

# Conservation Assessment for *Calypso bulbosa* Fairy Slipper



*Calypso bulbosa*  
[Fairy Slipper]

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This Conservation Assessment/Approach was prepared to compile the published and unpublished information on the subject taxon or community; or this document was prepared by another organization and provides information to serve as a Conservation Assessment for the Eastern Region of the Forest Service. It does not represent a management decision by the US Forest Service. Though the best scientific information available was used and subject experts were consulted in preparation of this document, it is expected that new information will arise. In the spirit of continuous learning and adaptive management, if you have information that will assist in conserving the subject taxon, please contact the Eastern Region of the Forest Service Threatened and Endangered Species Program at 310 Wisconsin Avenue, Suite 580 Milwaukee, Wisconsin 53203.

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## **EXECUTIVE SUMMARY**

This Conservation Assessment provides information pertaining to the life history, habitat, distribution and abundance, viability and potential threats, and future monitoring of fairy slipper (*Calypso bulbosa*).

*Calypso bulbosa* is a perennial orchid that is 5-20 cm tall with a yellowish-purple stem originating from a rounded or oval solid bulb. A single basal leaf at the base of the stem grows in late summer and overwinters until the next flowering season in May. The solitary flower has five purple petals, 1-2 cm long and a sac-like lip about 2 cm long. The back of the lip is translucent white and spotted with purple, the front is crested with three rows of yellow hairs.

Fruiting capsules are set in June and July, but according to Case (1987), are rarely produced in the Great Lakes region. Reproduction is primarily by rhizomes at the base of the tuber (Mousely 1924).

*Calypso bulbosa* is principally associated with northern white cedar - growing in the shaded duff with little or no herbaceous competition over a metamorphic and igneous bedrock parent material, with calcium accumulated from ground springs [Fewless (pers. comm., March 2003)]. In bogs, it can occur on stumps, logs, hummocks of drier soil, or slopes, but does not occur in soggy soils (Case 1987).

*Calypso bulbosa* is palearctic in distribution, and occurs in twenty of the forty-eight contiguous states and all of the Canadian provinces. It is considered a Threatened Species in Wisconsin and occurs across the northern third of Minnesota. A Michigan Natural Features Inventory Abstract references *Calypso* distribution as wide-spread in the northern Lower Peninsula and the Upper Peninsula of Michigan, with 100 location records of *Calypso bulbosa* [Fashoway (pers. comm., March 2003)]. The Ottawa National Forest does not consider *Calypso bulbosa* widespread, “widely distributed with sites across the whole UP maybe, but certainly not abundant” [Trull (pers. comm., August 2003)].

This species is designated as a Regional Forester Sensitive Species on the Chippewa, Chequamegon-Nicolet, Hiawatha, Ottawa and Superior National Forests. Although this species is widespread, abundant and secure globally, there are concerns for its viability at the southern edge of its North American range and specifically in the Great Lakes Region. Human impact from recreation, plant collection and photography may impact viability. Habitat references indicate a preference for old growth habitats with canopy closures greater than 60%, so any impact that increases canopy openings can be a threat.

## **ACKNOWLEDGEMENTS**

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- Department of Natural Resources Ecological Services - Steve Wilson
- Wisconsin Biomapper
- Wisconsin Department of Natural Resources Natural Heritage Inventory
- University of Minnesota – J. F. Bell Museum of Natural History Herbarium
- Linda Parker, Forest Ecologist Chequamegon-Nicolet National Forest
- Jack Greenlee, Forest Plant Ecologist, Superior National Forest (also provided Chippewa National Forest data)
- Craig Anderson, Wisconsin DNR – Bureau of Endangered Resources
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- Steven Spickerman, Chequamegon-Nicolet National Forest
- Gary Fewless, Cofrin Center for Biodiversity, U of Wisconsin – Green Bay
- Andy Clark, Wisconsin State Herbarium Records

## **NOMENCLATURE AND TAXONOMY**

Classification:

Kingdom	- Plantae – Plants
Subkingdom	- Tracheobionta – Vascular plants
Superdivision	- Spermatophyta – Seed plants
Division	- Magnoliophyta – Flowering plants
Class	- Liliopsida – Monocotyledons
Subclass	- Liliidae –
Order	- Orchidales –
Family	- Orchidaceae – Orchid family
Genus	- Calypso Salisb. – Fairy slipper
Species	- Calypso bulbosa (L.) Oakes – fairy slipper
Variety	- Calypso bulbosa (L.) Oakes var. americana - (R. Br. ex Ait. f.) Luer –fairy slipper

This is the only species in the genus *Calypso*. *Calypso bulbosa* v. *occidentalis* is a variety that occurs in western North America.

## **DESCRIPTION OF SPECIES**

The Natural Resource Conservation Service Plant database ([http://plants.usda.gov/cgi\\_bin/topics.cgi](http://plants.usda.gov/cgi_bin/topics.cgi)) references 96 North American genera in *Orchidaceae*, and 1 species in *Calypso*. “This species is a perennial plant 5-20 cm tall, from a rounded or oval, solid bulb. The stem is yellowish-purple to brownish-purple, delicate and covered with small, membranous, sheathing scales. There is a single leaf on a slender 3-angled stalk. It is oval to rounded and egg-shaped with a blunt to rounded and pointed tip and rounded or slightly heart-shaped base; 2-6 cm long, 2-5 cm wide; bluish green and veiny with wavy margins.”

The small, solitary flower has five purple petals and is 1-2 cm long with a sac-like lip about 2 cm long. The back of the lip is translucent white and spotted with purple, and the front is crested with three rows of yellow hairs. The lowermost saccate portion is whitish with red-brown to purple markings within and has two conspicuous horns at the base. Fruit are capsule-like, erect, and about 1.25 – 2.5 cm long. (Michigan Natural Features Inventory 1996).

*Calypso*'s common name “fairy slipper” may refer to the shape of the flower resembling a shoe for a fairy, or the “fairy slipper” may be an indication of the delicate root systems impacted by slight disturbances. The delicate root systems are easily impacted in flower collection processes, possibly causing mortality (Legasy 1995). The genus *Calypso* is named for the beautiful nymph in Homer's *Odyssey* who waylaid Ulysses on his return to Ithaca. The specific epithet *bulbosa* is the Latin meaning "bulbed," in reference to the small pseudobulb of this species (Correll 1950).

## **LIFE HISTORY AND ECOLOGY**

*Calypso bulbosa* blooms with a single flower in May to late June depending upon location. A solitary leaf emerges in late August, overwinters, and then senesces shortly after blooming. Fruiting capsules are set in June and July, but according to Case (1987), are rarely produced in the Great Lakes region. Reproduction is primarily by rhizomes at the base of the tuber (Mousely 1924). In late summer, a new leaf emerges and remains green throughout the winter until the next flowering season.

Mosquin (1970) reports densities of this species from single occurrences up to fifty plants per square foot. Dormancy from one to two years has also been reported possibly contributing to the varying densities and spatial distribution.

Due to the relative positions of the anther and stigma surfaces, external pollination is required. *Calypso* is pollinated by a number of species of bumblebees (Mosquin 1924). The yellow anther-like bristles attract bees, but they produce no pollen.

In a 1999 Draft Species Data Record for Region 9 of the US Forest Service, Mason cites Mosquin's (1970) studies on pollination of *Calypso bulbosa*:

*“When a bee tries to enter the flower, pollinia sticks to the bee’s hairy thorax as it presses against the deciduous anther. Due to the size of the flower, most bees can only enter halfway. At that point, the thorax is in the right place to contact the sticky stigma. Finding that the flower has no nectar, the bee backs out, either leaving the pollinia on the stigma or carrying it to the next flower. Pollinia may remain on the insect for many days. Soon, however, the bee abandons Calypso plants, due to the lack of nectar. They are therefore, seldom seen visiting the plants (Mosquin). The plant has highly derived pollen packaging, four waxy flake-like pollinia arranged in two pairs, one pair larger than the other, all attached to one sticky base. The entire group of pollinia is removed by one pollinator, and pollen may be deposited as one, two, three or four pollinia. The amount of pollen deposited on the stigma significantly affected seed production, where the difference was due to greater seed production by flowers pollinated with two pollinia compared with those that received one-half of a pollinium. Unpollinated flowers last long, remaining fresh for three weeks. According to Proctor and Harder, deposition of pollen results in dramatic changes in shape and color of the flower within four days, compared to eight to eleven days for flowers that had the pollinia removed but none deposited. Pollen receipt, but not pollen removal alone, seemed to induce floral senescence. Since removal of the pollinia is more likely to occur than its deposition on the stigma, this sequence stalls senescence of the plant until after pollination. Calypso seems to be dependent on the presence of other flowers blooming in the area to bring in pollinators.”*

### HABITAT

The U.S. Fish and Wildlife Service (NaturServe Explorer 2003) assigned the wetland indicator status for *Calypso bulbosa* as Facultative Wetland throughout its range in the U.S., indicating that it usually occurs in wetlands (estimated probability 67%-99%), but occasionally is found in non-wetlands.

*Calypso bulbosa* is principally associated with northern white cedar - growing in the shaded duff with little or no herbaceous competition over calcareous bedrock parent material. In bogs, it can occur on stumps, logs, hummocks of drier soil, or slopes, but does not occur in soggy soils (Case 1987). *Calypso* is found in closed canopy forest with at least 60% cover and cool soils, intolerant of soil temperatures higher than 15 degrees C (Caljouw 1981).

Table 1 shows occurrence data from the Bell Herbarium for sites within the Chippewa and Superior National Forests

**Table 1: Habitat data for *Calypso bulbosa* collected in the Superior and Chippewa NF**

Collection Year	Forest	Description of Habitat
1926	Chippewa	In Woods
1991	Chippewa	In localized pocket of cedar isolated from main wetland by a small <i>Abies</i> ridge. With <i>Platanthera obtusata</i> , <i>Corallorhiza trifida</i> , <i>Smilacina trifolia</i>
1992	Chippewa	Plants growing in a swamp forest dominated by <i>Thuja occidentalis</i> . Assoc. with <i>Mitella nuda</i> , <i>Coptis groenlandica</i> , <i>Pyrola secunda</i> .  Plants growing in a swamp forest dominated by <i>Thuja occidentalis</i> . Assoc. with <i>Cypripedium calceolus</i> var. <i>parviflorum</i> , <i>Moneses uniflora</i> , <i>Mitella nuda</i> .  Plants growing in a swamp forest dominated by <i>Thuja occidentalis</i> . Assoc. with <i>Pyrola secunda</i> , <i>Moneses uniflora</i> , <i>Halenia deflexa</i> .  Habitat: Plants growing in a swamp forest dominated by <i>Thuja occidentalis</i> . Assoc. with <i>Mitella nuda</i> , <i>Coptis groenlandica</i> , <i>Moneses uniflora</i>

1994	Chippewa	<p>Habitat: Conifer swamp. <i>Thuja occidentalis</i>; associated with <i>Coptis groenlandica</i>, <i>Carex leptalea</i>, <i>C. pedunculata</i>, <i>Trientalis borealis</i>, <i>Clintonia borealis</i>.</p> <p>Habitat: Conifer swamp. <i>Thuja occidentalis</i>; associated with <i>Maianthemum canadense</i>, <i>Mitella nuda</i>, <i>Platanthera obtusata</i>, <i>Trientalis borealis</i>, <i>Cornus canadensis</i>.</p> <p>Habitat: Conifer swamp. <i>Thuja occidentalis</i>; associated with <i>Smilacina trifolia</i>, <i>Coptis groenlandica</i>, <i>Listera cordata</i>, <i>Aralia nudicaulis</i>, <i>Rubus pubescens</i>.</p> <p>Habitat: Plants occur in a lowland forest dominated by <i>Thuja occidentalis</i>. Associated with <i>Corallorhiza striata</i>, <i>C. trifida</i>, <i>Carex disperma</i>, <i>C. castanea</i>.</p> <p>Habitat: Plants occur in swamp forest dominated by <i>Thuja occidentalis</i>. Associated with <i>Listera cordata</i>, <i>Goodyera repens</i> var. <i>ophioides</i>, <i>Platanthera obtusata</i>, <i>Moneses uniflora</i></p> <p>Habitat: Plants occur in a swamp forest dominated by <i>Thuja occidentalis</i>. Associated with <i>Listera cordata</i>, <i>Goodyera repens</i> var. <i>ophioides</i>, <i>Moneses uniflora</i>, and <i>Ribes hudsonianum</i>.</p> <p>Habitat: Plants occur in a swamp forest dominated by <i>Thuja occidentalis</i>. Associated with <i>Listera cordata</i>, <i>Goodyera repens</i> var. <i>ophioides</i>, <i>Platanthera obtusata</i>, <i>Cypripedium reginae</i>.</p> <p>Habitat: Plants occur in a swamp forest dominated by <i>Thuja occidentalis</i>. Assoc. with <i>Corallorhiza trifida</i>, <i>Moneses uniflora</i>, <i>Lonicera canadensis</i>, <i>Equisetum scirpoides</i>.</p> <p>Habitat: Plants occur in a swamp forest dominated by <i>Thuja occidentalis</i>. Associated with <i>Cypripedium reginae</i>, <i>Rubus acaulis</i>, <i>Listera cordata</i>, <i>Mitella nuda</i>.</p> <p>Habitat: Plants occur in a swamp forest dominated by <i>Thuja occidentalis</i>. Associated with <i>Fraxinus nigra</i>, <i>Mitella nuda</i>, <i>Coptis groenlandica</i>, <i>Trientalis borealis</i>, <i>Cornus canadensis</i>.</p>
1940 1944 1945	Superior	<p>Habitat: In moss along a creek</p> <p>Habitat: Wooded slope</p> <p>Habitat: Shaded steep slopes</p>
1998	Superior	<p>Habitat: Decadent, semi-open forest of <i>Populus tremuloides</i>, <i>Betula papyrifera</i>, <i>Thuja occidentalis</i> and abundant dead/down <i>Abies balsamea</i>.</p>

The Wisconsin Herbarium gives a generalized description of the habitat at specimen collection sites (see Appendix II) representative of Northern Wet Mesic Forest, restricted to old growth white cedar swamps. Detailed habitat reference from Andy Clark characterizing a 1996 collection as follows:

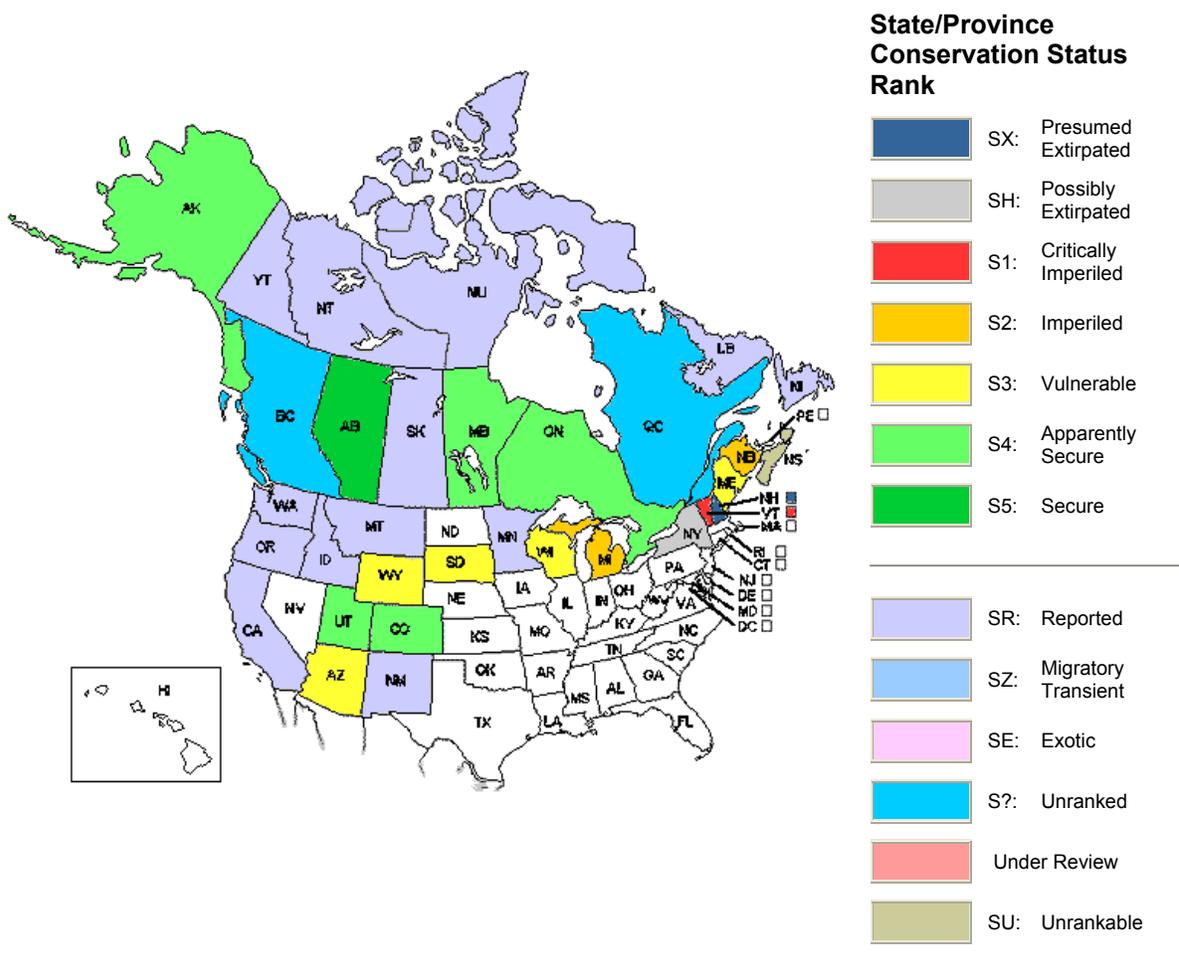
*“Old growth white cedar swamp with balsam fir, white & black spruce, tamarack, Fraxinus nigra, Alnus incana, Rhamnus alnifolia, Ledum, Sphagnum, Mitella nuda, Gymnocarpium, Moneses uniflora, Pyrola secunda, Luzula acuminata, Smilacina trifolia, Coptis trifolia, Carex trisperma, C. disperma, C. vaginata, Clintonia borealis, Ranunculus lapponicus, Ribes hudsonianum.”*

*Calypso bulbosa* habitat on the Chequamegon-Nicolet National Forest includes calcareous substrates underlain by the edge of the Niagara Escarpment and the more acidic swamps in the western half of the Forest [Spickerman (pers.comm., April 2003)].

In Michigan fairy slipper appears to occur in a wider range of habitats than in Wisconsin and Minnesota. Habitats in Michigan include coniferous woods (fir and cedar, spruce and fir, hemlock) mixed damp woods of conifers and hardwoods (Voss 1972), and dry *Thuja-Pinus-Abies* woods over limestone/dolomite along the Lake Superior/Lake Michigan shores (MNFI 1996). Michael Fashoway, Information Technology Professional (Conservation and GIS) for the Michigan Natural Features Inventory provided detailed location information and general habitat for 100 occurrences of *Calypso bulbosa*. Specific locations of these species cannot be published in this document, in the interest of protecting the species, but general habitat information including township and range is shown as Appendix III.

#### **DISTRIBUTION, ABUNDANCE AND STATUS**

*Calypso bulbosa* is palearctic in distribution. In the US, it extends south to California, Arizona and New Mexico, but is not present in Nevada. *Calypso* is present in South Dakota and Minnesota, but not in North Dakota. Range extends from Minnesota eastward to the Northern New England States. In Canada, *Calypso* occurs in all Canadian provinces with varying Heritage Status Ranks.



The Map references the State/Province Conservation Status Rank and shows the North American Distribution of *Calypso bulbosa*

A Global Heritage Status Rank of G5 has been assigned to *Calypso bulbosa*. According to the Natureserve website, the rank data is defined as:

*“The conservation rank of an element known or assumed to exist within a jurisdiction is designated by a whole number from 1 to 5, preceded by a G(Global), N(National), or S(Subnational) as appropriate. The numbers have the following meaning:*

- 1 = critically imperiled*
- 2 = imperiled*
- 3 = vulnerable to extirpation or extinction*
- 4 = apparently secure*
- 5 = demonstrably widespread, abundant, and secure.*

The G5 rank indicates that *Calypso bulbosa* is widespread, abundant and secure in its global distribution. *Calypso bulbosa* has the following State/Province Conservation Status Rank located at NatureServe Explorer 2001 as shown in Table 2.

**Table 2: State and Province Rank of *Calypso bulbosa***

State or Province	Status Ranking	Definition of Status
NH,	SX	Presumed Extirpated
NY	SH	Possibly Extirpated
VT	S1	Critically Imperiled
MI, Canada: NB,	S2	Imperiled
AZ, ME*,SD, WI, WY Canada	S3	Vulnerable *Borderline status (S3S4)
AK, CO, , UT Canada: MB, ON*	S4	Apparently Secure *Borderline status (S4S5)
Canada: AB,	S5	Secure
Navajo Nation Canada: BC, QC	S?	Unranked
Canada: NS	SU	Unrankable
CA, ID, MN, MT, NM, OR, WA Canada: NL, NT, NU,SK, YT	SR	Reported

This species is designated as a Regional Forester Sensitive Species on the Chippewa, Chequamegon-Nicolet, Hiawatha, Ottawa, and Superior National Forests.

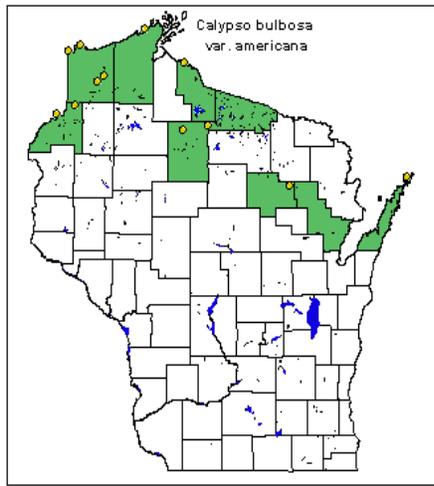
**Minnesota Distribution:**

*Calypso bulbosa* is found in the northern third of Minnesota. The University of Minnesota-Bell Museum Herbarium has forty-two specimens representing twelve counties as shown in table 3. Sixteen of these occurrences were on the Chippewa National Forest and four were located on the Superior National Forest.

<b>Table 3. Minnesota Counties with <i>Calypso bulbosa</i> sample</b>	<b># collection sites</b>
Aitkin	2
Beltrami	3
Carlton	3
Cass	8
Clearwater	4
Cook	5
Itasca	7
Koochiching	1
Lake	1
Lake Of The Woods	1
Roseau	2
St Louis	5

**Wisconsin Distribution:**

*Calypso bulbosa* was listed as Threatened in Wisconsin on August 1, 1989. The Wisconsin distribution map, originally published by the Wisconsin herbarium, was shown at the Natural Resource Conservation Service Plant database website ([http://plants.usda.gov/cgi\\_bin/topics.cgi](http://plants.usda.gov/cgi_bin/topics.cgi)). This map shows *Calypso bulbosa* distribution in Douglas, Bayfield, Burnett, Iron, Vilas, Price, Langlade, Oconto and Door Counties.



Wisconsin State Herbarium has sixteen *Calypso bulbosa* specimens collected from the counties shown in Table 4.

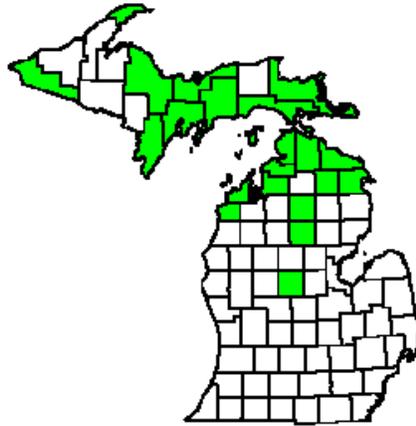
**Table 4. Wisconsin Counties with *Calypso bulbosa* sample # collection sites**

Wisconsin Counties with <i>Calypso bulbosa</i> sample	# collection sites
Bayfield	2
Burnett	1
Door	5
Douglas	3
Iron	1
Langlade	2
Oconto	1
Price	1

The Wisconsin Natural Heritage program has documented forty-seven total occurrences of *Calypso bulbosa* in the State of Wisconsin with at least ten of those occurrences recorded as historical. Of those forty-seven occurrences, nineteen occurrences are documented on the Chequamegon-Nicolet National Forest.

### Michigan Distribution:

The Michigan Distribution map for *Calypso bulbosa*, originally published by the Michigan Natural Features Inventory, was shown the Natural Resource Conservation Service Plant Database website ([http://plants.usda.gov/cgi\\_bin/topics.cgi](http://plants.usda.gov/cgi_bin/topics.cgi)). This map shows *Calypso bulbosa* distribution in the following Upper and Lower Peninsula Counties: Keweenaw, Gogebic, Marquette, Menominee, Delta, Alger, Schoolcraft, Mackinac, Chippewa, Emmett, Cheboygan, Presque Isle, Alpena, Montmorency, Antrim, Leelanau, Benzie, Crawford, Roscommon, and Isabella.



Natural Resource Conservation Service Plant database  
Michigan Distribution of *Calypso bulbosa*

A Michigan Natural Features Inventory Abstract references *Calypso* distribution as widespread in the northern Lower Peninsula and the Upper Peninsula of Michigan, with 100 location records of *Calypso bulbosa* [Fashoway (pers. comm., March 2003)].

The Michigan Natural Features Inventory fact sheet (1996) for *Calypso* states:

*“Calypso is widely distributed in the northern Peninsula of Michigan, with 85 locational records from 23 counties. At least 8 counties have records dating since the 1980. Most mainland-especially southerly- colonies consist of few plants, but large colonies with hundreds of plants occur occasionally to the north, especially on Isle Royale.”*

The Ottawa National Forest does not consider *Calypso bulbosa* widespread, “widely distributed with sites across the whole UP maybe, but certainly not abundant” [Trull (pers. comm., August 2003)].

Protected sites in Michigan include:

- Three Nature Conservancy Preserves
- Three State Natural Areas
- Two National Parks
- Within the Sylvania Recreation Area – but not relocated and it may be extant

[

### **VIABILITY AND POTENTIAL THREATS**

Although this species is widespread, abundant and secure globally, there are concerns for its viability at the southern edge of its North American range and specifically in the Great Lakes Region.

*Calypso bulbosa* requires older, closed canopy cedar stands, so any loss of a viable cedar type affects this species. Limited regeneration due to high deer populations is the primary threat to the cedar community and associated species. Other threats to the community include beaver activity and forest harvesting. Although cedar is no longer cut on National Forest lands in Wisconsin, cedar is still harvested on private and industrial forest lands [Spickerman (pers. comm., April 2003)]. The Wisconsin Element Occurrence Records indicate threats from any activity that decreases canopy cover. These disturbances include logging of cedar, deer browsing, or hydrologic alteration due to changes in land use such as road construction or wetland drainage. Wisconsin Element Occurrence data references old growth characteristics at many of the collection sites. Case (1987) references habitats impacted by a decrease in canopy cover followed by disappearance of *Calypso* populations. Mason references impacts in Michigan due to the action of photographers destructively manipulating plants around particularly photogenic specimens.

According to Throop, the Huron–Manistee National Forest in Michigan is a forest that was almost totally in a non-forested condition, deforested in the early 20<sup>th</sup> century. Many of the stands today are in the 70-80 year old class due to logging, fires, and agriculture that followed the logging in the 1930's. A March 2003 Huron-Manistee data queries documented only 62 acres of cedar on the forest are less than 60 years old and the cedar type makes up less than 1% of the total forest acreage. Data suggest most of the cedar acreage on the Huron Manistee National Forest occurs in old-growth designation as most of the acres are along major river corridors and may be designated as Recreational or Scenic Rivers. Cedar types are not harvested unless some major mortality event occurs outside of the old growth designation. [Throop (pers. comm., March 2003)], but the lack of effort in regenerating cedar is a future threat.

Current management of *Thuja occidentalis* on the Ottawa National Forest would fall under the lowland conifer type, which does provide for some silvicultural methods of harvest and regeneration. However, it is very, very, rare to have treatments prescribed on these wetland sites. The Forest Plan calls for case by case basis for treatments. In general most of the Ottawa's cedar swamps were so heavily cutover in the late 1800's and early 1900's for mining timbers that they are still recovering. The impact of this historic harvesting combined with restricted seasons for equipment operations, and riparian protection explain the limited management efforts in lowland cedar types on the Ottawa National Forest. [Trull/James Meunier (pers. comm., December 2002)].

Current management of *Thuja occidentalis* in Minnesota calls for no harvesting on Federal land on the Chippewa or Superior National Forests. State Land in Minnesota has a component of cedar preserved in Scientific and Natural Areas, although no actual inventory of SNA cedar types exist [Wilson (pers. comm., December 2002)]. State land

designated for timber harvest in Minnesota generally has a limited harvest policy on cedar [Klevorn (pers. comm., February 2003)]. Private lands in Minnesota are subject to the management philosophy of each individual landowner. Minnesota counties do allow harvests, but are a small component of total timber sales [Thompson (pers. comm., November 2002)].

Human impact through recreational activities may affect this species as the delicate root systems are impacted by slight disturbances. Legacy (1995) reports that the root disturbance caused by the collection of a flower can be significant enough to cause mortality. Some references encourage artificial propagation from seeds to discourage digging wild plants (Steele 1998).

The decline of *Thuja* swamps as a viable community and the high deer populations are also threats for this species on the Chequamegon-Nicolet National Forest, future influences of global warming may affect the ability of cedar communities to adapt to changing microclimatic conditions and to compete with communities shifting to the north [Fewless and Spickerman (pers. comm., April 2003)].

### **RESEARCH AND MONITORING**

Due to its rarity and small size, *Calypso bulbosa* may be difficult to locate on surveys conducted outside of the flowering period. The timing of this survey varies depending upon the location and specific weather conditions, but in the Great Lakes Region, surveys should be scheduled from late May throughout June. There is no quantitative monitoring of this species, although periodic site visits are conducted on the Chequamegon-Nicolet National Forest to verify presence/absence. Future plans may include more rigorous monitoring of known rare plant sites. [(pers. comm., April 2003 Spickerman)].

The Nature Conservancy references the need for future data collection concerning basic plant biology including:

- How long do the plants live? What triggers dormancy and flowering?
- How are they adapted to limited competition and pH of the substrate?
- How much time is required between germination and flowering?
- What is the rate of vegetative spread?
- What is the relationship between *Calypso bulbosa* and mycorrhizal fungi?

Monitoring of known occurrences is also needed to better understand the population dynamics of this rare orchid.

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## APPENDIX I:

Collection data for forty-two *Calypso bulbosa* specimens from the Minnesota Bell Herbarium  
Species data is presented as it appeared in the Herbarium records.

<p><b>1.</b> Location: Aitkin County- * Savanna Portage State Park Habitat: Plants occur in a swamp forest dominated by <i>Thuja occidentalis</i>. Assoc. with <i>Listera cordata</i>, <i>Platanthera obtusata</i>, <i>Goodyera repens</i> var. <i>ophioides</i>, <i>Moneses uniflora</i>. Collector 1: Myhre, K.M., Engels, A. and Dahle, R.M. Collector Date: Sunday May 26, 1996</p>
<p><b>2.</b> Location: Aitkin County Habitat: In cedar bog on cedar needles on dryer hummocks, with <i>Gaultheria hispida</i>, <i>Coptis groenlandica</i>, <i>Pyrola secunda</i>, <i>Monesis uniflora</i>, <i>Listera cordata</i>, and <i>Goodyera</i> Collector 1: Engels, A., Dahle, R. M Collector Date: Wednesday, May 18, 1994</p>
<p><b>3.</b> . Location: Beltrami County * Chippewa National Forest – Flora Lake Bog –Leech Lake Reservation Habitat: In localized pocket of cedar isolated from main wetland by a small <i>Abies</i> ridge. With <i>Platanthera obtusata</i>, <i>Corallorhiza trifida</i>, <i>Smilacina trifolia</i>. Collector 1: Sather, N.P Collector Date: Friday May 24, 1991</p>
<p><b>4.</b> Location: Beltrami Habitat: N/A Collector 1: Nybergt, L Collector Date: Monday, June 4, 1945</p>
<p><b>5.</b> . Location: Beltrami County * Pennington Orchid Bog Scientific and Natural Area – Leech Lake Reservation Habitat: In cedar bog Collector 1: Keller, C. Collector Date: Friday, June 8, 1979</p>
<p><b>6.</b> . Location: Carlton County Habitat: Deep ravines Collector 1: Sandberg, J.H Collector Date: June 1891</p>
<p><b>7.</b> Location: Carlton County Habitat: Deep ravines Collector 1: Sandberg, J.H Collector Date: June 1891</p>
<p><b>8.</b> Location: Carlton County Habitat: N/A Collector 1: Sandberg, J.H Collector Date: June 1891</p>
<p><b>9.</b> Location: Cass County Chippewa National Forest – Leech Lake Reservation; Bena Bog Habitat: Conifer swamp. <i>Thuja occidentalis</i>; associated with <i>Smilacina trifolia</i>, <i>Coptis groenlandica</i>, <i>Listera cordata</i>, <i>Aralia nudicaulis</i>, <i>Rubus pubescens</i>. Collector 1: Boe, J.S., Fitzloff-Westfield, C., Mooty, Jack Collector Date: Monday, June 6, 1994</p>
<p><b>10.</b> Location: Cass County * Chippewa National Forest Habitat: In woods Collector 1: Watson, J.B Collector Date: May 1926</p>
<p><b>11.</b> Location: Cass County * Chippewa National Forest – Leech Lake Reservation Habitat: Plants growing in a swamp forest dominated by <i>Thuja occidentalis</i>. Assoc. with <i>Mitella nuda</i>, <i>Coptis groenlandica</i>, <i>Pyrola secunda</i>. Collector 1: Myhre, K.M. Collector Date: Friday, May 15, 1992</p>

<p><b>12.</b> Location: Cass County * Chippewa National Forest – Leech Lake Reservation  Habitat: Plants growing in a swamp forest dominated by <i>Thuja occidentalis</i>. Assoc. with <i>Cypripedium calceolus</i> var. <i>parviflorum</i>, <i>Moneses uniflora</i>, <i>Mitella nuda</i>.  Collector 1: Myhre, K.M.  Collector Date: Tuesday, May 19, 1992</p>
<p><b>13.</b> Location: Cass County * Chippewa National Forest – Leech Lake Reservation  Habitat: Conifer swamp. <i>Thuja occidentalis</i>; associated with <i>Coptis groenlandica</i>, <i>Carex leptalea</i>, <i>C. pedunculata</i>, <i>Trientalis borealis</i>, <i>Clintonia borealis</i>.  Collector 1: Boe, J.S.  Collector Date: Tuesday, June 7, 1994</p>
<p><b>14.</b> Location: Cass County * Chippewa National Forest  Habitat: Conifer swamp. <i>Thuja occidentalis</i>; associated with <i>Maianthemum canadense</i>, <i>Mitella nuda</i>, <i>Platanthera obtusata</i>, <i>Trientalis borealis</i>, <i>Cornus canadensis</i>.  Collector 1: Boe, J.S.  Collector Date: Thursday, June 9, 1994</p>
<p><b>15.</b> Location: Cass County * Chippewa National Forest – Leech Lake Reservation  Habitat: Plants growing in a swamp forest dominated by <i>Thuja occidentalis</i>. Assoc. with <i>Pyrola secunda</i>, <i>Moneses uniflora</i>, <i>Halenia deflexa</i>.  Collector 1: Myhre, K.M.  Collector Date: Tuesday, May 12, 1992</p>
<p><b>16.</b> Location: Cass County * Chippewa National Forest – Leech Lake Reservation  Habitat: Plants growing in a swamp forest dominated by <i>Thuja occidentalis</i>. Assoc. with <i>Mitella nuda</i>, <i>Coptis groenlandica</i>, <i>Moneses uniflora</i>  Collector 1: Myhre, K.M.  Collector Date: Tuesday, May 26, 1992</p>
<p><b>17.</b> Location: Clearwater County * Itasca State Park  Habitat: Woods  Collector 1: Peterson, R.F.  Collector Date: Saturday, May 30, 1931</p>
<p><b>18.</b> Location: Clearwater County * Itasca State Park  Habitat: In a needle duff of <i>Pinus resinosa</i> and <i>Abies balsamea</i>.  Collector 1: Morley, T.  Collector Date: Sunday, June 19, 1966</p>
<p><b>19.</b> Location: Clearwater County * Itasca State Park – Garrison Point Bog  Habitat: Among mosses at the margin of a bay.  Collector 1: Nielsen, E.L.  Collector Date: Monday, May 29, 1933</p>
<p><b>20.</b> Location: Clearwater County * Itasca State Park – Garrison Point Bog  Habitat: In sandy-clayey soil, edges of densely shaded places.  Collector 1: Rosendahl, C.O. Butters, F.K.  Collector Date: Friday, May 30, 1930</p>
<p><b>21.</b> Location: Cook County * Cascade River State Park / North Shore  Habitat: Mossy woods  Collector 1: Roberts, Thomas S  Collector Date: Sunday, August 24, 1879</p>
<p><b>22.</b> Location: Cook County * Superior National Forest/BWCA  Habitat: In moss along a creek  Collector 1: Lakela, O.  Collector Date: Saturday, July 6, 1940</p>
<p><b>23.</b> Location: Cook County * Superior National Forest/BWCA  Habitat: Shaded steep slopes  Collector 1: Dahl, A.O  Collector Date: Friday, June 22, 1945</p>

<p><b>24.</b> Location: Cook County * Superior National Forest/BWCA  Habitat: Wooded slope  Collector 1: Butters, F.K., Abbe, E.C.  Collector Date: Sunday, July 30, 1944</p>
<p><b>25.</b> Location: Cook County * Superior National Forest  Habitat: Decadent, semi-open forest of <i>Populus tremuloides</i>, <i>Betula papyrifera</i>, <i>Thuja occidentalis</i> and abundant dead/down <i>Abies balsamea</i>  Collector 1: Gerdes, L.B., Gerdes, D.L  Collector Date: Tuesday, May 26, 1998</p>
<p><b>26.</b> Location: Itasca County *Chippewa National Forest – Leech Lake Reservation  Habitat: Plants occur in a lowland forest dominated by <i>Thuja occidentalis</i>. Associated with <i>Corallorhiza striata</i>, <i>C. trifida</i>, <i>Carex disperma</i>, <i>C. castanea</i>.  Collector 1: Myhre, K.M.  Collector Date: Friday, June 10, 1994</p>
<p><b>27.</b> Location: Itasca County *Chippewa National Forest  Habitat: Plants occur in swamp forest dominated by <i>Thuja occidentalis</i>. Associated with <i>Listera cordata</i>, <i>Goodyera repens</i> var. <i>ophioides</i>, <i>Platanthera obtusata</i>, <i>Moneses uniflora</i>.  Collector 1: Myhre, K.M.  Collector Date: Monday, May 23, 1994</p>
<p><b>28.</b> Location: Itasca County *Chippewa National Forest  Habitat: Plants occur in a swamp forest dominated by <i>Thuja occidentalis</i>. Associated with <i>Listera cordata</i>, <i>Goodyera repens</i> var. <i>ophioides</i>, <i>Moneses uniflora</i>, <i>Ribes hudsonianum</i>.  Collector 1: Myhre, K.M.  Collector Date: Saturday, May 21, 1994</p>
<p><b>29.</b> Location: Itasca County *Chippewa National Forest – Leech Lake Reservation  Habitat: Plants occur in a swamp forest dominated by <i>Thuja occidentalis</i>. Associated with <i>Listera cordata</i>, <i>Goodyera repens</i> var. <i>ophioides</i>, <i>Platanthera obtusata</i>, <i>Cypripedium reginae</i>.  Collector 1: Myhre, K.M.  Collector Date: Wednesday, May 25, 1994</p>
<p><b>30.</b> Location: Itasca County *Chippewa National Forest  Habitat: Plants occur in a swamp forest dominated by <i>Thuja occidentalis</i>. Assoc. with <i>Corallorhiza trifida</i>, <i>Moneses uniflora</i>, <i>Lonicera canadensis</i>, <i>Equisetum scirpoides</i>.  Collector 1: Myhre, K.M.  Collector Date: Tuesday, May 24, 1994</p>
<p><b>31.</b> Location: Itasca County *Chippewa National Forest  Habitat: Plants occur in a swamp forest dominated by <i>Thuja occidentalis</i>. Associated with <i>Cypripedium reginae</i>, <i>Rubus acaulis</i>, <i>Listera cordata</i>, <i>Mitella nuda</i>.  Collector 1: Myhre, K.M.  Collector Date: Monday, June 6, 1994</p>
<p><b>32.</b> Location: Itasca County *Chippewa National Forest  Habitat: Plants occur in a swamp forest dominated by <i>Thuja occidentalis</i>. Associated with <i>Fraxinus nigra</i>, <i>Mitella nuda</i>, <i>Coptis groenlandica</i>, <i>Trientalis borealis</i>, <i>Cornus canadensis</i>.  Collector 1: Myhre, K.M.  Collector Date: Tuesday, June 7, 1994</p>
<p><b>33.</b> Location: Koochiching County  Habitat: Birchdale  Collector 1: Anonymous  Collector Date: May 1927</p>
<p><b>34.</b> Location: Lake County  Habitat: Highland  Collector 1: Sheldon, E.P  Collector Date: June 1893</p>

<p><b>35.</b> Location: Lake of the Woods County  Habitat: <i>Thuja</i> stand with Sphagnum hummocks, old <i>Thuja</i> stumps. Moist soil.  Collector 1: Boe, J.S.  Collector Date: Friday, June 1, 1979</p>
<p><b>36.</b> Location: Roseau County * Beltrami Island State Forest  Habitat: In moist cedar with balsam fir, 8-10 mi from seep. With <i>Rubus pubescens</i>, <i>Fragaria virginiana</i>, <i>Maianthemum canadense</i>, and <i>Mitella nuda</i>  Collector 1: Boe, J.S.  Collector Date: June 9, 1992</p>
<p><b>37.</b> Location: Roseau County * Beltrami Island State Forest  Habitat: Edge of <i>Thuja occidentalis</i> swamp. With <i>Maianthemum canadense</i>, <i>Trientalis borealis</i>, <i>Cornus canadensis</i>, <i>Mitella nuda</i>, and <i>Smilacina trifolia</i>  Collector 1: Boe, J.S.  Collector Date: Friday, June 5, 1992</p>
<p><b>38.</b> Location: St. Louis County  Habitat: <i>Thuja-Picea</i> swamp.  Collector 1: Lakela, O.  Collector Date: Sunday, May 28, 1939</p>
<p><b>39.</b> Location: St. Louis County  Habitat: Near Tower MN  Collector 1: Sheldon, E.P.  Collector Date: Jun 1893</p>
<p><b>40.</b> Location: St. Louis County * Kabetogama State Forest  Habitat: Cedar forest.  Collector 1: Lakela, O.  Collector Date: Monday, June 12, 1950</p>
<p><b>41.</b> Location: St. Louis County * Kabetogama State Forest  Habitat: Cedar forest.  Collector 1: Lakela, O.  Collector Date: Monday, June 12, 1950</p>
<p><b>42.</b> Location: St. Louis County * Kabetogama State Forest  Habitat: Cedar forest.  Collector 1: Lakela, O.  Collector Date: Sunday, May 28, 1939</p>

**APPENDIX II:**

Collection data for sixteen *Calypso bulbosa* var. *americana* specimens from the Wisconsin Herbarium  
Species data is presented as it appeared in the Herbarium records.

<b>1.</b> Location: Douglas County Habitat: N/A Collector Date: May, 1892
<b>2.</b> Location: Door County Habitat: Under <i>Picea</i> and <i>Abies</i> Collector: Wadmond, Sc. Collector Date: 5/31/1928
<b>3.</b> Location: Door County Habitat: N/A Collector: Fuller, A.M. Collector Date: 6/2/1927
<b>4.</b> Location: Door County Habitat: Common in places Collector: Fuller, A.M. Collector Date: 6/2/1927
<b>5.</b> Location: Oconto County Habitat: N/A Collector: Plumb, F.H. Collector Date: 5/17/1877
<b>6.</b> Location: Iron County Habitat: Lake Superior region in cedar swamp of trout stream Collector: Cheney, L.S Collector Date: 7/22/1896
<b>7.</b> Location: Langlade County Habitat under 10" dbh <i>Thuja</i> in cedar swamp, no sphagnum within a meter Collector: Reuter, B Collector Date: 6/2/1983
<b>8.</b> Location: Door County Habitat: Dense woods, little underbrush, near creek but high above the water. In damp soil Collector: Thorne, A.L Collector Date: 6/10/1929
<b>9.</b> Location: Price County Habitat: Collection label reads Rice Lake, but there is no rice lake in Price county Collector: Sylvester, Miss Collector Date> 6/14/1915
<b>10.</b> Location: Burnett County Habitat: Cedar Swamp Collector: Wilson, LR Collector Date: 5/30/1927
<b>11.</b> Location: Langlade County Habitat: <i>Thuja</i> swamp with <i>Listera cordata</i> , <i>Ribes hudsonianum</i> , etc. Collector: Judziewick, E Additional Collectors: Jaunzems, M Collector Date: 5/25/1982
<b>12.</b> Location: Door County Habitat: coniferous woods Collector: Wadmond, SC Collector Date: 5/31/1928
<b>13.</b> Location: Bayfield County Habitat: Near the shores of Lake Superior region Collector: Cheney, L.S Collector Date: 6/25/1897

<p><b>14.</b> Location: Douglas County  Habitat: Near the shores of Lake Superior region  Collector: Cheney, L.S  Collector Date: 7/31/1897</p>
<p><b>15.</b> Location: Bayfield County  Habitat: Near the shores of Lake Superior region  Collector: Cheney, L.S  Collector Date: 6/25/1897</p>
<p><b>16.</b> Location: Douglas County  Habitat: Old growth white cedar swamp with balsam fir, white &amp; black spruce, tamarack, <i>Fraxinus nigra</i>, <i>Alnus incana</i>, <i>Rhamnus alnifolia</i>, <i>Ledum</i>, <i>Sphagnum</i>, <i>Mitella nuda</i>, <i>Gymnocarpium</i>, <i>Moneses uniflora</i>, <i>Pyrola secunda</i>, <i>Luzula acuminata</i>, <i>Smilacina trifolia</i>, <i>Coptis trifolia</i>, <i>Carex trisperma</i>, <i>C. disperma</i>, <i>C. vaginata</i>, <i>Clintonia borealis</i>, <i>Ranunculus lapponicus</i>, <i>Ribes hudsonianum</i>  Collector: Clark, Andy  Collector Date: 6/5/1996</p>

**APPENDIX III:**

Collection data for one-hundred *Calypso bulbosa* var. *americana* specimens from Michigan Natural Features Inventory (Data formatted from MNFI database)

Name	Collector Date	Habitat/Collection Data	County Data
<i>Calypso bulbosa</i>	1892-05-31	Growing under hemlocks.	14N 04W
<i>Calypso bulbosa</i>			24N 04W
<i>Calypso bulbosa</i>	1887-05-16		26N 03W
<i>Calypso bulbosa</i>	1893-05-19		26N 16W
<i>Calypso bulbosa</i>	1876-06-12		27N 10E
<i>Calypso bulbosa</i>	1893	No data provided.	30N 07W
<i>Calypso bulbosa</i>	1983-06-06	~9 plants.	30N 15W
<i>Calypso bulbosa</i>	1955		31N 01E
<i>Calypso bulbosa</i>	1908		31N 10E
<i>Calypso bulbosa</i>	1983-06-06	9 plants were reported found.	31N 15W
<i>Calypso bulbosa</i>	1984-08-19	Growing on the bases of raised cedars. 15-20 plants in fruit and leaf in small area. 71 plants including several white (except markings on lip).	33N 02E
<i>Calypso bulbosa</i>	1902		34N 05W
<i>Calypso bulbosa</i>	1934		34N 08E
<i>Calypso bulbosa</i>	1889		34N 26W
<i>Calypso bulbosa</i>	1901-05-22		35N 05W
<i>Calypso bulbosa</i>	1912	Local.	35N 06W
<i>Calypso bulbosa</i>	1989	At several localities.	35N 13W
<i>Calypso bulbosa</i>	1838-06-20		36N 04E
<i>Calypso bulbosa</i>	1961	Abundant.	36N 20W
<i>Calypso bulbosa</i>	1932-05-24	Growing in leaf mold near a felled tree on the sunny exposure of a stream bank.	37N 10W

<i>Calypso bulbosa</i>	1932-05-25	Growing in damp sod near hemlock, sunny edges of swamps.	37N 10W
<i>Calypso bulbosa</i>	1957-05-26	Occasional in moss at the edge of Thuja, Abies woods.	37N 10W
<i>Calypso bulbosa</i>		Classified as "endangered" on Beaver Is. by O. Niels.	37N 11W
<i>Calypso bulbosa</i>	1931-05-21		38N 01W
<i>Calypso bulbosa</i>	1963-05-20	Growing in humus and moss overlaying sandstone.	38N 18W
<i>Calypso bulbosa</i>	1960-05-29		39N 01W
<i>Calypso bulbosa</i>	1937-06-05	Growing in deep leaf carpet.	39N 01W
<i>Calypso bulbosa</i>	1961-05-30		39N 04W
<i>Calypso bulbosa</i>	1985	No data provided.	39N 05W
<i>Calypso bulbosa</i>	1966-06-02		39N 10W
<i>Calypso bulbosa</i>		No specific habitat data given. Classified as "endangered" on Beaver Is. by O. Niels.	39N 10W
<i>Calypso bulbosa</i>	1981-06-02	Growing among Polygala paucifolia, Trientalis, Maianthemum, Aster macrophyllum, Carex eburnea, Zigadenus, mosses and balsam spouts. 2000: Did not observe but likely still present.	39N 17W
<i>Calypso bulbosa</i>	1974	2000: Did not observe but likely still there.	39N 17W
<i>Calypso bulbosa</i>	1912		40N 03W
<i>Calypso bulbosa</i>	1940-06	Growing under balsams.	40N 03W
<i>Calypso bulbosa</i>	1979-07-31		41N 01E
<i>Calypso bulbosa</i>	1995-05-27	8 plants observed, growing under Thuja, Populus tre; in litter of cedar and aspen; associated w/ Mnium (moss), Trientalis, Linnaea. 1994: 8 plants observed; 1995: 3 plants observed.	41N 02E
<i>Calypso bulbosa</i>	1983-05-28	Two plants with white sepals and lateral petals.	41N 02E
<i>Calypso bulbosa</i>	1962-05-26	Growing in duff.	41N 02E
<i>Calypso bulbosa</i>	1978	Growing among dense groundcover of pipsissewa, round-leaf pyrola, one-sided pyrola, dwarf cornel and trailing arbutus.	41N 03E

<i>Calypso bulbosa</i>	1990-06-01	Four plants observed, 1 in flower, growing in mature white cedar stand, no shrubs, associated w/ <i>Mitella nud</i> , <i>Coptis</i> , <i>Trientalis</i> , <i>Linnaea</i> , <i>Petasites</i> , <i>Abies</i> , <i>Thuja</i> , <i>Populus</i> tre. Soil pH 6.6-8.4, litter 2-5 cm.	41N 04E
<i>Calypso bulbosa</i>	1970-05-28	Growing in thin soil over dolomite.	41N 05E
<i>Calypso bulbosa</i>	1993-06-05	Five plants noted in sec. 15, growing with ca. 25 ft area, in moist sandy-loam soil, under <i>Thuja</i> and <i>Abies</i> . Associates: <i>Linnaea bor</i> , <i>Trientalis</i> , <i>Potentilla fru</i> . In sec. 22, 9 plants (7 in flower) found within 60 ft area with similar associates.	41N 05E
<i>Calypso bulbosa</i>	1988-07	13 plants observed in 50 sqft area, in valley between wooded dune and open dune; apparently large vigorous plants, all flowering, in sandy soil, under <i>Quercus rub</i> , <i>Acer rub</i> , <i>Betula pap</i> , <i>Pinus str</i> ; understory of <i>Acer pen</i> , <i>Abies</i> and <i>Hamamelis</i> . Associated w	41N 05W
<i>Calypso bulbosa</i>	1958-05-30	Growing in low moist coniferous woods.	41N 07E
<i>Calypso bulbosa</i>	1988-05-25	16 plants observed, 14 flowering, 2 sterile, occurring ca. 100-150 m back from lake in ca. 100-200 m narrow belt going back to powerline, growing under 30-40 ft tall <i>Thuja</i> , w/ scattered <i>Betula pop</i> , <i>Picea gla</i> , <i>Abies</i> , also associated w/ <i>Cornus can</i> , <i>Trien</i>	41N 07E
<i>Calypso bulbosa</i>		Growing infrequently.	41N 16W
<i>Calypso bulbosa</i>	1995-05-30	2 groups of plants, 1 with 1 plant, another with 7 plants, seedlings observed (sterile plants), growing under <i>Thuja</i> , on small hummocks. Associated w/ <i>Viola ren</i> , <i>Linnaea</i> , <i>Coptis</i> , <i>Gaultheria his</i> , <i>Trientalis bor</i> , <i>Galium sp</i> . 1995: 10+ plants observed, 1/4 mile	42N 02E

<i>Calypso bulbosa</i>	1995-05-27	1994: 16 plants dispersed somewhat linearly over 10-15 m at edge of a cedar stand w/Trientalis bor & Linnaea bor. 1995: 200+ plants est. by Ewert & Hamas. >100 blooming plants observed in shaded spots w/little understory flora & thick litter layer on gentle	42N 02W
<i>Calypso bulbosa</i>	1958-05-29	Growing in humus but not wet sphagnum.	42N 03E
<i>Calypso bulbosa</i>	1995-05	1995: 5 plants found	42N 03W
<i>Calypso bulbosa</i>	1995-05-30	Occasional over several acres in moss & coniferous crumble.	42N 03W
<i>Calypso bulbosa</i>	1977		42N 04E
<i>Calypso bulbosa</i>	2000-06-05	5 plants in flr in dense cedar swamp. Site seems quite dry with a more open understory than most Calypso sites. Overstory 100% canopy cover of Thuja, Betula pap, Populus trem, P bal. Understory v. sparse (1%) Rhamnus aln, Lonicera can. Groundcover divers	43N 02W
<i>Calypso bulbosa</i>	1994-09-01	23 plants growing upland w/Thuja, Abies bal, Betula pap, & Acer rub over limestone. Plants are w/i rare fern study plot.	43N 04W
<i>Calypso bulbosa</i>	1995-06-05	27 fl. & 13 non-fl. individuals counted in rich, cedar-dominated swamp. Plants were growing in higher, drier areas including blown down trees, and where other vegetation was minimal.	43N 05W
<i>Calypso bulbosa</i>	1994-05-19	4 healthy plants, in filtered light, adjacent to forest gaps. Associates: Thuja occ, Populus tre, Abies bal, Cornus can, Maianthemum can, Lonicera can. Under canopy of Thuja, Populus tre, Pinus str, Betula pap, Abies bal.	43N 05W
<i>Calypso bulbosa</i>	1994-05-25	21 flowering plants over 50 ft, growing in mature Thuja, Abies bal, Populus tre and Betula pap, in Niagra escarpment LTA. Ground cover is heavy but low in stature. Associates: Lonicera can, Mitella nud, Viola ren, Trientalis, Linnaea, Maianthemum, Clinto	43N 05W

<i>Calypso bulbosa</i>	1993-05-25	Eight plants observed scattered under relatively dense Thuja, Picea, Abies forest canopy in s27 & 1 plant noted in similar habitat in s33. All plants noted were in fl. 1993: found in moist Thuja stands. Approx. 5-6 plants observed, in fl., sparsely scattered	43N 06E
<i>Calypso bulbosa</i>	1995-06-15	4 flowering and 11 sterile in Sphagnum hummocks at base of Thuja; plus, a second population of 6 plants including some in fr. Associates: Trientalis bor, Gaultheria his, Polygala pau, Mitella nud, Smilacina tri, Rubus pub, Aralia nud, Carex gyn, Listeria	43N 20W
<i>Calypso bulbosa</i>	1994-05-25	3 plants growing in upland cedar, Populus tre, Abies bal, in large limestone rock outcrop.	44N 03W
<i>Calypso bulbosa</i>	1901-05-21	Growing in moss.	44N 24W
<i>Calypso bulbosa</i>	1974		44N 40W
<i>Calypso bulbosa</i>	1990-06-04	Five plants observed, all in flower, growing under Thuja and Abies, associated with Mitella nud, Viola ren, Petasites pal, Coptis; thick moss cover; hummocky microhabitat.	45N 02E
<i>Calypso bulbosa</i>	1957-06-11		45N 02E
<i>Calypso bulbosa</i>	1985		45N 04W
<i>Calypso bulbosa</i>	1890		47N 47W
<i>Calypso bulbosa</i>	1973-SU		49N 14W
<i>Calypso bulbosa</i>	1973-06-11	Occasional and scattered, only under balsam fir.	49N 14W
<i>Calypso bulbosa</i>	1984		49N 14W
<i>Calypso bulbosa</i>		Growing under large white pine.	51N 28W
<i>Calypso bulbosa</i>	1941-06-07		57N 30W
<i>Calypso bulbosa</i>	1982-SU		58N 28W
<i>Calypso bulbosa</i>	1951-05-28	Growing in moist soil.	58N 30W
<i>Calypso bulbosa</i>	1865-06-02	On rocks.	58N 32W
<i>Calypso bulbosa</i>	1886-08-30		58N 32W
<i>Calypso bulbosa</i>	1993-05-26	Growing within 10'-30' of the open shore of Lake Superior. 1993: Single plant observed by B. Beck, occurring in deep swale between bedrock ca. 100 ft. from shore, in gap caused by blowdowns, growing in leaf litter under Thuja and Abies.	59N 27W
<i>Calypso bulbosa</i>	1982		59N 28W

<i>Calypso bulbosa</i>	1951-05-28	Growing under a northern hardwood canopy.	59N 28W
<i>Calypso bulbosa</i>	1981-06-08		59N 29W
<i>Calypso bulbosa</i>	1958-05-18	Growing in a shady, grassy spot.	59N 30W
<i>Calypso bulbosa</i>	1951-05-28	A north-facing slope.	59N 30W
<i>Calypso bulbosa</i>	1994-06-04	45 plants on N-facing slope. 13 fl.	64N 37W
<i>Calypso bulbosa</i>	1994-06-03	Clumps of 3-100 plants found in 6 locations. 30-50% fl.	64N 38W
<i>Calypso bulbosa</i>	1994-06-09	At outlet of Wallace Lake, 20 of 25 plants fl.	65N 34W
<i>Calypso bulbosa</i>	1994-05-16	20 plants found along trail.	65N 34W
<i>Calypso bulbosa</i>	1953-06-14	Growing under spruce.	65N 35W
<i>Calypso bulbosa</i>	1984	1994: 20 plants 1 km SW of Rock Harbor lodge. A few plants in woods near cabin on Tobin Harbor side of Scoville Point. 2 locations of 10-15 plants on Scoville Point Trail.	66N 33W
<i>Calypso bulbosa</i>	1930-06-28		66N 33W
<i>Calypso bulbosa</i>	1994-05-23	1994: 7 locations of 12-60 plants each, 20-60% fl.	66N 33W
<i>Calypso bulbosa</i>	1994-06-01	1994: Mt. Franklin Trail - 3 locations of 5-61 plants, 20-30% fl. Mt. Franklin: 70 plants, 40 fl. Shore of mainland opposite Mott Island dock: 2 locations of 10-25 plants.	66N 33W
<i>Calypso bulbosa</i>	1994-05-20	20 plants found along trail. 20 found on ridge.	66N 34W
<i>Calypso bulbosa</i>	1994-05-27	Greenstone Ridge: a few large fl. clumps in open, rocky brush area. Mt. Ojibway Trail: 38 plants at edge of glade near Baies forest.	66N 34W

		1994: on Mott Island, 12 of 30 plants fl. 3 plants near lakeside of E Caribou Island, 5 near lakeshore. On W Caribou Island, 50 of 75 plants fl on E bay near S tip.	66N 34W
<i>Calypso bulbosa</i>	1994-05-31		66N 34W
<i>Calypso bulbosa</i>	1933-06-06		66N 34W
<i>Calypso bulbosa</i>	1985-06-14		66N 34W
<i>Calypso bulbosa</i>	1994-06-09	5 plants.	66N 34W
<i>Calypso bulbosa</i>	1994-06-14	On Porter Is: 75 plants, 25 fl.	67N 33W
<i>Calypso bulbosa</i>	1994-05-19	2 plants is s31 & 10 plants in s36.	67N 33W
<i>Calypso bulbosa</i>	1994-05-18	20 plants on steep N-facing slope.	67N 33W