A DRAFT Illinois

Species Status Assessment

for

French's Shootingstar (*Dodecatheon frenchii*)

Illinois Department of Natural Resources

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SECTION 1. SPECIES DESCRIPTION

Taxonomy

Dodecatheon frenchii (Vasey) Rydberg, known by the common name French's shootingstar, is a member of the primrose family (Primulaceae) (Reveal 2009). The species was named after George Hazen French, a biology professor at Southern Illinois University, who first discovered and collected the plant in 1870 from an area in southern Illinois that later became Giant City State Park (Voigt and Swayne 1955).

The taxonomic status of *D. frenchii* has received different treatments since its discovery. Some early treatments described the plant as *var. frenchii* of the widespread species *Dodecatheon meadia* Linnaeus (Vasey 1891, Fassett 1944). It was described as a unique species for the first time in 1932 (Rydberg). Please see Section 6 for additional discussion of the taxonomic uncertainty between these species.

Physical Characteristics

Details of physical characteristics presented here are cited from Reveal (2009). *D. frenchii* is a perennial herb. Leaves are produced in a basal rosette and typically measure 10 to 30 cm long by 4 to 8 cm wide. The leaves are spatulate to ovate in shape, and taper abruptly to a petiole. This is a primary morphological feature used to distinguish *D. frenchii* from *D. meadia*, as the leaves of *D. meadia* taper gradually to petioles. *D. frenchii* produces a flowering stem that is typically 20 to 40 cm tall, and which bears a 2 to 15-flowered umbel. Flowers contain 4-5 light green sepals and 4-5 petals that are usually white. Plants form seed capsules. Plants are generally glabrous throughout.

Habitat

D. frenchii shows high fidelity to a specific and localized habitat type. The plants are known to grown in shaded conditions underneath overhanging sandstone cliffs (Mohlenbrock and Voight 1959). Populations are generally observed growing under north and east facing sandstones cliffs, but it has been reported that they may occur under bluff exposures facing any direction (Voight and Swayne 1955, Timme and Lacefield 1991). *D. frenchii* is particularly associated with moist sandstone cliffs, usually growing directly under the drip line of overhanging cliffs (Timme and Lacefield 1991). While usually described as growing beneath sandstone overhangs, *D. frenchii* will also grow on moist, sheltered rock ledges ascending a short way up sandstone cliff or bluff features (Nelson 1979, personal observation by IDNR biologists). There are also infrequent reports of *D. frenchii* growing in open upland woods (Voight and Swayne 1955) or in sunlit areas some distance from their typical sandstone overhang habitat (Olah and DeFilipps 1969). The soils on which *D. frenchii* grows include unconsolidated, sandy, organic-poor soils derived from weathered sandstone, and may include unweathered loess as well (Kurz and Bowles 1981, Timme and Lacefield 1991).

Life History and Reproduction

D. frenchii typically produces its first leaves in February (Biotic Consultants 1976). Wild plants have been observed to flower in southern Illinois in March and April (Mohlenbrock 1978), while cultivated plants in central Illinois have flowered between late April and late May (Hill 2002). Seed maturation occurs through May and June, leaf senescence has usually occurred by early July, and seeds are dispersed from late June through late summer (Biotic Consultations 1976, Hill 2002). Possible methods of dispersal for the small seeds of this species include wind and water flow (Hill 2002).

D. frenchii does not seem to compete well with other plants, but rather appears to utilize its specific and demanding dripline habitat to avoid competition with other species. Cultivated plants have required bare soil and a minimum distance of 20-40 cm from other plants for growth (Hill 2002). In wild populations, bare, moist soil lacking leaf litter may be necessary for germination and populations will sometimes grow in homogenous clusters occupying appropriate habitat (Timme and Lacefiled 1991).

Conservation Status

At the global level, NatureServe has given *D. frenchii* a Global Conservation Status Rank of G3 (Vulnerable), a rank assigned to species that are "at moderate risk of extinction or collapse due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors" (NatureServe 2022).

In Illinois, *D. frenchii* was added as a threatened species to the Illinois Endangered and Threatened Species list on September 1, 2004. The reasons given for listing were that *D. frenchii* has a "very restricted geographic range of which IL is a part" and "restricted habitats or low [populations] in IL" (Mankowski 2012). NatureServe has assigned *D. frenchii* a Subnational Conservation Status Rank of S1 (Critically Imperiled) for the state of Illinois. *D. frenchii* has also received the following Subnational Conservation Status Ranks for the other states in which it is present: S1 (Critically Imperiled) – Alabama and Missouri; S2 (Imperiled) – Arkansas; and S3 (Vulnerable) – Indiana and Kentucky (NatureServe 2022) (Figure 1). As the species is most frequent in Illinois (Hill 2002), the NatureServe subnational rank for the state of Illinois may be deserving of revision.

D. frenchii is included as a Regional Forester Sensitive Species for Region 9 of the U.S. Forest Service, where it occurs in both the Shawnee and the Hoosier National Forests (USFS 2012).

SECTION 2. DISTRIBUTION

North American Range

D. frenchii occurs in the midwestern and southeastern United States, where it is known from the following six states: Alabama, Arkansas, Illinois, Indiana, Kentucky and Missouri (Hill 2002, NatureServe 2022). Previous reports from additional states that were shown to be incorrect have come from Pennsylvania and Minnesota (Fassett 1944, Voight and Swayne 1955) and from Wisconsin (Iltis and Shaughnessy 1960).

Illinois Distribution

D. frenchii occurs in Illinois only in the southern portion of the state, below the southern extent of Pleistocene glaciation; here it occurs within an east-west belt about 10-miles wide known as the [redacted] (Fassett 1944, Voight and Swayne 1955). Every known population of *D. frenchii* in Illinois occurs within, or within 1 mile of, the [redacted] of the Shawnee Hills Natural Division (Schwegman 1973). Illinois populations are currently known, or were recorded historically, from the following counties: Hardin (not seen since 1948), Jackson, Johnson, Pope, Saline (2020 observation requires confirmation of species identity), and Union (Figure 2).

Limitations of Surveys and/or Data Reporting

D. frenchii is a recognizable, well-known, and charismatic species within the Illinois botanical community, and there are a number of natural resource professionals and hobbyists who conduct surveys for *D. frenchii* in southern Illinois. The species' very specific affinity for sandstone cliff overhangs means that surveys can be conducted effectively to determine if the species is present in a specific area, provided that surveys can be completed during the spring months. Within the [redacted], there are certainly areas that, due to rugged terrain, poor access, or private land ownership, have the potential to contain populations of *D. frenchii* that have not yet been documented; however, due to the recognizability of the species, its habitat requirements, and its apparent fidelity in Illinois to the sandstone features of the [redacted], it seems very likely that the known overall extent and distribution of the species in Illinois is accurate.

It can be difficult to conduct highly precise surveys and counts of *D. frenchii* populations that are distributed amongst many subpopulations across a complex and rugged system of cliffs and ravines. See further comments in Sections 3 and 4 about the precision with which *D. frenchii* has been surveyed and tracked in Illinois.

SECTION 3. POPULATION IDENTIFICATION

This assessment identifies unique populations as those tracked in the Illinois Natural Heritage Database (NHD) as unique Element Occurrences (EOs), which are used by NatureServe as a surrogate for populations for a variety of biodiversity and conservation tracking purposes. Guidance for the delineation of unique Element Occurrences is provided by NatureServe and implemented by the Illinois NHD. One element of this delineation is a minimum separation distance that is used to separate EOs. For *D. frenchii*, NatureServe uses a default minimum separation distance of 1-kilometer, so that populations separated by greater than 1-kilometer are treated as separate EOs (NatureServe 2022).

D. frenchii occupies a unique and discreet habitat in sandstone overhangs. The species may grow in a locally patchy distribution as plants occupy discreet overhangs that occur intermittently along an extended sandstone cliff line. Populations may also be dispersed across wider areas, growing along cliffs on either side of a stream valley or growing in multiple drainages in a steeply dissected landscape. In cases like this, it may be practically and biologically beneficial to treat local and discreet groups of plants as separate populations, or subpopulations. Some biologists who have conducted monitoring for this species in southern Illinois have followed this approach. The 1-kilometer minimum separation distance used by NatureServe is a much coarser method for delineating populations. As a result, EOs tracked in the Illinois NHD often aggregate groups of plants that could potentially be treated as separate populations or subpopulations. While monitoring data from these smaller subpopulations is, to a degree, tracked separately within EOs in the NHD, the monitoring and observation records at the subpopulation level are not always clearly delineated within the database. Therefore, while this assessment currently uses EOs, it may be beneficial in future development of this document to attempt to separate EOs into more discreet populations and subpopulations. Similar comments regarding population identification for conservation purposes were made by Hill (2002).

SECTION 4. NUMBER OF POPULATIONS AND ABUNDANCE

22 populations (EOs) of *D. frenchii* are tracked in the Illinois NHD. Of these, 17 have been observed in the last ten years (since 2012) and for all of these the population was successfully located in the most recent survey attempt. Of the five populations not observed in the last ten years, two were surveyed for unsuccessfully in 2013 and three have not had a survey effort recorded in the Illinois NHD in more than 40 years.

Of the 17 populations observed in the last ten years, 13 have had a population size of 100 plants or more recorded since 2018. Survey notes for these populations generally indicate that populations are healthy and robust. Many of these populations contain several subpopulations. Exact counts of the number of plants are not always made for these populations; instead, monitors have often indicated that there are "many" or "hundreds" of plants spread across several subpopulations. The largest population size specifically identified for a single EO was 2,957 individual plants counted among 22 subpopulations at [redacted] in Johnson County.

The Saline County population added in 2020 to the Illinois NHD requires confirmation of the species identity and should be considered as tentative.

SECTION 5. POPULATION VIABILITY

NatureServe has developed a system of EO Ranks to serve as a viability estimate for EOs. Using criteria provided by NatureServe (2020), each Illinois population of *D. frenchii* was assigned an EO Rank by Stephen Tillman (Natural Resources Specialist, Division of Natural Heritage, Illinois Department of Natural Resources) in October 2022. These EO Ranks are reported in Table 1.

Of the 22 Illinois populations, 13 were given at least a partial rank of A (Excellent Viability) or B (Good Viability). These populations were judged to be robust and/or apparently stable, and their rating indicates an assessment that these populations are likely to very likely to persist for the foreseeable future (approximately 20-30 years). Two populations were given a sole rank of C (Fair Viability), indicating that there is a reasonable likelihood of persistence, but that the small population size or the presence of immediate threats to the populations cause uncertainty in projecting their future size and persistence. The remaining seven populations were given ranks of E (Verified Extant), H (Historical), or NR (Not Ranked) due to the absence of sufficient data and/or recent observation records necessary to rank them otherwise.

These rank assessments would benefit from consideration and revision by other botanists familiar with the status of *D. frenchii* in Illinois.

SECTION 6. PAST RESEARCH AND CONSERVATION ASSESSMENTS

There has been a great deal of previous research examining taxonomic uncertainty within the genus *Dodecatheon*, and several publications have investigated the distinction between *D. frenchii* and *D. meadia*. Early studies conducted greenhouse and transplant experiments to examine differences in leaf shape between *D. frenchii* and *D. meadia*, as well as the phenotypic plasticity of these traits and their implications for making taxonomic distinctions (Fassett 1944, Voigt and Swayne 1955).

Olah and DeFilipps (1968) showed that *D. frenchii* is diploid (2*n* = 44) while *D. meadia* is tetraploid (2*n* = 88).

Oberle and Esselman (2011) presented evidence for significant differences in seed characteristics, particularly in seed shape, between these species. These seed differences may be paired with differences in leaf shape to provide a reliable means to distinguish these species based on morphology. However, the authors in this study also investigated *Dodecatheon* populations occurring in habitats that were intermediate between the open forested habitats preferred by *D. meadia* and the cliff overhangs preferred by *D. frenchii*. Plants in these populations showed evidence of intergradation and morphological variability between the two species, indicating the possibility of gene flow between species through introgressive hybridization.

Oberle and Schaal (2011) conducted a genetic comparison between species of *Dodecatheon* in eastern North America. They found no significant genetic differentiation between *D. frenchii* and *D. meadia*, indicating that *D. frenchii* does not belong to its own distinct evolutionary lineage. Rather, their results suggest that the differences in morphology and habitat between these species are the result of divergent local adaptation to specific microclimates, which has occurred since the last glacial maximum. These authors also identify evidence for the importance of genetic introgression in the evolutionary history between these species.

For a Conservation Assessment of *D. frenchii* which covers many of the topics discussed here in greater detail, as well as providing additional relevant literature, please see Hill (2002).

SECTION 7. CURRENT RESEARCH, MONITORING, AND DATA NEEDS

As previously discussed, the relatively robust size of many *D. frenchii* populations, and in some cases their distribution across several subpopulations, complicates efforts to monitor and track this species. As a result, there is not a high level of precision in the way that some monitoring efforts are conducted and the way in which EOs are tracked in the NHD. This may be sufficient for current efforts to monitor the status and distribution of this species; however, more precise monitoring and record keeping would be necessary to conduct rigorous tracking of population trends and local distribution.

There has been a sentiment among some botanists in southern Illinois that the status of *D. frenchii* in Illinois may be secure enough to warrant downgrading its status as state-threatened and removing it from the Illinois Endangered and Threatened Species. This Species Status Assessment will be updated if such a proposal is initiated.

SECTION 8. FIGURES

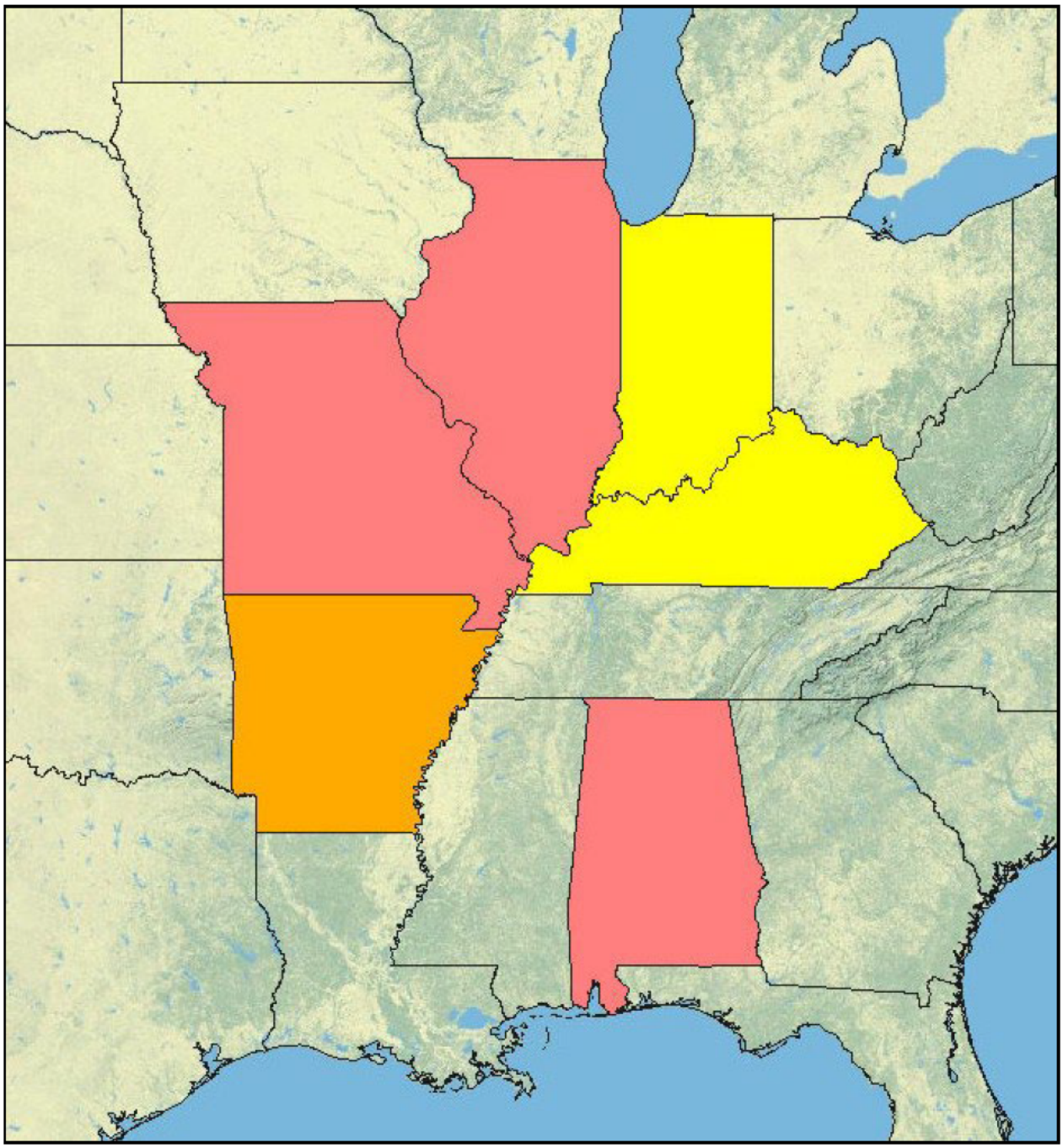

Figure 1. Global and national distribution of French's shootingstar (*Dodecatheon frenchii*). Shaded colors reflect the Subnational Conservation Status Rank assigned by NatureServe for each state within which *D. frenchii* occurs (NatureServe 2022). The status ranks indicated by each color are as follows: Red – S1 (Critically Imperiled); Orange – S2 (Imperiled); Yellow – S3 (Vulnerable).

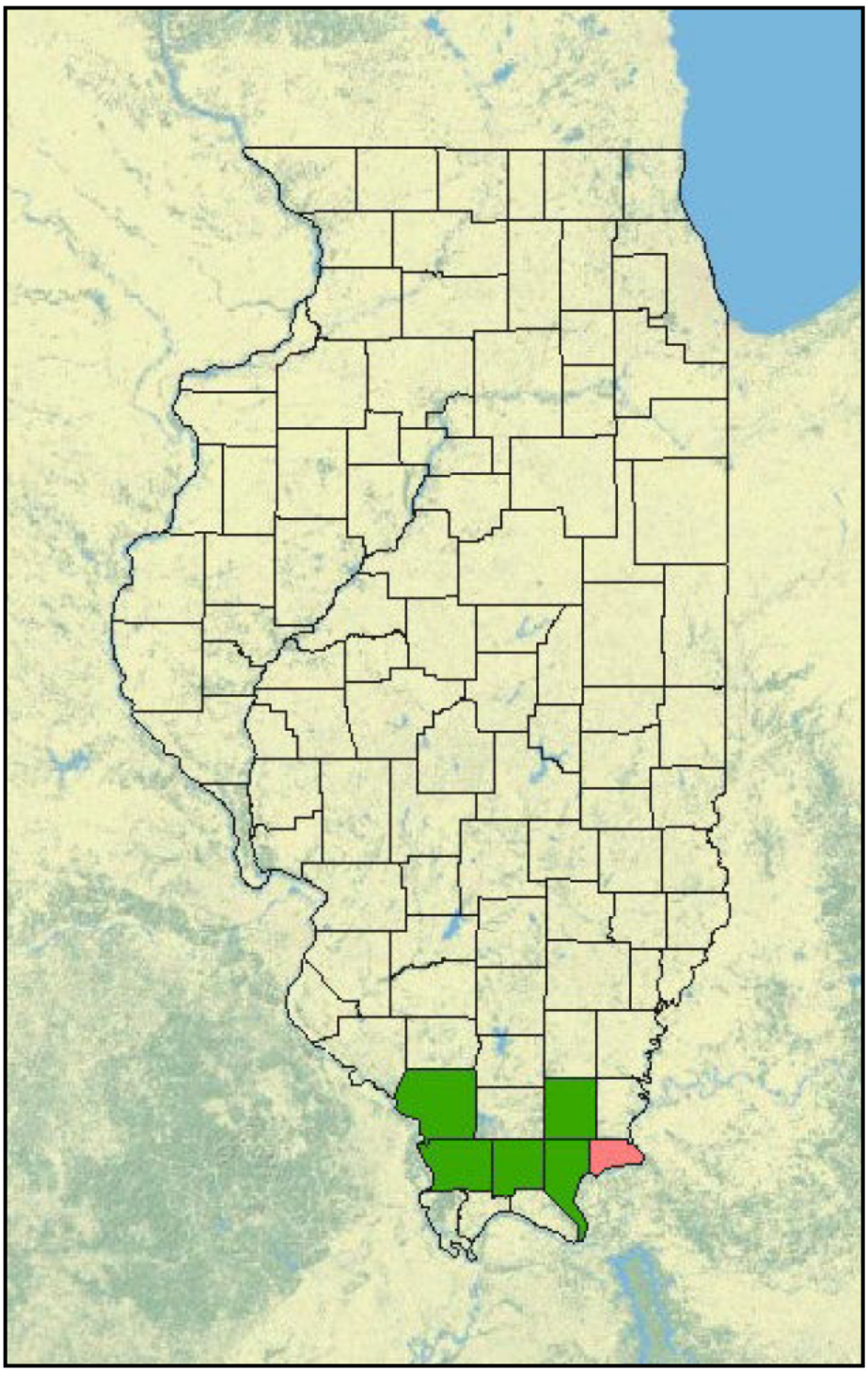

Figure 2. Distribution of counties in Illinois from which French's shootingstar (*Dodecatheon frenchii*) has been reported. Counties in which *D. frenchii* has been observed in the last ten years are shown in green. Counties in which *D. frenchii* has been observed historically, but not in the last ten years, are shown in red.

SECTION 9. TABLES

Table 1. Description of French's shootingstar (*Dodecatheon frenchii*) sites, including information about the first observation year, most recent observation year, the largest population size that has been observed, and EO Rank. Data are sorted by EO Rank, from highest population viability to lowest. Data were obtained from the Illinois Natural Heritage Database.

EO_ID	County	Contains Subpopulations	First Observation Year	Most Recent Observation Year	Largest Number Observed	EO Rank[a]
6895	Johnson	Yes	1902	2022	More than 1000	A
7481	Johnson	Yes	1948	2020	Almost 3000	A
6666	Jackson	Yes	1951	2020	Hundreds	AB
7485	Pope	Yes	1948	2020	Hundreds	AB
8706	Jackson	Yes	2011	2020	Hundreds	AB
7863	Union	Yes	1978	2019	Hundreds	AB
6899	Pope	No	1952	2018	Hundreds	AB
6775	Union	Yes	1983	2022	Hundreds	B
6792	Johnson	Yes	1961	2021	Hundreds	B
7510	Pope	Yes	1974	2020	Hundreds	B
8450	Johnson	Unknown	2010	2022	100	BC
7861	Johnson	Yes	1948	2021	65	BC
12228	Johnson	No	2020	2020	100	BC
7864	Jackson	Yes	1870	2022	170	C
7480	Jackson	No	1948	2020	30	C
7484	Johnson	No	1969	2013	Not recorded	E
7486	Pope	No	1981	1981	Not recorded	H
7862	Jackson	No	1978	1978	Not recorded	H
7868	Jackson	No	1956	1956	Not recorded	H
7866	Johnson	No	1951	1951	Not recorded	H
7479	Hardin	No	1948	1948	Not recorded	H
12341	Saline	No	2020	2020	Dozens	NR[b]

a The EO Rank categories assigned to *D. frenchii* are as follows: A - Excellent Viability; B - Good Viability; C - Fair Viability; E - Verified Extant; H - Historical; NR - Not Ranked

b Population requires verification that species identity is correct

SECTION 10. REFERENCES

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