stream or river (e.g., stream/road crossings, new stormwater outfall discharge, dams, other in-stream work, etc.)
2. Have potential to indirectly impact the stream/river or the riparian zone (e.g., cut and fill, horizontal directional drilling, construction, vegetation removal, discharge, etc.)

The AOI for mussels is currently a county-based list. The Group 3 is a more specific list of stream segments within known counties that contain habitat likely to be occupied by listed mussels (see <https://www.fws.gov/media/michigan-freshwater-mussel-survey-protocols-and-relocation-procedures-rivers-and-streams> for additional information). Avoiding direct or indirect impacts to the stream, including changes to hydrology, will ensure adverse effects are insignificant and/or discountable.

In addition, some Michigan EGLE/Army Corps of Engineer joint permit application Minor Permit (MP) and General Permit (GP) categories (https://www.michigan.gov/documents/deq/wrd-general-permit-categories_555828_7.pdf) have been evaluated and determined to have discountable effects to listed mussels, including:

- MP 3 - Boat Hoist;
- MP 5 - Boat Wells;
- MP 7 - Completed Enforcement Actions;
- MP 13 - Dock;
- MP 22 - Fish and Wildlife Habitat Structures;
- MP 25 - Ford Stream Crossings for Commercial Forestry Operations;
- MP 31 - Maintenance and Repair of Serviceable Structures;
- MP 52 - Temporary Recreational Structures;
- MP 54 - Wetland Habitat Restoration and Enhancement;
- GP A - Aids to Navigation;
- GP C - Clear Span Bridge;
- GP G - Culverts - Small;
- GP J - Dry Fire Hydrant;
- GP O - Minor Permit Revisions and Transfers;
- GP Q - Mooring Buoy;
- GP V - Scientific Measuring Devices;
- GP W - Snow Road Stream Crossings for Forestry Operations;
- GP Y - Spring Piles and Piling Clusters

Group 2 Streams are those that are likely to have state listed mussels. Note that if the project intersects a Group 2 stream, the output letter will include language notifying the applicant that state-listed mussels may occur in the area, and to contact the Michigan Department of Natural Resources to determine effects to state-listed mussels.

Hine's Emerald Dragonfly and Hine's Emerald Dragonfly CH

Projects that intersect the Hine's emerald dragonfly AOI or CH must not:

1. Disturb the ground or existing vegetation within 500 meters of a calcareous wetland, fen, sedge meadow, or marsh⁸
2. Affect local hydrology (permanently or temporarily)
3. Include construction or modification of a road or trail within occupied or CH buffered habitat

The main threats to Hine's emerald dragonfly are habitat destruction, urban sprawl, off-road vehicles, road and pipeline construction – all of which result in ground disturbance. Avoiding ground disturbance will preclude direct effects to Hine's emerald dragonfly. Avoiding alterations to hydrology will preclude indirect effects.

Hungerford's Crawling Water Beetle

Projects that intersect the HCWB AOI must not:

1. Involve any road or stream actions (e.g., bridge or culvert actions) or in-stream disturbance within or adjacent to (i.e., within 100m of) a stream or river including loss of riparian vegetation
2. Affect local hydrology (permanently or temporarily)

Avoiding direct and indirect impacts to streams will avoid impacts to suitable HCWB habitat. Projects that involve work within or adjacent to streams within the HCWB's AOI do not qualify for this key.

Karner Blue Butterfly

Projects that intersect the KBB AOI must avoid the following within suitable habitat⁹:

1. Disturbance to any areas containing wild lupine
2. Chemical use
3. Any activities that may result in habitat loss

Avoiding areas containing wild lupine (the host plant for KBB) will ensure disturbance will have no adverse effects to KBB. Additional consultation (outside of the Dkey) is needed if loss of habitat will occur to ensure effects are insignificant or discountable.

Mitchell's Satyr

Projects that intersect the Mitchell's satyr AOI must not:

1. Include alteration or fill of more than 3 acres of wetland
2. Affect local hydrology (permanently or temporarily)
3. Disturb the ground or existing vegetation within 0.5 miles of a Mitchell's satyr occurrence in suitable habitat (prairie fen, shrub carr, tamarack swamp, tamarack savanna, wet meadow, or wet prairie habitat)

Projects must avoid disturbing the ground or existing vegetation, which includes any off road vehicle access, soil compaction, digging, seismic survey, directional drilling, heavy equipment,

⁸This includes any off road vehicle access, soil compaction, digging, seismic survey, directional drilling, heavy equipment, grading, trenching, placement of fill, pesticide application, vegetation management (including removal or maintenance using equipment or chemicals), cultivation, development, etc.

⁹This includes a variety of habitats containing wild lupine, including oak savanna, oak or pine barrens, openings within oak forest (including rights-of-way), or old fields in association with oak forest.

grading, trenching, placement of fill, pesticide application, vegetation management (including removal or maintenance using equipment or chemicals), cultivation, development, etc. Avoiding ground disturbance (defined to include use of chemicals) in suitable habitat will ensure direct effects are discountable. Avoiding changes to hydrology will avoid indirect effects to Mitchell's satyr within an occupied watershed.

Poweshiek Skipperling and Poweshiek Skipperling Critical Habitat

Projects that intersect the Poweshiek skipperling AOI or CH must not:

1. Include alteration or fill of more than 3 acres of wetland
2. Affect local hydrology (permanently or temporarily)
3. Disturb the ground or existing vegetation within 0.5 miles of a population that has been extant within the last 5 years in suitable habitat (prairie fen, sedge meadow, or tall grass prairie habitat)

Projects must avoid disturbing the ground or existing vegetation, which includes any off road vehicle access, soil compaction, digging, seismic survey, directional drilling, heavy equipment, grading, trenching, placement of fill, pesticide application, vegetation management (including removal or maintenance using equipment or chemicals), cultivation, development, etc. Avoiding ground disturbance (defined to include use of chemicals) in suitable habitat will ensure direct effects are discountable. Avoiding changes to hydrology will avoid indirect effects to Poweshiek skipperling within an occupied watershed.

Canada Lynx

Projects that intersect the Canada lynx AOI must not include any actions that would harm the species directly (e.g., mammal trapping, poison bait, etc.).

Gray Wolf

Projects that intersect the gray wolf AOI must not:

1. Overlap with a known gray wolf denning or rendezvous area (users are directed to contact the lead gray wolf biologist with the Michigan Department of Natural Resources for assistance in determining whether their project area may overlap known denning or rendezvous areas)
2. Have any potential for the action to harm wolves directly (e.g., mammal trapping, poison bait), or indirectly (e.g., increasing vehicle use that may result in vehicle strikes, exposure to potential human persecution)

Indiana Bat

Projects that intersect the Indiana bat AOI must not:

1. Contain any known or potential hibernacula (including natural caves, abandoned mines, or underground quarries) within the project area
2. Remove/modify a human structure (barn, house or other building) known to contain roosting Indiana bats

Additionally, projects that contain known or potential Indiana bat habitat¹⁰ and include tree cutting/trimming, prescribed fire, and/or pesticide (including insecticide and rodenticide) application must not:

1. Clear >10 acres of modeled summer habitat (see Appendix I, II)
2. Clear $\geq$ 20 acres of forest or fragment a connective corridor between 2 or more forest patches of at least 5 acres (see Appendix II)
3. Cut or trim any potential Indiana bat roost trees (trees $\geq$ 5 inches in diameter [at breast height] with cracks, crevices and/or exfoliating bark; see Appendix III), conduct prescribed burning, or apply pesticides (including insecticides and rodenticides) during the following location-specific periods:
 - a. Within 5 miles of a known hibernaculum (Tippy Dam): April 1 through October 31 (i.e., activities limited to November 1 through March 31).
 - b. In modeled summer habitat and >5 mi from Tippy Dam: April 1 through September 30 (i.e., activities limited to October 1 through April 14)
 - c. Outside modeled summer habitat and >5 miles from Tippy Dam: June 1 through July 31 (i.e., activities limited to August 1 through May 31)

Projects that contain known or potential Indiana bat habitat and include herbicide application must follow all label instructions and limit application to targeted methods such as spot-spraying, hack-and-squirt, basal bark, injections, cut-stump, or foliar spraying on individual plants.

Projects that include removal/modification of an existing bridge or culvert suitable for day-roosting Indiana bats¹¹ must not:

1. Result in the permanent loss of known or potential roosting spaces
 - a. Perform construction activities during the active season of April 15 through September 30 (i.e., construction activities limited to October 1 through April 14)

¹⁰Suitable summer habitat for Indiana bats consists of a wide variety of forested/wooded habitats where they roost, forage, and travel and may also include some adjacent and interspersed non-forested habitats, such as emergent wetlands and adjacent edges of agricultural fields, old fields and pastures. This includes forests and woodlots containing potential roosts (i.e., live trees and/or snags $\geq$ 5 inches dbh that have exfoliating bark or cracks/crevices), as well as linear features such as fencerows, riparian forests, and other wooded corridors. These wooded areas may be dense or loose aggregates of trees with variable amounts of canopy closure. Individual trees may be considered suitable habitat when they exhibit characteristics of suitable roost trees and are within 1,000 feet of other forested/wooded habitat. Southern Michigan maternity roost trees are typically dead or dying trees in open areas exposed to solar radiation. Infrequently, Indiana bats are observed roosting in human-made structures, such as buildings, barns, bridges, and bat boxes.

The Michigan Field Office has modeled suitable Indiana bat habitat across the species' expected range in Michigan based on available data. See Appendix I for details on how the habitat suitability model was developed and incorporated into the DKey.

¹¹Suitable bridges and culverts include those located below the third county tier of Michigan and within 1,000 feet of suitable forested habitat that contain suitable roosting spaces (e.g., expansion joints, cracks/crevices). Suitable culverts are limited to those at least 4 feet (1.2 meters) high and 50 feet (15 meters) long. If the bridge/culvert been inspected for signs of roosting bats (guano, urine staining, bat vocalizations, and/or bats) during the summer roosting season (May 15 through August 15) and no bats or signs of bats were observed, work on the bridge/structure can proceed at any time of year.

Lastly, projects that include temporary or permanent lighting of roadway(s), facility(ies), and/or parking lot(s) must:

1. When installing new or replacing existing permanent lights, use downward-facing, full cut-off lens lights (with same intensity or less for replacement lighting); or for those transportation agencies using the BUG system developed by the Illuminating Engineering Society, the goal is to be as close to 0 for all three ratings with a priority of "uplight" of 0 and "backlight" as low as practicable.
2. Direct temporary lighting away from suitable habitat when bats may be present.

Northern Long-eared Bat

Projects must not:

1. Result in take within a known northern long-eared bat hibernaculum¹²
2. Result in the incidental take of northern long-eared bats by altering a known hibernaculum's entrance or interior environment if it impairs an essential behavioral pattern, including sheltering northern long-eared bats
3. Result in incidental take caused by tree removal IF:
 - b. Tree removal occurs within 0.25 miles of a known hibernaculum, at any time of year; or
 - c. Tree removal cuts or destroys a known occupied maternity roost tree¹² or any other trees within a 150-foot radius of the maternity roost tree during the pup season (June 1 through July 31)

Note that some qualifying projects may result in adverse effects to and/or take of northern long-eared bats; however, applying the above conservation measures will ensure that the project does not result in prohibited take of the species per the northern long-eared bat 4(d) rule. The Michigan Dkey was set up to mirror the rangewide northern long-eared bat 4(d) Dkey (see the [standing analysis for the range-wide Dkey](#)). Although projects can currently rely on the final 4(d) rule through the Michigan Dkey, the recent proposed reclassification of the northern long-eared bat from threatened to endangered would remove the existing 4(d) rule if finalized. Depending on the types of effects a project has on northern long-eared bats, the change in the species' status may trigger the need to re-initiate consultation for any actions that are not completed and for which the Federal action agency retains discretion once the new listing determination becomes effective (anticipated to occur by December 30, 2022). Projects that may result in incidental take of northern long-eared bats after the new listing goes into effect this will first need to be addressed in an updated consultation that includes an Incidental Take Statement.

Copperbelly Water Snake

Projects that intersect the copperbelly water snake AOI and buffered habitat must not:

1. Involve construction or maintenance of a road or other barrier (e.g., paved trail)
2. Affect local hydrology (permanently or temporarily)

¹²Locations of known northern long-eared bat roosts and hibernacula in Michigan can be found here: <https://www.fws.gov/media/northern-long-eared-bat-project-review-michigan>

3. Disturb the ground or existing vegetation¹³ within 0.5 miles of a copperbelly occurrence

Projects that fragment habitat, affect hydrology, or result in ground disturbance need project-specific review in areas where copperbelly occur.

Eastern Massasauga Rattlesnake

The following projects are not covered by the Dkey in Tier 1 or Tier 2 habitat¹⁴:

1. Prescribed fire
2. New roads, widening existing roads, and other types of projects that create a permanent barrier to snake movement
3. Projects that permanently alter hydrology
4. Projects that temporarily alter hydrology during the inactive season
5. In Tier 1, projects that impact more than 0.5 acres of EMR habitat, or in Tier 2, greater than 1 acre of EMR habitat
6. Projects that include mowing vegetation (non-turf grass) during the active season

In addition, in order to reach a not likely to adversely affect determination:

7. In Tier 1, projects cannot result in ground disturbance in areas where potential hibernacula occur. (If present in Tier 1, projects must avoid ground disturbance any time of year). In Tier 2, projects cannot result in ground disturbance to potential hibernacula during the inactive season (if present in Tier 2, ground disturbance must be well within the active season to avoid when snakes are present underground).
8. If conducting ground disturbing work in Tier 1 or Tier 2 habitat, the following best management practices (BMPs) must be implemented (if applicable):
 - a. Use existing roads and minimize speeds at facilities and access roads (e.g., <15 mph on two track roads), during the active season.
 - b. Use low impact equipment such as lightweight track mounted vehicles with low ground pressure OR limit vehicle use to the inactive season, when the ground is completely frozen.
 - c. Revegetate all disturbed areas with appropriate plant species (i.e., native species or other suitable non-invasive species present on site prior to disturbance). Monitor all restoration plantings for proper establishment and implement supplemental plantings as necessary to ensure restorations are of equal to or better habitat quality than previous conditions.
 - d. Avoid the spread of invasive species into suitable EMR habitat by following best practices such as inspecting and cleaning equipment and vehicles for invasive plant materials and seeds before entering EMR habitat areas.
 - e. Ensure fill is clean and free of contaminants/invasive species.
9. For projects during the active season, in Tier 1 and Tier 2, projects must include the following BMPs (if applicable):

¹³This includes any off road vehicle access, soil compaction, digging, seismic survey, directional drilling, heavy equipment, grading, trenching, placement of fill, pesticide application, vegetation management (including removal or maintenance using equipment or chemicals), cultivation, development, etc.

¹⁴In Tier 1 habitat, contact the Service regarding the potential applicability of surveys to determine EMR absence in suitable habitat.

- a. In Tier 1, for projects involving earth work, properly install exclusionary fencing, clear the area before work begins using a qualified person, and remove all fencing following project completion.
 - b. Keep turf grass short (<6 inches) throughout the active season. In non-turf grass, mow tall (>6 inches) vegetation during the inactive season (for Tier 1), or raise the deck height to greater than 8 inches (for Tier 2).
10. For projects using chemical treatments (e.g., herbicides), they must agree to follow all appropriate label instructions regarding which herbicide formulation and proper use in potential EMR habitat AND avoid spray drift beyond the target species/area (observing label instructions regarding optimal wind speed and direction, boom height, droplet size calibration, precipitation forecast, etc.).

For all Projects within the range, including Tier 1 and Tier 2, projects must include all General BMPs:

- a. Use wildlife-safe materials for erosion control and site restoration throughout the project area. Do not use erosion control products containing plastic mesh netting or other similar material that could entangle eastern massasauga rattlesnake (EMR). Several products for soil erosion and control exist that do not contain plastic netting including net-less erosion control blankets (for example, made of excelsior), loose mulch, hydraulic mulch, soil binders, unreinforced silt fences, and straw bales. Others are made from natural fibers (such as jute) and loosely woven together (often referred to as "leno weave") in a manner that allows wildlife to wiggle free.
- b. To increase human safety and awareness of EMR, those implementing the project should first watch MDNR's "60-Second Snakes: The Eastern Massasauga Rattlesnake" video (available at https://youtu.be/~PFnXe_e02w), review the EMR factsheet (available at <https://www.fws.gov/media/eastern-massasauga-rattlesnake-fact-sheet>), or call (517) 351-2555.
- c. During project implementation, require reporting of any Federally listed species, including EMR, to the Service within 24 hours.

Based on implementation of the recommended BMPs, and avoidance of the excluded actions, adverse effects to eastern massasauga are expected to be discountable.

Plants

In Michigan, threatened plants include American hart's tongue fern, dwarf lake iris, eastern prairie fringed orchid, Houghton's goldenrod, lakeside daisy, and Pitcher's thistle. Michigan monkey flower is Michigan's only endangered plant species. Plants in Michigan are protected by state law in addition to the Federal ESA.

Projects that are funded, authorized, or carried out by a Federal agency, intersect the AOI and/or buffered habitat of a Federally listed plant, and have either determined presence through a survey or have not conducted a survey and are assuming presence must not:

1. Indirectly alter the habitat or resources of the listed plant(s)¹⁵

¹⁵For example, actions that cause a change in canopy cover, microclimate, humidity, increase in invasive species, hydrologic alterations, etc.

2. Directly harm the listed plant(s)¹⁶

If the project does not have a Federal nexus but has the potential to affect a listed plant, the user will receive output language advising them to contact the Michigan Department of Natural Resources regarding compliance with state law and to determine whether a state permit is needed. We also encourage landowners to maintain habitat for listed plant species and avoid disturbing listed plants to the extent possible.

For projects with a Federal nexus, avoiding direct and indirect effects to plants will ensure effects are insignificant or discountable.

Bald eagle

Although no longer listed under the ESA, bald eagles are protected under the Bald and Golden Eagle Protection Act (BGEPA) (54 Stat. 250, as amended, 16 U.S.C. 668a-d). The Dkey provides the user with information on the BGEPA and directs users to contact the MIFO for more information on the BGEPA if their action may impact bald or golden eagles.

Effects Analysis

Projects that meet all of the following criteria can get to a “no effect” determination for all species:

1. Occurs entirely within an already-developed area (e.g., within an existing structure, graveled or paved lot, industrial site) that does not provide habitat for listed species.
2. Does not have any potential for indirect effects to listed species or the habitats they depend on (e.g., water discharge into adjacent habitat or waterbody, changes in hydrology (e.g., surface flows, discharges, groundwater elevation, etc.), sound, introduction of an exotic plant species).
3. Will not impact structures that may serve as roosts for listed bats.

Note that we define "already-developed area", for the purpose of the Dkey, as highly disturbed habitat that does not provide potential feeding, breeding, or sheltering resources for any listed species. This does not include areas such as road or transmission line rights-of-way, other roadside habitat, bridges/culverts, or other developed or disturbed areas that still provide resources to listed species.

For the most part, the species-specific conservation measures ensure projects are not occurring in suitable (occupied) habitat and will not have direct or indirect effects, as described above. For projects where listed species may be present, activities may involve some or all of the following stressors:

Insignificant Habitat Loss/Degradation

Some projects that qualify for use of this DKey may result in minor loss/fragmentation or temporary degradation of available habitat for one or more Federally listed species. However, we believe that adherence to the specific conservation measures will ensure that any reduction or modification of available habitat will result in only insignificant effects to listed species and critical habitats. Conservation measures that control for significant loss/degradation of habitat

¹⁶For example, through prescribed fire, herbicide application, trampling, increased herbivory, cutting/clearing, cultivation, crushing by vehicle, reduction to possession, etc.

include restrictions on the extent and timing of certain activities (e.g., acreage thresholds for tree clearing projects within the Indiana bat AOI, seasonal restrictions on temporary surface- and groundwater elevation changes in potential eastern massasauga hibernation habitat), restrictions on stream/hydrology-impacting or vegetation/ground-disturbing activities within the AOIs/buffered habitat of several species (e.g., copperbelly water snake, listed insects), and restrictions on actions that may fragment habitat or create barriers to movement/dispersal within the AOIs of several species (e.g., dams within Group 3 streams, roads/trails/fences within listed snake habitats).

Noise and Vibration

Noise and/or vibration resulting from some projects are typically produced temporarily during the construction phase (e.g., construction vehicles and equipment, blasting) and may be permanently produced during the operation phase (e.g., roads/trails/bridges, commercial/recreational facilities, military operations, etc.). However, we believe that adherence to the specific conservation measures will ensure that any disturbance related to an increase in noise and/or vibration will result in only insignificant effects to listed species and critical habitats. Conservation measures that limit exposure to these stressors and control for significant disturbance include restrictions on the timing of certain activities (e.g., tree cutting during the Indiana bat active season, modifications to beaches, dunes, mudflats or other potential habitats during the red knot migration windows), restrictions on ground-disturbing activities within the AOIs of several species (e.g., listed snakes, insects), and restrictions on in-stream disturbance within the AOIs of Hungerford's crawling water beetle and listed mussels).

Smoke, Dust, Chemicals, and Odor

Smoke, dust, chemicals, and/or odor resulting from some project activities are typically produced temporarily during the construction phase (e.g., construction vehicles and equipment, blasting, invasives treatment/pesticide application, prescribed burning) and may be permanently produced during the operation phase (e.g., mines/quarries, commercial/residential developments, military operations, etc.). However, we believe that adherence to the specific conservation measures will ensure that any disturbance related to an increase in smoke, dust, chemicals, and/or odor will result in only insignificant effects to listed species and critical habitats. Conservation measures that limit exposure to these stressors and control for significant disturbance include restrictions on the timing of certain activities (e.g., prescribed burning and pesticide use in potential habitat during the Indiana bat and eastern massasauga active seasons), restrictions on chemical use and vegetation-disturbing activities within the AOI of listed insects, restrictions on direct and indirect river/stream impacts in Group 3 streams, and disturbance buffers around sensitive areas (e.g., known gray wolf denning or rendezvous sites).

Night Lighting

Night lighting produced by some projects may occur temporarily during the construction phase (e.g., equipment lighting) and/or permanently during the operation phase (e.g., road/trail and facility lighting). However, we believe that application of the specific conservation measures will ensure that any disturbance related to night lighting will result in only insignificant effects to listed species and critical habitats. Most Federally listed species are not expected to be affected by night lighting; however, certain species that are active at night (e.g., listed mammals, snakes, migrating birds) may be sensitive to an increase in lighting at night. Conservation measures that limit exposure to this stressor and control for significant disturbance include the general

exclusion for communications towers more than 200 feet in height (which require night lighting), the timing of certain activities (e.g., actions that may increase human activity in potential habitat during the red knot migration windows), and disturbance buffers around sensitive areas (e.g., known gray wolf denning or rendezvous sites).

Conclusion

If a project is not consistent with the general and species/taxon-specific conservation measures and/or exclusions detailed above, the DKey will provide a response indicating that it cannot generate a conclusion (i.e., “no effect” [NE] or “may affect – not likely to adversely affect” [NLAA] determinations) for all species and will recommend project-specific coordination with the MIFO. In other words, for any species for which the user gets a “may affect” (MA) determination, further consultation with MIFO is required and their endangered species review cannot be completed using the Dkey. On the other hand, if the user provides project-specific information consistent with the conservation measures, IPaC will generate a consistency letter (for non-Federal action agencies) or a concurrence letter (for Federal action agencies) concluding that the project is consistent with NE and/or NLAA determinations for all listed species. We base these conclusions on the effects analysis above, which are summarized in Table 1.

Table 1. A summary of the effects of the stressors from qualifying projects on Federally listed species in Michigan.

Stressor	Effect
Habitat Loss/Degradation	None or insignificant
Noise and Vibration	None or insignificant
Smoke, Dust, Chemicals, and Odor	None or insignificant
Night Lighting	None or insignificant
Conclusion	“May affect – not likely to adversely affect”

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Appendix I: Development of a Habitat Suitability Model for the Indiana Bat (*Myotis sodalis*) in Michigan

In 2018, the Michigan Ecological Services Field Office contracted with Dr. Eric McCluskey of Grand Valley State University to develop a habitat model for the Indiana bat in Michigan. A shapefile and KMZ of the model are available for download here: [Indiana Bat Habitat Model](#)

To develop the model, we compiled all available Indiana bat summer capture (foraging) and roost occurrence data and applied a 500-m spatial filter as a minimum distance between occurrence records to minimize overemphasis of habitat importance based on clusters of individuals. After filtering the occurrence data, 44 locations remained (20 capture and 24 roost locations). We developed models using capture and roost occurrences separately as well as with all occurrences combined to determine which model was best suited for identifying foraging and roost habitat.

Due to the small number of occurrences, we used an ensemble of small models (ESM) approach that permits more predictor variables to be used by running each pairwise combination of variables and then weighting these final models in an ensemble. The ESMs were run in the R package *ecospat*. Presence only modeling requires the selection of background area from which background points will be randomly sampled to compare to the occurrence data. The background area should represent parts of the landscape that are accessible to the focal organism. We created a convex hull around our occurrence data using ArcMap, a polygon formed by connecting straight lines between points. We then buffered this convex hull by 25 km to include areas beyond the known core distribution of Indiana Bat in southern Michigan that should be physically accessible and may have undetected presences. We set background point selection for this entire buffered area except for within 5 km of Indiana Bat occurrences where background points are most likely to unintentionally represent true presences.

We selected predictor variables by removing the worse performing variable from highly correlated pairs (>0.75) using the ‘corSelect’ function from the *fuzzySim* R package. Then we then used Maxent’s internal variable importance (permutation importance) and jackknife measures to determine which of the remaining variables were important to retain for separate capture and roost models. We selected two model types, Artificial neural network (ANN) and Maxent, for the ESMs. We compared five runs for each model type with the capture, roost, and combined datasets using area under the ROC curve (AUC) and true skill statistic (TSS). We then calculated the Boyce Index value using *ecospat* to compare the ANN and Maxent models from each dataset in their ability to identify capture and roost locations. We used Boyce Index as the primary assessment metric as it allowed for comparisons across all three model types for capture and roost data.

Based on the Boyce Index assessment, we selected the Maxent presence-only roost model as the strongest fit model. Using the 10th percentile threshold, we converted the model output to a binary raster. The binary raster was then converted to a shapefile using non-simplified shapes. Because considerable portions of the modeled habitat contained clearly non-suitable cover types, particularly near highly developed urban areas, we further refined the model by clipping the binary shapefile by the most recent available National Land Cover Database (NLCD 2019) data. Land cover categories excluded (“Clipped”) from modeled habitat included open water, perennial ice/snow, developed (low, medium, and high intensity), and barren land (sand, rock, clay).

To further refine the model output, we created a grid of five-acre hexagons for Michigan's Lower Peninsula using the "Generate Tesselation" tool in ArcPro 2.9. Five acres was selected as the patch size based on available literature and data suggesting that Indiana bats are unlikely to occupy an isolated forest stand of less than five acres. The hexagon layer was then "Clipped" to the Indiana bat range. The total acres of modeled Indiana bat habitat were summarized by hexagon using the "Summarize Within" tool. Hexagons with less than one acre of habitat were then removed. These small model fragments were typically isolated from other modeled hexagons, likely artifacts of imprecise raster data, and were considered unlikely to provide sufficient habitat to support roosting Indiana bats. Hexagons containing more than one acre of modeled habitat were retained, helping to fill gaps and buffer edges among smaller but closely connected modeled patches and increasing the overall acreage of modeled habitat within the species' range.

The remaining hexagons were then aggregated using the "Dissolve" tool allowing for multipart features. The "Summarize Within" tool was run again to obtain acres of modeled habitat within each hexagon cluster. We then ran a "Near Neighbor" analysis to identify forest patches that were greater than 1,000 feet from forested areas to remove isolated patches unlikely to be used by roosting Indiana bats. We removed hexagons that were more than 1,000 feet from their nearest neighbor and that contained less than five acres of modeled habitat. These isolated forest patches are considered unlikely to support roosting Indiana bat due to their insufficient size and distance from other suitable, modeled areas.

APPENDIX II

Projects that may cause indirect adverse effects/harm to ESA-listed bats

Indiana bats and northern long-eared bats are forest dependent and require a network of forested tracts for roosting, commuting, and foraging. The Service defines suitable roosting habitat for Indiana bats as forest patches containing trees of 5 inches diameter at breast height (DBH) or larger, and suitable roosting habitat for the northern long-eared bat as forest patches containing trees of 3 inches DBH or larger. However, early successional habitat with small diameter trees may also be used as important foraging and/or commuting habitat by listed bats. Loss or degradation of suitable roosting or foraging habitat may lead to maternity colony fragmentation and/or reproductive failure if a substantial number of maternity roost trees (particularly primary roosts) are removed or if a sufficient amount of suitable roosting, foraging, and/or commuting habitat will no longer be available, even if the clearing takes place during times of the year when bats are not present on the landscape (e.g., inactive season).

Although site specifics (e.g., availability of nearby habitat, quality of remaining habitat, etc.) can modify a risk assessment, the Michigan Ecological Services Field Office generally views the following project activities, regardless of when they are conducted, as having potential to cause adverse effects and/or harm to federally listed bats if they are present (or when assuming potential presence without survey data¹⁷):

1. Clearing >10 contiguous¹⁸ acres of modeled bat habitat;
2. Clearing >20 contiguous acres of forest; and/or
3. Fragmenting¹⁹ a connective corridor (e.g., tree line) between two or more forest patches of at least 5 acres

Acreage Thresholds

To better characterize potential habitat and focus conservation efforts, the Michigan Ecological Services Field Office recently developed a habitat suitability model for the Indiana bat within the species' Michigan range and is currently developing a similar model for the northern long-eared bat. Potentially suitable habitat for listed bats may occur outside of modeled areas, but occupancy of such areas is expected to be less likely.

As Indiana bat maternity home ranges contain multiple primary and secondary roost trees, it is extremely unlikely that loss of up to 10 contiguous acres of habitat would eliminate all primary roost trees within a roosting area. Available literature suggests that northern long-eared bat maternity colonies can tolerate loss of a single primary roost or up to 20% of available secondary roosts in the inactive season before abandoning roosting areas or substantially altering roosting behaviors (Silvis et al. 2014, 2015), and Indiana bats are expected to respond similarly. Loss of up to 10 contiguous acres of modeled habitat is also unlikely to noticeably degrade the quality of a roosting or foraging area or render a travel corridor unsuitable. For these reasons, the

¹⁷Surveys conducted in accordance with the Service's Range-wide Indiana bat and Northern Long-eared Bat Survey Guidelines may be used to demonstrate presence or probable absence of listed bats within a project area. Lacking presence/absence survey data, presence is assumed in suitable habitat.

¹⁸Connected by 1,000 feet or less

¹⁹Creating a gap of 1,000 feet or more between previously connected forest

Michigan Ecological Services Field Office believes it is extremely unlikely that loss of up to 10 contiguous acres of modeled habitat when removed during the inactive season would lead to detectable adverse effects/harm. Because listed bats are less likely to occupy forest outside modeled habitat, we further believe that removal of up to 20 acres of contiguous forest (including both modeled and/or unmodeled areas) during the inactive season is unlikely to cause adverse effects/harm.

Projects that will clear >10 contiguous acres of modeled habitat and/or >20 contiguous acres of forest within the Indiana bat's range warrant project-specific consideration and coordination with the Service in order to better evaluate and minimize potential impacts to Indiana bat. Until a habitat model for the northern long-eared bat in Michigan is finalized, we also encourage projects to seek site-specific recommendations for avoiding potential adverse effects to northern long-eared bats if they will remove >10 contiguous acres of suitable habitat. However, until a new final listing determination for the northern long-eared bat becomes effective, projects may also have the option of relying on the Service's January 5, 2016 Intra-Service Programmatic Biological Opinion on Final 4(d) Rule for the Northern Long-Eared Bat and Activities Excepted from Take Prohibitions to cover potential incidental take of northern long-eared bat. For more information on the final 4(d) rule and the March 23, 2022 proposed rule to reclassify the northern long-eared bat as endangered, please visit the Service's [northern long-eared bat species page](#).

Minimum Patch Size

Based on life history information and available literature for Indiana bats (e.g., average foraging distances and occupied forest patch sizes), the Service believes that it is unlikely that an isolated forest stand of 10 acres or less would provide sufficient resources for an Indiana bat. However, available data indicate that Indiana bats may infrequently use isolated forest patches as small as 5.6 acres (Keith Lott, personal communication). The Michigan Ecological Services Field Office believes a conservative minimum patch size of 5 acres is appropriate for both Indiana and northern long-eared bats. Although listed bats rarely traverse non-forested areas of 1,000 feet or more, they are frequently observed using vegetated corridors, such as tree lines, to travel among suitable forest patches. Because they may connect important foraging and roosting habitats, removal of forested corridors (regardless of size/area of corridor) could severely fragment available habitat and result in adverse effects or indirect take of listed bats. Therefore, projects that remove connective corridors between forest patches warrant project-specific consideration and coordination with the Service.

Supporting Documents

The following Service web pages provide further information and background on the potential for indirect adverse effects via habitat loss or fragmentation.

- [Section 7 Technical Assistance, Summary of Indiana Bat Ecology](#)
- [Indiana Bat Section 7 and Section 10 Guidance for Wind Energy Projects](#)
- [Range-wide Indiana bat and Northern Long-eared Bat Survey Guidelines](#)

Literature Cited

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APPENDIX III

Potential Indiana bat roost trees

The Service defines suitable Indiana bat roost tree as any tree ≥ 5 inches in diameter (at breast height) with cracks, crevices and/or exfoliating bark that is within 1,000 feet of forested/wooded habitat.

Although live trees may be used, Indiana bat roosts are most typically snags in early to mid-decay stages. When healthy live trees are used, they tend to be species with naturally sloughing bark, such as shagbark hickory (*Carya ovata*). While over 40 Indiana bat roost tree species have been documented, including coniferous species, deciduous trees are most frequently used, and all the Indiana bat roosts reported in Michigan have been deciduous species. Generally, roost quality improves with tree height, diameter, amount of peeling bark, and solar exposure. Maternity roosts (roost trees used by reproductive female bats and their young) are typically high-quality roosts (i.e., large, tall trees with peeling bark and/or large cracks/crevices that receive a high degree of solar radiation).

Examples of Indiana bat roost trees:



APPENDIX IV

Potential northern long-eared bat roost trees

The Service defines suitable northern long-eared bat roost tree as any tree ≥ 3 inches in diameter (at breast height) with cracks, crevices, exfoliating bark, and/or cavities/hollows that is within 1,000 feet of forested/wooded habitat.

Although northern long-eared bat roosts are often dead or dying trees, live trees with defects are also commonly used. Northern long-eared bats have been reported to use over 35 roost tree species, but deciduous species are most frequently selected. Maternity roosts (roost trees used by reproductive female bats and their young) are typically higher-quality roosts (i.e., large-diameter, tall trees with peeling bark and/or notable defects and adequate solar exposure); however, compared to sympatric Indiana bat roosts, northern long-eared bat roosts (even maternity roosts) are often smaller, shorter trees with a higher degree of canopy cover and are more likely to be living.

Examples of northern long-eared bat roost trees:

