STATUS REVIEW
Dwarf lake iris (*Iris lacustris*)

GENERAL INFORMATION

Species: Dwarf lake iris (*Iris lacustris*) (DLI)

Reviewers:

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Listing Status:

Date of listing publication: September 28, 1988

FR citation(s): 53 FR 37972 - 37975

Classification: Threatened species

FR Notice citation announcing the species is under active review: 89 FR 804 Initiation of 5-Year Status Reviews of 16 Listed Animal and Plant Species

Review History:
U.S. Fish and Wildlife Service. 2011. Dwarf Lake Iris (*Iris lacustris*) 5-Year Review: Summary and Evaluation. East Lansing Field Office, East Lansing, MI. 21 pp. Finalized – July 12, 2011.

U.S. Fish and Wildlife Service. 2022. Status Review of Dwarf Lake Iris (*Iris lacustris*). East Lansing Field Office, East Lansing, MI. 10 pp. Finalized – January 18, 2022.

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 dwarf lake iris (*Iris lacustris,* DLI) as part of a Species Status Assessment (SSA) to inform this status review.

This status review was conducted by the Service's Michigan Ecological Services Field Office with assistance from the Region 3 Regional Office. Data for this review were solicited from

interested parties through a Federal Register notice announcing this review on January 5, 2024. We also contacted the Michigan Natural Features Inventory (MNFI), United States Forest Service (USFS), Michigan Department of Natural Resources (MDNR), Michigan Department of Transportation (MDOT), Wisconsin Department of Natural Resources (WDNR), The Nature Conservancy (TNC), federal agencies, and other conservation partners to request any data or information we should consider in our review.

The SSA report represents our evaluation of the best available scientific information, including the resource needs and the current and future condition of the species. Independent peer reviewers and partner representatives reviewed the SSA report before we used it as the scientific basis to support our 5-year review decision-making process. The information below provides some background to give the reader context and summarizes our findings from the SSA and substantive new information since our previous 5-year review in 2022.

1.0 REVIEW ANALYSIS

1.1 Recovery Criteria

Recovery Plan or Outline: Dwarf Lake Iris (*Iris lacustris*) Recovery Plan (8/1/2013)

New information since the recovery plan was written indicate that the recovery criteria may need to be reevaluated. Criterion 1 calls for the species to have a 95% probability of persistence within the next 20 years, based on data obtained from accepted standardized monitoring methods and on population viability analysis (PVA; USFWS 2013, pp. iv-v).

Surveys of Michigan populations of DLI were used to develop both a count-based and a demographic-based PVA (Hackett et al. 2021, entire; Hackett et al. 2022, entire). A detailed summary of these PVAs is available in the SSA (USFWS 2023, pp 37-44). The PVAs found that populations with less than 5,000 ramets were at a higher risk of extirpation, while populations with at least 25,000 ramets were unlikely to become extirpated within 50 years. The count-based model found a slightly negative stochastic growth rate (-0.06) with a high variability (0.38; Hackett et al. 2022, p. 12). The addition of one year of data (from 2021 to 2022) more than doubled variance in this count-based analysis. Using the count-based PVA, simulations projected 17.4% of populations would reach a status of presumed extirpated (<10% probability of persistence) within 10 years. The demographic-based PVA found less dire extirpation projections and no populations were expected to drop below a 75% probability of persistence within 50 years (Hackett et al. 2021 pp. 27–28). Though the PVAs have useful applications in understanding resiliency, redundancy, and representation of DLI, data limitations prevent reliable projections further than 5–10 years into the future (Hackett et al. 2021, pp. 26–27; Hackett et al. 2022, pp. 19–20). The data required to create a PVA with reliable projections over 20 years is prohibitive to collect with the current resources devoted to species conservation. Due to this data limitation, the SSA provided alternative methods to assess the probability of persistence of the species.

The SSA analysis showed that populations are widely distributed across the four representation units, increasing the species' ability to adapt to novel changes in its environment and making a catastrophic event that negatively impacts all populations highly unlikely (Fig. 1). All representation groups have multiple populations with high condition: nine in the East (15%), four

in the Upper Straits (13%), six in the Lower Straits (29%), and nine in the West (27%). Overall, the species has maintained redundancy across its range compared to its historical range. Though 20 populations have been extirpated or presumed extirpated and 12 populations are historical, new populations have also been discovered. At the time of listing in 1988, 75 occurrences were known in the U.S.: 60 in Michigan and 15 in Wisconsin. We now know of 74 extant or unknown populations in Michigan and 28 extant or unknown in Wisconsin. Survey efforts in Canada have also discovered new populations. Both the PVA and SSA analyses suggest large and/or dense populations of DLI are stable at current conditions and likely to persist for several decades.

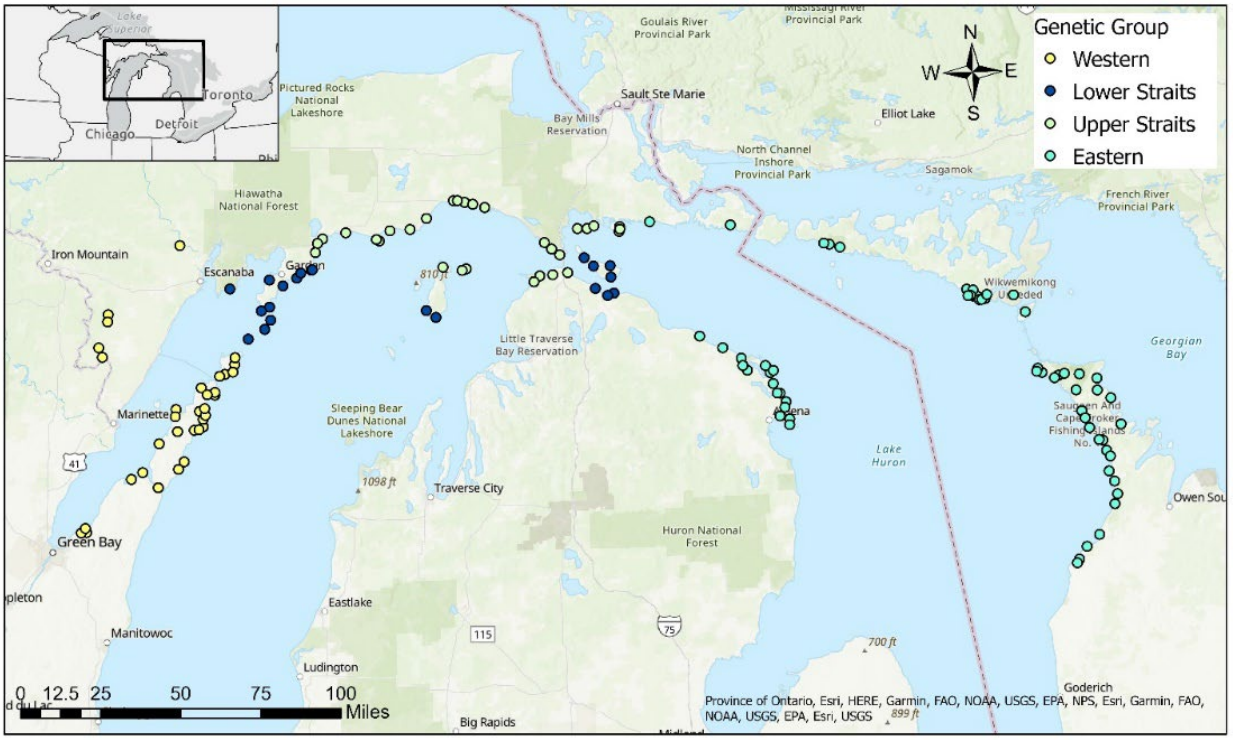

Figure 1. Representation groups of extant and unknown dwarf lake iris populations.

Criterion 2 calls for the development and implementation of management plans to protect and manage DLI habitat that is associated with element occurrences (EOs) identified by MNFI. In 2022 and 2023, management of woody species, including some invasives, was done at 5 known EOs. Monitoring was done at each of the sites pre- and post-management, and the preliminary results showed the treatments that included complete removal of the woody vegetation from the site resulted in those populations increasing in area covered, number of ramets, and number of reproductive ramets. As of 2024, management plans are being written and will continue to be implemented at these sites. To provide safeguards and agreements for the continued management and protection of DLI and its habitat, a DLI conservation strategy (Strategy) is also under development with an anticipated completion date in 2025. The Strategy is being written in collaboration with partners that have known DLI EOs on their lands. The Strategy focuses on efforts to conduct monitoring, management, and outreach at DLI EOs, as well as have systems in place to help partners coordinate and communicate efficiently. Potential partners that may be involved in developing and implementing the Strategy are MDNR, WDNR, MNFI, USFS, MDOT, and other conservation and academic organizations.

Criterion 3 calls for the development and implementation of a public outreach and education plan. In February 2024, MNFI finalized a video that will be publicly distributed to inform the public about DLI, its habitat, threats, what is currently being done to protect it, and its future conservation needs. The Strategy also incorporates working with partners to create signage to help inform the public about protecting DLI and its habitat as well as expanding public outreach activities and educational materials.

1.2 Updated Information and Current Species Status

Following the completion of the SSA and the call for new information for this current 5-year review, we received new information from Michigan Department of Transportation (MDOT) and U.S. Forest Service (USFS) about four DLI populations.

1. EO ID 24245
   Surveys in 2020 and 2021 show continued presence of DLI in suitable habitat but did not show a significant change in abundance from that documented in the SSA. According to USFS, the primary threats to the population are rising lake level and shoreline erosion. USFS also noted that no management was occurring at this site, which could potentially change Scenario One in the future conditions, since at the time of the SSA it was unknown if management was occurring at this site (J. Bournoville, personal communication, 2023).
2. EO ID 4458
   This population was classified as presumed extirpated and not evaluated in the SSA as surveys in 2020 and 2021 could not locate the population. In reply to the data call, MDOT provided spatial information showing the presence of DLI in the rights-of-way in Michigan. Potential presence of DLI was documented from outside the known EO at the Point aux Chenes Bay population in 2015. USFS noted in their correspondence that they were unable to locate the population in 2008, 2020 and 2021. Until further survey efforts can be done to confirm presence or absence, this population will remain as presumed extirpated in the SSA (J. Bournoville, personal communication, 2023, K. Alvarado, personal communication, 2024).
3. EO 10154
   USFS notes that habitat suitability for this population is unknown and that threats at this site include recreation and potentially a non-native honeysuckle. USFS also noted that no management was occurring at this site, which could potentially change Scenario One in the future conditions, since at the time of the SSA it was unknown if management was occurring at this site (J. Bournoville, personal communication, 2023).
4. EO ID 3132
   USFS has continued to conduct surveys at this population. While new abundance estimates are not available, surveys indicate the population has remained stable (J. Bournoville, personal communication, 2023). This would change the trend of this population in the SSA to medium instead of unknown but would not change the current condition.

Though this new information might cause some minor changes in the SSA, as discussed above,

we do not believe it will affect the overall resiliency of the species or conclusions of the SSA.

1.2.1 Biology and Habitat:

DLI is a low-growing, perennial, flowering plant with slender rhizomes that is capable of both sexual and vegetative reproduction. DLI is endemic to the modern and ancient shorelines of northern Lakes Huron and Michigan and is found in the states of Michigan and Wisconsin and the province of Ontario. Great Lakes shoreline habitat is often highly impacted by development and recreational use. The U.S. listed DLI as threatened in 1988 due to habitat loss and lack of appropriate overstory management (53 FR 37972). At the time it was listed, DLI was known from 75 U.S. populations. As of 2004, 43 sites with DLI had been reported to the Ontario Natural Heritage Information Centre (COSEWIC 2004, p. 9). DLI is now believed to occur in at least 144 populations distributed across Michigan, Wisconsin, and Ontario. Using a count of minimum estimates over the last 20 years, the species has a current estimate of 60 million plants, which includes counts of individuals and their ramets, of which 50 million are located at Thompson's Harbor State Park in Michigan. DLI is a gap-phase species, and disturbance is an important component of their habitat. The cyclical fluctuations of Great Lakes water levels, wind, waves, and winter ice formations are significant natural disturbance features that create the necessary soil and light conditions for DLI to thrive. Optimal DLI habitat is openings that provide intermediate light levels, thin soils with minimal litter to discourage faster growing competitors, and adequate soil moisture (USFWS 2023, p. iii).

DLI has limited genetic variability, but recent genetic analysis has found population clusters corresponding to the geographic regions of east Michigan, the upper Straits of Mackinac, the lower Straits of Mackinac, and west Michigan and Wisconsin (Cohen et al. 2021, entire; Cohen and Turgman-Cohen 2023, entire). These geographic units were used to delineate our representation groups for DLI (Fig. 1). Due to a lack of genetic data, we included Ontario populations with the closest geographic region of eastern Michigan. For additional information regarding DLI biology and habitat, see the SSA report (USFWS 2023, p. iii).

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

Current or potential future threats to dwarf lake iris include development, recreational activities, invasive species, woody encroachment and natural succession, drought, high-lake levels and associated flooding, and climate change (Fig. 2).

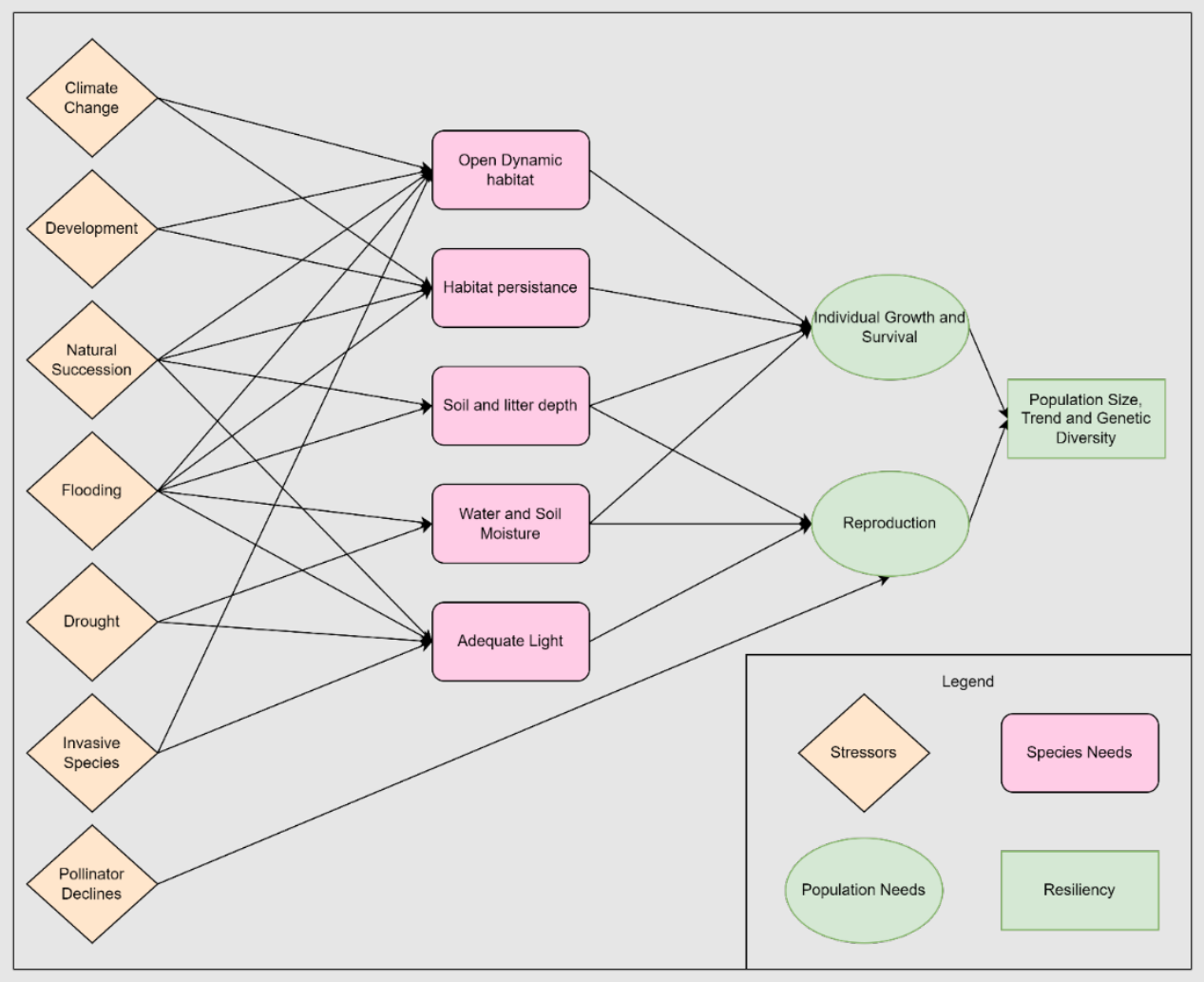

Figure 1. Dwarf lake iris core conceptual model (yellow diamonds are stressors, pink rectangles are species needs, green circles are population needs, and the green rectangle is resiliency).

The primary threat to DLI is human development of shoreline habitat (USFWS 2023, p. 12). Survey efforts in Michigan in the last 10–55 years have failed to find at least eight populations of DLI that historically occurred (Hackett et al. 2021, p. 27). All but one of these populations was near a roadside or a developing residential area, although it is unknown if anthropogenic stressors contributed to the decline of these populations. In the SSA, habitat persistence on the landscape was assessed through land ownership. We assumed that public lands or lands designated for conservation or preservation purposes (such as land held by land conservancies) were more likely to have management actions implemented and less likely to be developed than private lands. Therefore, we assumed habitat on public lands would be more likely to persist than habitat on private lands (USFWS 2023, p. 24). Of the 144 populations analyzed in the SSA, 41 are entirely on public land, 32 are on both public and private land or a conservation easement, and 71 are entirely on private land (USFWS 2023, pp. B1-B6).

To address the threats of invasive species and natural succession, the SSA looked at management actions that benefit DLI that are being implemented at some populations. Invasive species

control is taking place in at least 23 populations, which can help reduce competition and shading risk to DLI populations. Canopy cover manipulation to maintain appropriate light levels for DLI is occurring in at least 17 populations. At least one population in Ontario has been treated with prescribed burns to maintain habitat. Additional management actions may be taking place at other populations that we are unaware of (USFWS 2023, pp. 27-28).

While they could not be analyzed quantitatively, we also discussed the potential effects of flooding, drought, erosion, and deposition to DLI populations as the climate changes. DLI is a species adapted to growing in disturbed areas. Disturbance can often benefit a population by creating new habitat, setting back natural succession, and returning light and soil to a condition preferred by DLI. Disturbance can also cause a negative effect if it occurs at a frequency or intensity that does not allow time for regrowth and reestablishment of the population. Many factors, such as Great Lakes water levels, drought, erosion, and deposition, are expected to impact coastal habitats where DLI occurs at new severities and durations as the climate changes in the future. There is a great deal of uncertainty in understanding the risks posed by changing climate and how DLI may potentially respond (USFWS 2023, pp. 33-34, 42).

For additional information regarding DLI threats and how threats were considered in assessing the current and projected future condition of populations, see the SSA report (USFWS 2023, entire).

1.2.3 Current and Projected Future Condition

In the SSA, we assessed the current condition of DLI populations by using data on demographic and habitat conditions to determine the overall condition. Each demographic and habitat metric was assigned a condition of high, medium, or low, based on the criteria in Tables 1 and 2, which were correlated with a probability of persistence based on estimates in the near future (i.e., 5–10 years) (USFWS 2023, pp. 22–25). Overall, 19.4% (28) of populations have a high condition, 45.8% (66) have a medium condition, and 34.7% (50) of populations have a low condition for resiliency (Table 3 and Fig. 3). This means that in the near future, 65.2% of populations had an estimated probability of persistence that exceeds 60%, while 34.7% of populations had an estimated probability of persistence below 60% (USFWS 2023, p. 34).

Table 1. Criteria used to determine demographic condition of dwarf lake iris populations.

Condition	Abundance	Trend	Flowering Rate	Probability of Persistence (Estimate)[1]
	The number of individuals in the most recent count	Is population increasing, decreasing, or stable over at least three years	The potential for sexual reproduction to occur	
High	>25,000	Increasing	>33%	>90%
Medium	5,000–25,000	Stable	10–33%	60–90%
Low	<5,000	Decreasing	<10%	<60%

[1] Probability of persistence is an estimate based on expert opinion of persistence in the near future (i.e., 5–10 years).

Table 2. Criteria used to determine habitat condition of dwarf lake iris populations.

Condition	Light Availability	Resource availability (i.e., light, water, nutrients)	Habitat Persistence on Landscape	Probability of Persistence (Estimate)[2]
	Canopy Cover	Shading and competition risk from invasive species	Risk of land being developed as determined by land ownership	
High	20–50%	No invasives present	Land is entirely protected	>90%
Medium	10–20% or 50–80%	Herbaceous non-graminoid invasives present	Land is partially protected	60–90%
Low	<10% or >80%	Invasive shrubs or grasses present or herbaceous invasives prevalent	Land has no protection	<60%

Table 3. Summary of number of populations for DLI resiliency across representation units.

Overall Condition	East	Upper Straits	Lower Straits	West	Total
High	9	4	6	9	28
Medium	28	16	8	14	66
Low	23	10	7	10	50
Total	60	30	21	33	144

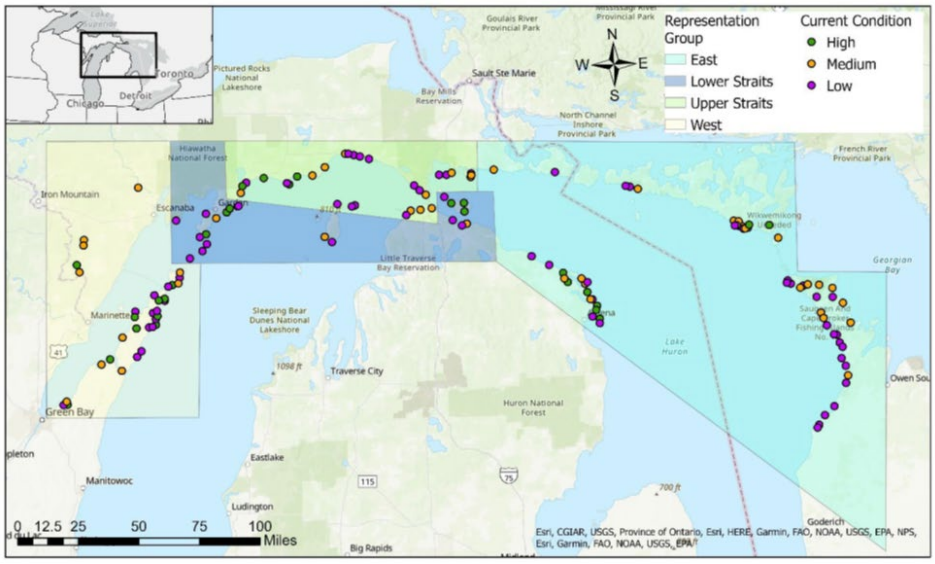

Figure 3. Overall current condition of extant and unknown dwarf lake iris populations across representation units.

[2] Probability of persistence is an estimate based on expert opinion of persistence in the near future (i.e., 5–10 years).

Three factors were assessed to determine the future habitat condition of a population: light availability, resource availability, and habitat persistence on the landscape. We forecasted future DLI habitat viability under three future scenarios (Table 4). Scenario One assumed a moderate level of climate change based on the IPCC Special Report on Emissions Scenario (SRES) B1 (Nakićenović et al. 2000, pp. 169–236) and that habitat management actions were implemented. Scenario Two assumed a moderate level of climate change based on SRES B1 with no habitat management actions. Scenario Three assumed more severe impacts of climate change based on SRES A2 (Nakićenović et al. 2000, pp. 169–236) with no habitat management actions. Scenarios were projected approximately 40 and 80 years out into the future based on information from NatureServe and DLI's ability to persist as rhizomes and in the seed bank (USFWS 2023, p. 30–35).

Table 4. Summary of habitat factor projections for future scenarios of U.S. dwarf lake iris populations (Forecasted Scenarios of Land Use Change (FORE-SCE), IPCC Special Report on Emissions Scenarios (SRES)).

Scenarios	Light Availability	Resource Availability	Habitat Persistence
Scenario One	Expected canopy cover manipulation + percent change in canopy cover as modeled for forest cover in FORE-SCE under SRES B1	Expected invasive species management + invasives in untreated areas remain at same prevalence	Percent change in development and agriculture in FORE-SCE under SRES B1
Scenario Two	Percent change in canopy cover as modeled for forest cover in FORE-SCE under SRES B1	Invasive species remain at same prevalence	Percent change in development and agriculture in FORE-SCE under SRES B1
Scenario Three	Percent change as modeled for forest cover in FORE-SCE under SRES A2	Invasive species increase in prevalence	Percent change in development and agriculture in FORE-SCE under SRES A2

In the future, for all scenarios, 8–12% of populations are projected to have a high condition, close to 55% a medium condition, and 30–33% a low condition for resiliency. Under all scenarios, at least 63% of populations are projected to have an estimated probability of persistence that exceeds 60%, and fewer than 38% of populations were projected to have an estimated probability of persistence below 60% (Fig. 4). All representation groups are expected to have at least 14 populations in a medium or high condition under all three scenarios (Fig. 5). Species representation is not at a high risk of being lost in the future under any of the scenarios. Species redundancy is expected to be minimally reduced in the future. Under the different scenarios, five to six populations may become extirpated, but this is not expected to shrink the range of the species (USFWS 2023, pp. 37–41).

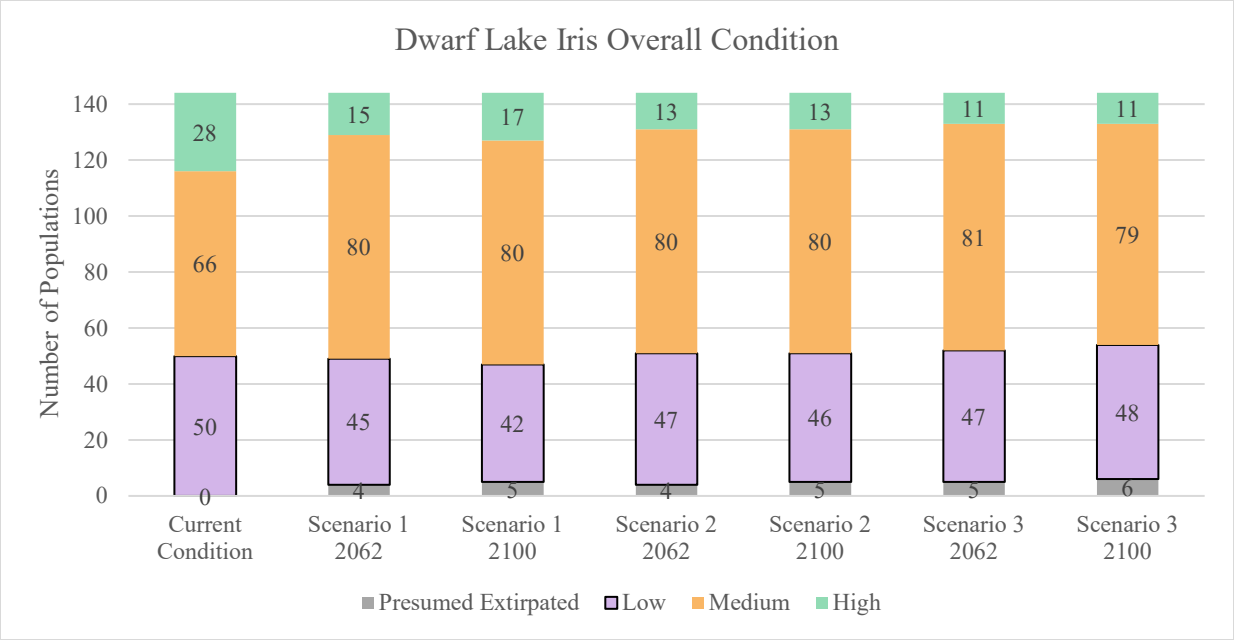

Figure 4. Overall condition of dwarf lake iris populations range wide under future scenarios.

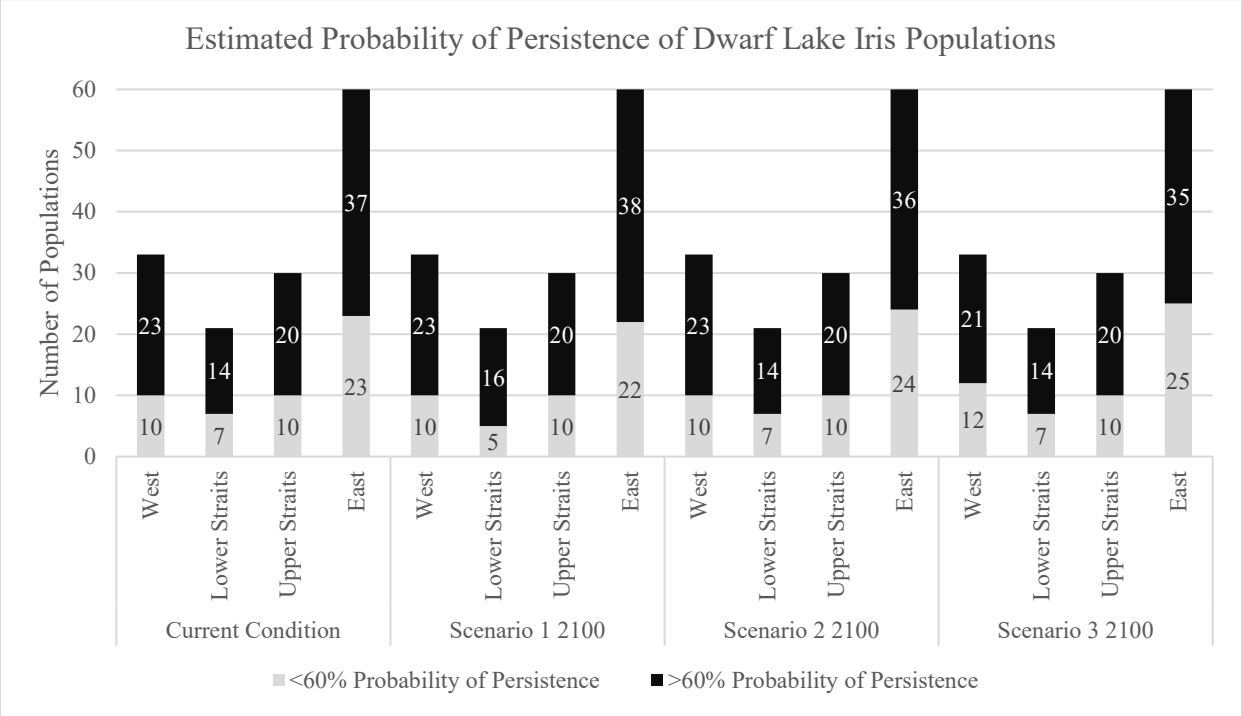

Figure 5. Estimated probability of persistence of dwarf lake iris populations by representation group under future scenarios.

1.2.4 Synthesis

DLI is a perennial plant species that is endemic to the Great Lakes region. The primary threats include habitat destruction and degradation and the encroachment of woody vegetation and invasive plant species. Additional stressors (climate change, drought, erosion, deposition, and

flooding) were considered in our analyses but could not be quantified or evaluated at an individual population level. It is estimated that the species has good viability and will be able to persist into the future due to the existence of high to moderately-resilient populations across the species range and within each representation unit.

The number of known populations of DLI has increased from 75 U.S. populations at the time of listing in 1988 to over 100 U.S. populations today, and protection status and ongoing management activities sustain stable populations at these sites. Currently, 144 populations of DLI are distributed across Michigan, Wisconsin, and Ontario where the species was historically known (Fig. 1). Twenty-eight populations are in high condition, 66 in medium condition, and 50 in low condition. These populations are spread across all four representation units: 60 populations in the East representation unit, 30 in the Upper Straits, 21 in the Lower Straits, and 33 in the West (Table 3). This geographic distribution of populations makes a catastrophic event eliminating all populations unlikely, and distribution across representation units enhances its ability to adapt to novel changes in its environment. Across DLI's range, 41 populations are entirely on public land and therefore more protected from land conversion. Of these populations, 6 are in high condition, 29 are in medium condition, and 6 are in low condition. Management that replicates natural disturbance processes (e.g., canopy manipulation, woody vegetation removal) at DLI populations minimizes the threat of encroaching dominant vegetation. Protection coupled with management will likely allow the species' condition to continue or improve at these sites into the future.

Although Recovery Criterion 1 has not been met as specified in the recovery plan, we believe that its intention has been met. In both future timeframes (approximately 40 and 80 years), At least 63% of populations are projected to have an estimated probability of persistence that exceeds 60%, and fewer than 38% of populations are projected to have an estimated probability of persistence below 60%. Significant progress towards achieving criterions 2 and 3 has been made in the last 5 years and, through the DLI conservation strategy, protection and management at DLI populations and outreach and education about DLI to the public will continue to increase.

In reviewing the current population status and future scenarios, we were able to assess whether the species rises to the definition of threatened or endangered throughout its whole range or a significant portion of its range. Currently, the species has multiple populations with moderate to high resiliency, high representation, and moderate redundancy. The majority of DLI populations are currently considered to be in medium or high condition. There are at least 144 populations of DLI spread across the range, and all representation groups have multiple populations currently ranked as high condition. Of these 144 populations, 19% are known to have active management. There are potentially sites that have management activities occurring at them that we are unaware of. Also, MDOT as well as some parks and preserves conduct routine maintenance activities that could benefit DLI (e.g., right-of-way, utility easement, and trail maintenance). Based on this information, it is recommended that the species no longer meets the definition of threatened or endangered throughout all or a significant portion of its range and that it be considered for delisting.

RESULTS
U.S. FISH AND WILDLIFE SERVICE
STATUS REVIEW of Dwarf Lake Iris *(Iris lacustris)*

Current Classification: Threatened

Status Recommendation resulting from Status Review:

____ Downlist to Threatened
____Uplist to Endangered
__X__ Delist (Indicate reasons for delisting per 50 CFR 424.11):
____The species is extinct
__X__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

Recommendation Team Meeting Information
A recommendation team meeting was held on July 11 and 12, 2023. The outcome of the meeting was a recommendation to delist DLI because it no longer met the definition of an endangered or threatened species. This recommendation was the result of the following rationale:

- The species currently has moderate to high resiliency, high representation, and moderate redundancy. The majority of populations (65%) are currently considered to be in medium or high condition. There are at least 144 populations of DLI spread across the range, and all representation groups have multiple populations currently ranked as high condition.
- Recommenders identified in their rationale that less than 12% of DLI populations have been lost since the species was listed. Core team members added further that there have been new populations discovered since the time of listing.
- About 60% of DLI populations are at least partially located on public land or land set aside for conservation purposes.
- Of the 144 populations assessed in the Species Status Assessment, about 19% were reported to have active management. One recommender felt that this level of management was not sufficient to make management a dominant factor in species recovery. One recommender felt this was an important factor in species recovery, as additional management for other purposes, such as right-of-way management along roadways and transmission lines, may also benefit the species.
- Under all future scenarios considered during the Species Status Assessment at least 63% of DLI populations were projected to have an estimated probability of persistence that exceeded 60%, and fewer than 38% of populations were projected to have an estimated probability of persistence below 60%. Under the different scenarios, five to six populations may become extirpated, but this is not expected to shrink the range of the species.
- While the unknown ability of the species to adapt to wide-ranging fluctuations, the effects of climate change, and the threats to the unique coastal habitat some populations occupy will likely continue to threaten the overall health of populations, DLI will likely be able to persist on the landscape under future conditions.

- After reviewing the current population statuses, recommenders agreed no portion of the species rises to the definition of threatened or endangered.

Based on this information, the recommenders concluded that DLI was not currently in danger of extinction and was not likely to become endangered within the foreseeable future throughout all or a significant portion of the species' range.

Delisting (Removal from list regardless of current classification) Priority Number: 4
Brief Rationale: The Service has not been petitioned to remove the species from the List of Threatened and Endangered Wildlife and Plants and the management burden entailed by the species being listed is moderate.

REGIONAL OFFICE APPROVAL:

Lead Assistant Regional Director, Fish and Wildlife Service

Approve LORI NORDSTROM Digitally signed by LORI NORDSTROM Date _____
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Personal Communications

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