

**Michigan Monkey-flower
(*Mimulus michiganensis*)**

**Status Review:
Summary and Evaluation**



Photo credit: Kaitlyn Kelly, USFWS

**U.S. Fish and Wildlife Service
Michigan Ecological Services Office
East Lansing, Michigan**

STATUS REVIEW

Michigan monkey-flower (*Mimulus michiganensis*)

GENERAL INFORMATION

Species: Michigan monkey-flower; *as currently listed in 50 CFR 17.11 or 17.22* [Link](#)

Reviewers:

Lead Regional or Headquarters Office:

Region 3; Laura Ragan, Endangered Species Recovery Coordinator, Midwest Regional Office, 612-713-5157

Lead Field Office: Michigan Field Office, 517-351-2555

Scott Hicks, Field Supervisor

Kaitlyn Kelly, Biologist

Listing Status:

Date of listing publication: June 21, 1990

FR citation(s): 55 FR 25596

Classification: Endangered

Methodology used to complete the review:

In accordance with section 4(c)(2) of the Endangered Species Act of 1973, as amended (Act), the purpose of a status review is to assess each threatened species or endangered species to determine whether its status has changed and if it should be classified differently or removed from the Lists of Threatened and Endangered Wildlife and Plants. The U.S. Fish and Wildlife Service (Service) evaluated the biology and status of the Michigan monkey-flower to inform this status review.

The Michigan Field Office (MIFO), in coordination with Midwest Regional Office Ecological Services staff, conducted this review. We reviewed literature, the Michigan monkey-flower Recovery Plan (USFWS 1997), the Michigan Natural Features Inventory (MNFI) database, and reports since the last status review (USFWS 2018) to prepare this 5-year review. The lead Service biologist coordinated with state agencies, university extension, federal partners, conservancies, and local experts to compile the best available information regarding Michigan monkey-flower. The Service's 5-Year Review Guidance does not require peer review if a 5-year review results in a recommendation to leave the status unchanged because there was no significant new information, or all new information has undergone prior peer review.

FR Notice citation announcing the species is under active review: January 13, 2023; 88 FR 2368 pp. 2368–2369

Review History: The Service initiated a cursory 5-year review of all species listed before January 1, 1991, which included Michigan monkey-flower (56 FR 56882). This review resulted in no change to the Michigan monkey-flower listing classification of endangered.

In 2011, the Service completed a 5-year review for Michigan monkey-flower (74 FR 11600). This review resulted in no change to the species' listing classification of endangered.

In 2018, the Service completed a 5-year review for Michigan monkey-flower (80 FR 78751). This review resulted in no change to the species' listing classification of endangered.

REVIEW ANALYSIS

Recovery Criteria

Recovery Plan or Outline: Michigan Monkey-flower Recovery Plan; September 17, 1997

Michigan monkey-flower was listed as a variation, *Mimulus glabratus* var. *michiganensis*, when the recovery plan was finalized. In 2003, genetic analyses revealed it was a full species, recognized as *Mimulus michiganensis* (Posto and Prather 2003). A revised taxonomy of the Phrymaceae family in 2012 resulted in a change to the genus nomenclature, recognized as *Erythranthe michiganensis* (Barker et al. 2012). However, the majority of the botanical community in Michigan continues to use *Mimulus*. Lowery et al. (2019) perceived that the new nomenclature put forward for *Mimulus* species was based on distinct sets of morphological traits, however, should be implemented at the subgenus level vs. genus level. Not all within the *Mimulus* community agree with this opinion. Redefinition to have monophyletic genera has support (Nesom et al. 2019). Into the future, publications and presentations are expected to continue to use *Mimulus* to refer to monkey-flowers until additional genomic data is developed (Lowery et al. 2019) and this is expected to be the case within Michigan.

The recovery criterion for Michigan monkey-flower has not yet been met. The criterion for Michigan monkey-flower is securing long-term protection for all occurrences and when eight occurrences are ranked at or higher than good than the species will be considered for downlisting. Most of the known occurrences are not secured in long-term protection and only 6 of the known populations are considered to have good estimated viability. There are eight occurrences that have long-term protection as they are located partially or fully on lands owned by the State of Michigan, federal government, land conservancies, or biological stations. The one AB ranked population is on biological station property, 3 ranked as B occur on land conservancy and state lands, 1 ranked as B? is located on Federal land, 2 ranked BC occur on land conservancy and state land, and 1 ranked C occurs on land conservancy lands. The two populations that are privately owned and estimated to be in good viability are recorded as last being surveyed in 2012.

Given our current level of understanding of the species, the recovery plan criteria are still appropriate.

Table 1. Number of populations by Element Occurrence viability ranking and land ownership.

Element Occurrence Estimated Viability Rank	Partially or fully protected	Privately owned	Total
AB (Excellent or Good)	1		1
B (Good)	3	2	5
B? (Possibly Good)	1		1
BC (Good or Fair)	2	1	3
C (Fair)	1	2	3
C? (Possibly Fair)		1	1
CD (Fair or Poor)		2	2
D (Poor)		2	2
Total	8	10	18

Updated Information and Current Species Status

Biology and Habitat: While it has not been documented in reports or literature, Michigan monkey-flower vegetation persists year-round (pers. comm. L. Voran, J. Marquis, and L. May, July 2023). It appears that individuals can live even under snow or water during the winter. This indicates that hydrology needs are not seasonal, but rather during the full year.



Figure 1. Photo of Michigan monkey-flower vegetation persisting in the winter underneath snow. Photo credit: Laurel Voran.

Range and distribution: Currently Michigan monkey-flower has 18 extant element occurrences. Recent surveys have indicated that at two areas, populations had extended beyond the area previously thought to be occupied and therefore, some adjacent element occurrences have been combined. The previous status review (2018) for Michigan monkey-flower listed 23 element occurrences. The species still occurs in the same six Michigan counties – Benzie, Leelanau, Charlevoix, Emmet, Cheboygan, and Mackinac.

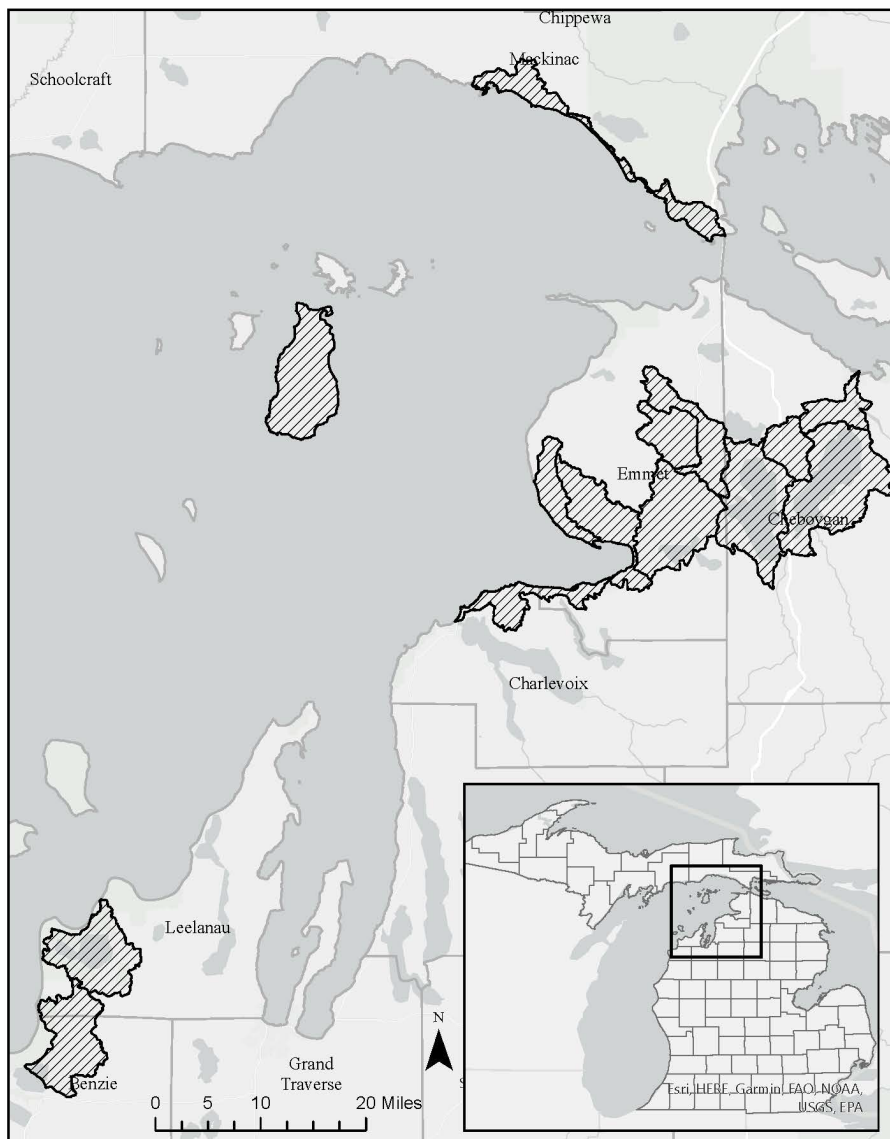


Figure 2. Map of the Michigan Monkey-flower current range.

Population demographics: Three occurrences decreased in ranking since the 2018 review. One occurrence increased in ranking from BC in 2018 to a B ranking and occurs on land conservancy property where habitat management has been implemented, including some beaver management. This area occurs on Beaver Island and the most recent survey of this area has shown an expansion along the shoreline with clumps of Michigan monkey-flower occurring now in 20 patches.

The Kathleen Lake drawn down and dam removal project was completed in 2018. Monitoring of the Maple River population, downstream of the dam, indicated that the water table in the first year dropped a mean of 2.5 inches (May et al. 2019). It was noted in the 2019 report that the population had decreased in abundance likely due to the competition with forget-me-not interacting with decreases in the water table. The Maple River site is the only known seed-setting

population (Bliss 1986, Penskar and Higman 2001), with seed capsules found on only 1% of plants in 2015 (Slaughter 2015). Because of the importance of this population, and concern that the 2018 drawdown could inundate the site where Michigan monkey-flower occurs, individuals from the population were transplanted prior to the lake draw down in an attempt to preserve the seed-setting trait. Within the first year post-transplanting, transplanted sites had Michigan monkey-flower growth that varied between sites, ranging from an increase in cover by 500% to 80% decrease in cover (May et al. 2019). Sites that had poor performance shared in low water flow rates from a headwater seep or spring along with low dissolved oxygen (May et al. 2019). The most drastic decline in abundance occurred at sites where water forget-me-not (*Myosotis scorpioides*) growth was dense. The pandemic prevented monitoring efforts to be completed in 2020–2021. These efforts were continued in 2022 and 2023. A report on the drawdown monitoring project and translocations is forthcoming.

The McFarlane Woods population that occurs partially on Federal land has been monitored annually since 2018. There are three subpopulations on this property that occur primarily in seepage pools and small springs at the forest edge. Across these three subpopulations, there are 97 patches recoded in the 2022 survey, covering a total area of 70.55 m² (0.017 acres; Wiler and Skoglund 2022). In 2018, land managers developed an invasive species management plan for this area (Wiler and Skoglund 2022). The presence of non-native and invasive species, such as forget-me-not (*Myosotis scorpioides*), water-cress (*Nasturtium spp.*), reed canary grass (*Phalaris arundinacea*), along with others, is considered a significant threat to this population (Wiler and Skoglund 2022).

Genetics: No new information since the last five-year review (USFWS 2018).

Taxonomic and nomenclature: No new information since the last five-year review (USFWS 2018).

Habitat: The Cut River west and east populations were combined into a single element occurrence. The separation distance between was approximately 100 meters. The combination of these element occurrences was based on notes from the status assessment conducted statewide (Penskar 2012). Additionally, the Carp Creek and Reese’s swamp sites were combined into the same element occurrence. This population occurs on University of Michigan Biological Station (UMBS) property. The area has experienced some habitat changes due to beaver activities. The flow of a culvert was inhibited by the beavers and became a concern for the road that crosses Carp Creek. A structure was installed around the culvert to prevent the beavers from continuing to build there, but they built a dam just upstream of the culvert. This flooded out some of the areas that had Michigan monkey-flower; however, it also caused some deposition further downstream, creating sand bars upon which individuals became established. Although MNFI combined these element occurrences, the overall distribution remains unchanged from the prior five-year review (USFWS 2018) as they are all previously known occurrences.

Canopy cover was monitored at the population at McFarlane Woods. However, percent canopy cover is not intuitive and largely dependent on the observer and therefore, not consistently repeatable. Especially because canopy cover has been estimated for large areas, it was suggested to create a more detailed and standardized approach (Wiler and Skoglund 2022). This

standardized methodology could assist in understanding the population dynamics around canopy cover across the range.

Threats Analysis (threats, conservation measures, and regulatory mechanisms):

Conservation Measures: MNFI mapped a portion of the element occurrences in 2022. This helped inform updates to rankings for populations, along with an updated survey for the population abundance.

Threats: The major threats across Michigan monkey-flower range are destruction and modification of habitat, hydrological alterations, canopy closure, lack of sexual reproduction at all but a single site, and competition from invasive and native aggressive species.

Present or threatened destruction, modification or curtailment of its habitat or range: The Carp Creek and Reese's swamp population modification from beaver activity has been a recent development at this location. While there have been some areas that were inundated (and removed Michigan monkey-flower from that area of the population), there were also some new habitat created downstream where individuals established. It is unsure if the beaver activity is a new threat or something that could create new microhabitat. Continued monitoring of this population is suggested to evaluate the impacts of beavers within the habitat.

The Epoufette Bay population occurs along a ditch that requires maintenance to prevent flooding events over the road. Ditch maintenance that utilizes best management practices can reduce or avoid impacts to Michigan monkey-flower. This population experienced loss of individuals due to ditch maintenance in the past and was slowly recovering. This most recent maintenance (2021) when best management practices were utilized appears to not have disturbed individuals, and the spoil piles were monitored for individuals the following growing period.

Overutilization for commercial, recreational, scientific, or educational purposes: No new information.

Disease or predation: Deer browsing has been observed at several sites. In addition to deer browse, insect herbivory is a threat at some sites and should be recorded separately when monitoring populations in the future to help us evaluate these potential impacts (Wiler and Skoglund 2022).

Inadequacy of existing regulatory mechanisms: No new information.

Other natural or manmade factors affecting its continued existence: The species remains vulnerable to extirpation due to the low number and limited sexual reproduction. Invasive species continue to be a problem at sites. Commonly found are forget-me-not (*Myosotis scorpioides*), Canada thistle (*Cirsium arvense*), swamp thistle (*Cirsium palustre*), water-cress (*Nasturtium spp.*) and coltsfoot (*Tussilago farfara*). Local land conservancy have coordinated with partners to organize volunteer workdays to remove invasive species at several Michigan monkey-flower sites. Evaluating the effectiveness of invasive species removal is difficult (Wiler and Skoglund 2022, May et al. 2019). Rough covered estimates of invasives before and after

removal are documented but the lack of protocol makes it difficult to meaningfully evaluate changes (Wiler and Skoglund 2022). For example, at the Maple River site, during monitoring following the Lake Kathleen drawdown, it was noted that the protocol for invasive species monitoring needs to be improved because forget-me-not growth overtopped Michigan monkey-flower, covering it from the view of the surveyor (May et al. 2019). The invasive species monitoring still provides information regarding the threats and competition for resources; however, a standardized protocol that can be applied across the range would improve the understanding of risk associated with invasive species.

Climate change is an additional threat to Michigan monkey-flower which can come from change in precipitation, water availability across the landscape, and Great Lake water levels. Precipitation is predicted to increase in winter and spring time in the Great Lakes region, but then decline in the summer (Wuebbles et al. 2019). The Great Lakes water levels are difficult to predict in future climate scenarios; however current projections predict an increased variability in water levels, resulting in more fluctuations and extreme high- and low- water levels (Magee et al. 2021). Additionally, changes in groundwater movement can impact populations and individual health. Climate change may create a necessity for additional groundwater extraction for human uses, further impacting groundwater inputs (Steinman et al. 2022) into the habitat for Michigan monkey-flower. While effects of climate change have not been evaluated specifically for Michigan monkey-flower, the predicted changes in temperatures, seasonality, and hydrology will impact key life history needs for the species.

Recommendations for future actions

- Develop a plan for conducting regular surveys, assessments, and monitoring at all known extant and historical Michigan monkey-flower locations. It is especially important to prioritize populations that have not been surveyed in the last decade. An updated population status is crucial for these areas. Continue exploration for new occurrences in the Lower Peninsula and eastern Upper Peninsula and provide detail mapping of all occurrences. Document habitat and status conditions and population trends during these assessments. *Recovery plan action numbers: 2-21, 2-22, 2-23, 4-45*
- Monitor non-native and aggressive native species and control as appropriate.
- Genetic research to understand the diversity among and between populations. *Recovery plan action number: 2-44*
- Acquire land containing occupied or suitable Michigan monkey-flower habitat. Create outreach materials for public and private landowners, site managers, and general stakeholders to inform and protect the species and its habitat. *Recovery plan action numbers: 1-121, 1-122, 1-123, 1-15.*

Synthesis

Michigan monkey-flower is a rare endemic to Michigan with very specific habitat requirements and restricted range. Michigan monkey-flower continues to occur within the same general area on the landscape with 18 EOs; a couple populations grew in extent but not abundance, and a few populations are declining, and there are a few that have not been surveyed in recent years, so their current status is unknown. Michigan monkey-flower is susceptible to stochastic events given its low population numbers, fragmented populations, and low fertility.

The main recovery criterion states all populations must have secured long-term protections in order for the species to be considered recovered. Eight extant population are currently either fully or only part of the area in long-term protection.

Habitat management efforts continue to focus on hydrology and invasive species. Invasive species continue to be a threat at numerous populations. The monitoring initiated from the Kathleen Lake drawdown continues. Early monitoring has indicated the water table dropping, but it may take several years for effects to ground water inputs to be understood. Further hydrological changes from beavers have been noted and continued to be monitored at the population on UMBS property.

Additional actions are recommended including a consistent survey schedule for all populations, continued monitoring and management of invasive species, genetic and reproduction research, and creation of local outreach materials.

RESULTS

**U.S. FISH AND WILDLIFE SERVICE
STATUS REVIEW of Michigan monkey-flower**

Current Classification: Endangered

Status Recommendation resulting from Status Review:

- Downlist to Threatened
- Uplist to Endangered
- Delist (Indicate reasons for delisting per 50 CFR 424.11):
 - The species is extinct
 - The species does not meet the definition of an endangered or threatened species
 - The listed entity does not meet the statutory definition of a species
- No change needed

Lead Field Supervisor, Fish and Wildlife Service

Approve _____ Date _____

The lead Field Office must ensure that other offices within the range of the species have been provided adequate opportunity to review and comment prior to the review's completion. The lead field office should document this coordination in the agency record.

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