Recovery Strategy for the Few-flowered Club-rush/ Bashful Bulrush In Canada (*Trichophorum planifolium* (Sprengel) Palla) 2006-2011

DRAFT

Photo courtesy of Tyler Smith

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Royal Botanical Gardens

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Recovery Strategy for Few-flowered Club-rush/Bashful Bulrush (*Trichophorum planifolium*) in Canada

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Under the Accord for the Protection of Species at Risk (1996), the federal, provincial, and territorial governments agreed to work together on legislation, programs, and policies to protect wildlife species at risk throughout Canada.

In the spirit of cooperation of the Accord, the Government of Ontario has given permission to the Government of Canada to adopt the Recovery Strategy for Few-flowered Club-rush/Bashful Bulrush (*Trichophorum planifolium*) in Canada under Section 44 of the *Species at Risk Act* (SARA). Details are provided in the addenda of this document.

Following this 60-day comment period starting in February 2007, and until the federal Minister of the Environment determines otherwise or the Ontario Ministry of Natural Resources formally amends this document, this recovery strategy will be the recovery strategy of the Minister of the Environment of Canada for this species.

Recommended Citation

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« Programme de rétablissement du trichophore à feuilles plates – scirpe timide (*Trichophorum planifolium* (Sprengel) Palla) au Canada »

Responsible Jurisdictions

Few-flowered Club-rush/Bashful bulrush occurs in the province of Ontario, and the recovery strategy was developed by the province. The Canadian Wildlife Service - Ontario Region, on behalf of the competent minister (the Minister of the Environment), cooperated in the development of the recovery strategy.

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Preface

The Few-flowered Club-rush/Bashful bulrush is under the management jurisdiction of the Ontario provincial government.

The *Species at Risk Act* (SARA, Section 37) requires the competent Minister to prepare a recovery strategy for all listed extirpated, endangered or threatened species. SARA Section 44(1) allows the Minister to adopt an existing plan for the species if it meets the requirements under SARA for content and process (Sections 39-41).

The Few-flowered Club-rush/Bashful bulrush was listed as Endangered under SARA in June 2003. The Ontario Ministry of Natural Resources led the development of this recovery strategy for the species in cooperation with the Canadian Wildlife Service – Ontario Region, Environment Canada. All responsible jurisdictions reviewed and acknowledged receipt of the strategy. This recovery strategy was developed in consultation with the Royal Botanical Gardens and the Rouge Park, on behalf of the Toronto and Region Conservation Authority.

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Executive Summary

The common name used throughout this strategy (Few-flowered Club-rush) is a synonym for Bashful Bulrush, which is the common name used in Schedule 1 of the Species at Risk Act. Few-flowered Club-rush/Bashful Bulrush (*Trichophorum planifolium*, formerly *Scirpus verecundus*) is limited to two locations in Canada: Cootes Paradise Nature Sanctuary in Hamilton, and Rouge Park in Toronto. The Cootes Paradise populations consist of around 1200 plants[1], and the Rouge Park population consisted of only 40 stems (one plant) in 2001, but it was not found in 2005. These populations are at the northern edge of this species' range; populations in the eastern United States are secure. This species was uplisted from "Special Concern" to "Endangered" by COSEWIC (Committee On the Status of Endangered Wildlife In Canada) in May 2000. It is also regulated as an Endangered species under the Ontario Endangered Species Act.

This recovery strategy is effective for the years 2006-2011. The recovery goal is to ensure the long-term survival of the extant Canadian populations, through the protection and enhancement of these populations (as necessary). Population studies may reveal that this species exhibits metapopulation dynamics, in which case its persistence will require the availability of suitable unoccupied ("recovery") habitat. If this proves true, this species is likely threatened by deteriorating ecological conditions on a landscape scale, as many other species have exhibited (See Ambrose et al., 2004).

Recovery is currently hampered by an absence of clear data on the threats facing this species, compounded by an incomplete understanding of its basic ecology. This document details the research necessary to address these deficiencies, and the subsequent recovery actions necessary to ensure the persistence of this species in Canada.

[1] "Plant," in the document, refers to a cluster of stems separated by at least one centimetre from any other such cluster. This is a working definition, and will be revised upon the availability of new information.

I. RECOVERY

1. Recovery Goals

The recovery goal for this species is to ensure the long-term survival of the extant Canadian populations, which necessitates keeping the Cootes Paradise population at current population levels (1000-1200 plants; in 2003) until a minimum population viability study has been finished, and increasing the Rouge Park population to sustainable levels. Depending on the results of population studies, it may also be necessary to increase the supply of suitable, but unoccupied habitat to accommodate metapopulation dynamics. This goal is thus on the continuum between survival and full recovery, as is appropriate for a species whose Canadian populations are on the margin of a secure population in the United States.

2. Recovery Objectives (2006-2011)

1) Clarify the threats posed to this species in its Canadian range
2) Manage sites to maintain the conditions necessary to sustain extant populations, and maintain their genetic diversity
3) Establish and implement monitoring protocols to evaluate threats and the impact of management actions
4) Search selected areas for previously unreported populations; investigate increasing the availability of recovery habitat
5) Further refine objectives as increased data become available

3. Approaches for Meeting Recovery Objectives:

A summary of the recommended activities for the recovery of Few-flowered Club-rush/Bashful Bulrush is provided in Table 1.

Table 1. Strategies and Approaches for Recovery

Priority	Obj. No.	Broad Approach	Threats Addressed	Specific Steps	Anticipated Effect (identify measurable targets)
Urgent	1; 2; 3; 4	Research	▪ Improve understanding of current threats and identify new threats	▪ Determine what level/type of disturbance promotes persistence and what level/type is a threat ▪ Determine fire ecology of this species and if prescribed burns are useful or necessary to promote recruitment ▪ Assess role of other potential threats: human disturbance; changing abiotic conditions (due to canopy closure or habitat fragmentation or disturbance); predators/pathogens; competition (including non-native species); potential loss of genetic variability; etc. ▪ Perform a minimum population viability analysis for the Canadian populations ▪ Determine precise biotic/abiotic characteristics of critical habitat ▪ Elucidate key aspects of the species' ecology: sexual system; recruitment (seed vs. clonal); dispersal; survivorship; longevity; ecological relationships; population dynamics; competitive ability; etc. These studies will need to occur within both the Canadian and the core (American) populations in order to assess the effect of the peripheral position of the Canadian populations on their ecology ▪ Assess the genetic variability within the Canadian populations, and between the Canadian and core populations, and perform subsequent research with genetic components (evaluate degree of local adaptation; determine degree of gene flow;	▪ Development of threat-based management criteria and techniques, including evaluating the potential for metapopulation dynamics and the roles of stewardship, education, enforcement, etc. in recovery ▪ Production of recovery action plan incorporating the above data ▪ Determination of minimum sustainable population sizes ▪ Determination of need for *ex situ* conservation (seed bank, etc.) ▪ Development of criteria to recognise and protect critical and recovery habitat, and to assess changes in habitat of extant populations

Priority	Obj. No.	Broad Approach	Threats Addressed	Specific Steps	Anticipated Effect (identify measurable targets)
				determine role of clonal vs. sexual reproduction; etc.) ▪ Explore the need for a seed bank to conserve local genetic diversity	
Urgent	2	Management and Threat Reduction	▪ All site-specific threats (succession, excessive disturbance, deer browse, competition)	▪ Develop site-specific management plans for extant populations	▪ Development of threat-based management plans (including education/ enforcement components to address human impacts) ▪ Stabilisation (and potentially restoration) of extant populations
Urgent	3	Monitoring and Evaluation	▪ Evaluate whether management actions are having the intended effect	▪ Establish monitoring protocols to assess populations and their responses to management techniques ▪ Monitor populations and threats	▪ Provision of accurate data for subsequent management and research, and for the evaluation of recovery efforts
Beneficial	4	Inventory	▪ Ensure that the plant was not overlooked at other sites, since most people are not familiar with this species	▪ Survey suitable habitat for new populations ▪ Survey sites of potential recovery habitat in Canada ▪ Educate field staff from various agencies on how and when to identify this species	▪ Development of an accurate understanding of distribution of recovery habitat and of areas that could be restored to recovery habitat ▪ Development of an accurate understanding of distribution and population levels of Few-flowered Club-rush/Bashful Bulrush
Beneficial	4	Restoration	▪ Succession, excessive disturbance, deer browse, competition	▪ Promote the restoration of Few-flowered Club-rush/Bashful Bulrush recovery habitat independently, or in conjunction with other groups/recovery strategies	▪ Increased availability of habitat for potential new populations ▪ Potential increased habitat for tallgrass woodland species
Necessary	5	Recovery Planning	▪ Ensure actions are appropriate and based on current data	▪ Revisit this strategy regularly upon the availability of new data	▪ Provision of a long-term management plan with a sound biological basis ▪ Production of recovery action plan

4. Potential Impacts of Recovery Strategy on Other Species/Ecological Processes

Few-flowered Club-rush/Bashful bulrush co-occurs in Canada with tallgrass species on dry, open, wooded slopes. As such, recovery actions for Few-flowered Club-rush/Bashful Bulrush could have a positive impact on tallgrass woodland communities. Numerous other rare species occur in canopy gaps of tallgrass woodlands (either at present or historically) such as Hoary Mountain Mint (*Pycnanthemum incanum*), Virginia Yellow Flax (*Linum virginianum*), Downy False-foxglove (*Aureolaria virginica*), and Eastern Yellow Star-grass (*Hypoxis hirsuta*). Tallgrass woodland is a provincially rare habitat type. As a putative gap-phase species, Few-flowered Club-rush/Bashful Bulrush may be sensitive to encroachment by exotic invasives, so recovery actions may require local control of non-native species.

5. Actions Already Completed or Underway

Some seed storage and germination requirements have been studied at the Royal Botanical Gardens (RBG). Habitat mapping was completed at Cootes Paradise, and an investigatory demography study was initiated. RBG has also undertaken tallgrass restoration activities (prescribed burns), which may benefit this species. Inventories of all populations were completed in 2001 and a search for one of the Rouge Park population was completed in 2005. Partnerships are being explored to continue monitoring this species in Rouge Park.

6. Statement of When One or More Action Plans in Relation to the Recovery Strategy will be Completed

An action plan will be prepared by the Recovery Team, and if necessary, with the assistance of a Recovery Implementation Group (RIG) by 2009. It will address research needs, inventories, site management, monitoring, and restoration.

7. Evaluation

The success of this recovery strategy can be measured against several criteria:

1. Threats to the persistence of this species in Canada have been identified and mitigated, through the enactment of site-specific threat-based management plans
2. Long-term sustainable local population levels have been determined and met
3. Critical habitats have been precisely determined and protected
4. Monitoring regimes have been developed and implemented
5. Potential sites have been surveyed for the presence of suitable habitat and for Few-flowered Club-rush/Bashful Bulrush populations
6. Sufficient habitat has been restored throughout the range of this species to ensure its ability to spread to new sites and maintain a self-sustaining national population

II. BACKGROUND

8. Species Information

Date of Assessment:	May 2000
Common Name:	Bashful Bulrush
Scientific Name:	*Trichophorum planifolium* (Sprengel) Palla
COSEWIC Status:	Endangered
Reason for Designation:	More that 50% decline over the past decade of the few remaining populations due to habitat destruction and alteration within its two remaining areas of occurrence.
Canadian Occurrence:	ON
COSEWIC Status History:	Designated Special Concern in April 1986. Status re-examined and designated Endangered in May 2000. Last assessment based on an update status report.

8.1 Species Description

Few-flowered Club-rush/Bashful Bulrush is a perennial herbaceous sedge with short (10-40 cm), erect, grass-like leaves, which form small clumps. However, during seed dispersal in July and August, the leaves and culms become flattened and matted on the forest floor. Each clump produces flowering spikes in the spring, just as its leaves are beginning to lengthen and prior to the emergence of tree leaves. The spikes are triangular in cross section, 10-20 cm high. The flowers are not showy, with only a small solitary spike being produced at the end of each stalk. They have no petals, and the stamens and stigmas dangle outside the flowers for wind pollination. The leaf sheaths at the base of the plant are weathered, shredded and light-brown to reddish-brown.

Until recently, this species has been referred to as *Scirpus verecundus* Fernald. However, based on embryological, anatomical, and morphological data the genus *Scirpus* sensu lato has been found to contain several distinct, and only distantly related, genera (for a review see Strong, 1994). *Scirpus* sensu lato species with a single terminal spikelet with a scale-like bract are now referred to as *Trichophorum* Persoon. This treatment is widely accepted in Europe, and is used in Flora of North America (Crins, 2002).

Common names are not often applied to sedge species, but this one has several. COSEWIC lists this species as Bashful Bulrush, the Committee on the Status of Species at Risk in Ontario (COSSARO) lists it as Few-flowered Club-rush and Bashful Bulrush, and it is also known as Shy Bulrush. Bashful Bulrush and Shy Bulrush are probably recent creations, the product of a direct translation of *Scirpus verecundus*. In light of the generic revision of *Scirpus* sensu lato it would be appropriate to reserve the name bulrush for the robust wetland species in the new segregate genera *Schoenoplectus, Bulboschoenus,* and *Scirpus* s.s.. Species in the genus *Trichophorum* have been consistently called club-rushes, and that treatment is followed here.

9. Distribution

9.1 Global range

Few-flowered Club-rush/Bashful Bulrush occurs throughout north-eastern North America, from Vermont south to Virginia, west to Missouri (Crins, 2002). There is some question as to the validity of two records from Maine. One of the records was based on a misidentified collection of *Trichophorum clintonii*, and the voucher for the other record has not been located (Haines pers. comm.). The southern Ontario populations represent the northern limit of the global distribution.

The entire global distribution of Few-flowered Club-rush/Bashful Bulrush is presented in Figure 1. This map has been compiled from previously published distribution maps, internet databases, and personal communications with American botanists (Haines per. comm., 2001; McAvoy, 2001; Sargent pers.comm., 2001; Kentucky State Nature Preserves Commission, 2000; Magee and Ahles, 1999; Maryland Wildlife and Heritage Division, 1996; Eaton, 1987; Wherry et al., 1979; Mohlenbrock and Ladd, 1978; Strasbaugh and Core, 1978; Stone, 1973; Braun, 1967; Steyermark, 1963; Massey, 1961; Zenkert, 1934; House, 1924). Some of these references are quite old, and report records that have not been recently verified. Other references do not include county information, so only vague regional records can be inferred. The distribution map prepared by Crins for the Flora of North America (FNA) is also included in Figure 1. Note that in publication this map was simplified to reflect only the state by state presence of *Trichophorum planifolium* (Crins, 2002).

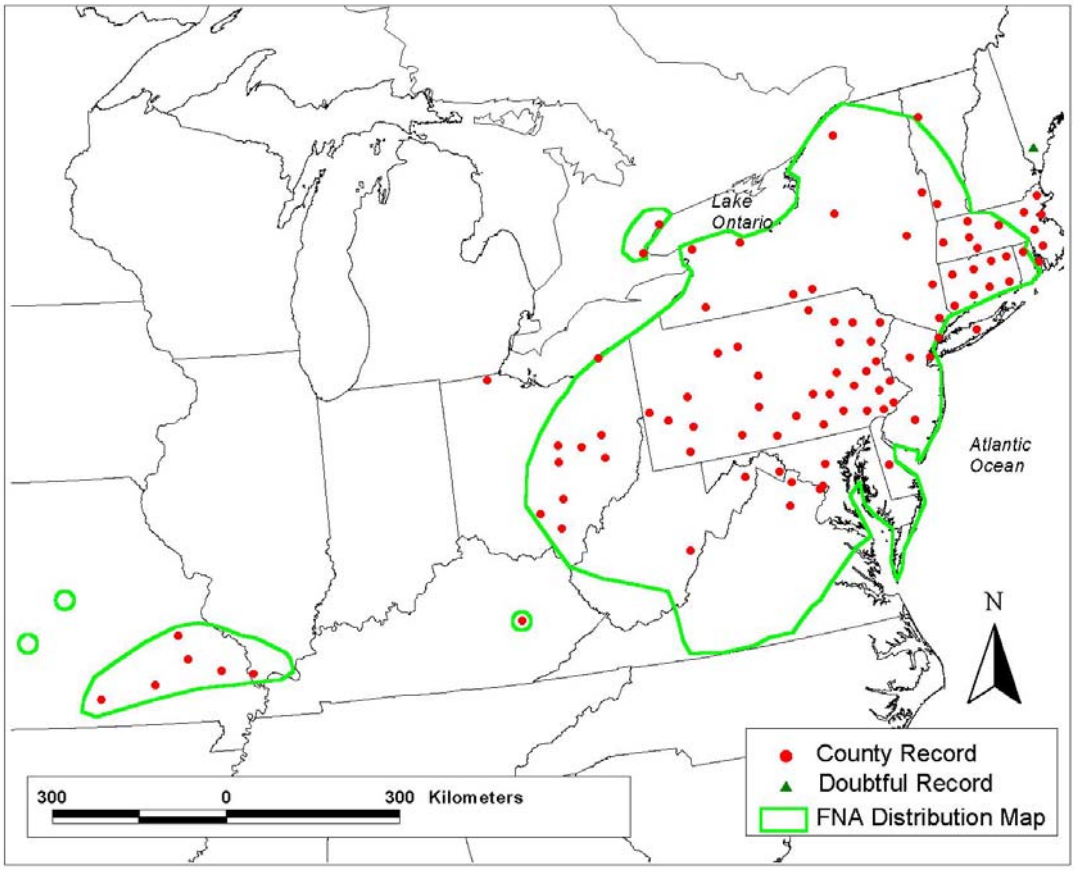

Figure 1. Global Distribution of Few-flowered Club-rush/Bashful Bulrush

9.2 Canadian range

The only occurrences of this species in Canada are in southern Ontario. There are two known locations (Figure 2): Royal Botanical Gardens' Cootes Paradise Nature Sanctuary in Hamilton (eight extant occurrences and two historic records) and Rouge Park in Toronto (one potentially extant occurrence and one historic record).

Figure 2. Canadian Distribution of Few-flowered Club-rush/Bashful Bulrush

9.3 Percent of Global Distribution in Canada

Canada comprises less than 1% of the species' global range.

9.4 Distribution Trend

The Canadian range of this species has remained roughly steady (two sites). However, only one plant was found in Rouge Park in 2001 and none were found in 2005. Few-flowered Club-rush/Bashful Bulrush may be extirpated from this location, but additional surveys are required to confirm this.

10. Population Abundance

For the purposes of this document, "plant" is defined as a grouping of stems which is separated from other such groupings by at least one centimetre (see O'Hara, 2001). This operating definition may be revised upon the completion of ecological and genetic investigations (see Section 3).

10.1 Global Range

Few-flowered Club-rush/Bashful Bulrush is globally secure to apparently secure (G4G5), but rare along the margins of its distribution in Vermont (S1), Maryland (S2S3), Ontario

(S1), Missouri (S3S4), Kentucky (S1?), West Virginia (S1), and Delaware (S2). It is uncommon in New Jersey (S4) and is considered historic in Illinois (SH) or District of Columbia (SH). All Nranks and Sranks come from NatureServe (2005). It is listed as Endangered in Vermont (VFWD, 2005), Ontario (OMNR, 2005) and Kentucky (Kentucky State Nature Preserves Commission, 2000). Rare species tracking data for Few-flowered Club-rush/Bashful Bulrush are not available in the rest of its range – it is reported without an assigned status (SNR) in Connecticut, Maine, Massachusetts, New York, Ohio, Pennsylvania, Rhode Island, and Virginia (NatureServe, 2005).

10.2 Canadian Range

Few-flowered Clubrush/Bashful Bulrush is nationally critically imperilled (N1) (NatureServe 2006). Field work completed in 2001, located 1633 plants from eight sites in Hamilton, however, only one plant (with 40 stems) was located in Rouge Park in 2001 and none were found in 2005. A second Rouge Park population is suspected to have been extirpated as there were several unsuccessful searches in the 1990s (White, 2000). It could not be located by the primary author in 2001, despite intensive searches in the vicinity of the original record. Census data for each of the existing and historic Canadian records of Few-flowered Club-rush/Bashful Bulrush are presented in Table 2.

10.3 Percent of Global Abundance in Canada

Less than 1% of the global abundance occurs in Canada.

10.4 Population Trend

Significant declines are documented in the abundance of the Rouge Park populations. One Rouge Park population consisted of hundreds of flowering culms in 1984 (Crins, 1989). Varga et al. (1991) confirmed its persistence in comparable numbers. It was not located during 1997, and only a single "tuft" was found in 1999 (White, 2000). A single plant was located in 2001 (Smith, 2001). Field work during 2005 failed to find it at this location.

The other Rouge Park population consisted of a single "tuft" in 1981. Royal Botanical Gardens staff returned to the location of the original report in 2001, but did not find any Few-flowered Club-rush/Bashful Bulrush. Several other searches have failed to locate this population, and it is presumed extirpated (White, 2000).

It is difficult to determine the status of the Cootes Paradise Populations based on current data. Four of the Hamilton populations numbered several hundred to thousands of fruiting culms in 1984 (Crins, 1989). A fifth Hamilton population consisted of eight clumps of five to 30 flowering culms each. White (2000) reported significant declines, being unable to locate three of these populations, and observing more than a 50% reduction in numbers at another two populations in 1999. However, subsequent surveys conducted by Royal Botanical Gardens staff documented large populations at Cootes Paradise in 2000 and 2001 (O'Hara, 2001 and new data presented here).

The discrepancies between the data presented in Table 2 by Smith (2001) and those presented by White (2000) highlights the challenges in assessing the status of Few-flowered Club-rush/Bashful Bulrush. This species is extremely inconspicuous. In

addition, it is associated with gap-phase succession2. As a result, even under optimum conditions the persistence of Few-flowered Club-rush/Bashful Bulrush at any given location may be naturally limited, with long-term survival dependant upon the colonization of new sites. Ongoing monitoring efforts should take this into account: in addition to monitoring existing populations, regular surveys to locate new populations should be conducted.

[2] Gap-phase succession refers to the dynamic ongoing process of regeneration that occurs in small forests openings. These openings or gaps are continually created by the loss of single mature trees. These sites become areas of increased regeneration and are eventually occupied by trees reaching into the canopy.

Table 2. Summary of Reports of Historical and Extant Few-flowered Club-rush/Bashful Bulrush Sites

Site	EO ID	Tamsalu's Collections	Crins 1989	White 2000	Smith 2001	Varga, Davies, Miller 2005	Vouchers
Cootes 1	13026	Not located	First record, no population estimate	Not located	NS1, 6 plants	N/A	HAM 1329
Cootes 2	3100	First record 1955, "sparsely grouped"	"large colony, about 100's of culms"	Not located	NS2, 18 plants	N/A	HAM 1327 HAM 1333 HAM 1335
Cootes 3	13027	First record 1955, "common"	Not located	Not located	Not located	N/A	HAM 1331
Cootes 4	13027	First record 1955, "sparse"	Not located	Not located	Not located	N/A	HAM 1332
Cootes 5	13027	First record 1958, "rare"	"100's of culms, about 10 large clumps"	Not located	SS1, approximately 1150 plants	N/A	HAM 1328 HAM 1336 HAM 11323
Cootes 6	13027	Not located	Not located	Not located	First record, SS2, 4 plants	N/A	None
Cootes 7	13027	Not located	Not located	First record, 1.5m x 1.5m patch of 10 clumps, each with about 10-20 flowering stems	SS3, 81 plants	N/A	None
Cootes 8	13027	Two 1957 collections, HAM 1330 and HAM 1334, could be from either this location or the next. "Sparsely grouped"	Not located	Not located	First record?, SS4, 171 plants	N/A	HAM 1330 HAM 1334
Cootes 9	13027	See above	Not located	Not located	First record? SS5, 92 plants	N/A	None
Cootes 10	13027	Not located	Not located	Not located	First record, SS6, 111 plants	N/A	HAM 11319
Rouge 1	3098	N/A	"Hundreds of flowering culms"	"One small clump"	1 plant, 40 stems	Not located	None
Rouge 2	3101	N/A	A single clump first recorded in 1981, not located in 1984.	Not located	Not located	N/A	None

Sources: Collections by Bill Crins, Paul O'Hara, and Aleksander Tamsalu in the Royal Botanical Gardens Herbarium (HAM); fieldwork completed by Steve Varga, Barb Davies and Gavin Miller in 2005, Tyler Smith in 2001; Varga et. al, 1991; Crins, 1989; O'Hara, 2001; White, 2000.

11. Biologically Limiting Factors:

The ecology of Few-flowered Club-rush/Bashful Bulrush is poorly understood. Crins (1989) observed that all Canadian populations occur in the vicinity of forest canopy gaps. This association suggests that gap-phase succession is likely responsible for producing and maintaining Few-flowered Club-rush/Bashful Bulrush habitat. If this is the case, metapopulation dynamics that are controlled by gap dynamics may be more important than individual population trends in the long term. No mechanism for long distance seed dispersal has been identified. The relationships between gap creation, dispersal and colonization, seed bank and germination conditions, and demographic trends need to be elucidated.

12. Threats

Potential threats to Few-flowered Club-rush/Bashful Bulrush have been compiled from documents and individuals who are knowledgeable about the plant. These threats are listed below, but none have been investigated empirically. Basic biological studies need to be conducted (see Section 3) before these threats can be fully characterized, ranked and eliminated.

Canopy closure due to succession and fire suppression, may pose the greatest threat to this species. Crins (1989) suggested that the primary limiting factor in the establishment of new colonies appears to be the amount of sunlight reaching the forest floor through canopy gaps. It is suspected that this is a contributing factor to the decline of Few-flowered Club-rush/Bashful Bulrush in Rouge Park and was identified as a threat to all eights sites in Cootes Paradise (O'Hara, 2001).

While moderate disturbance has been suggested as important in producing habitat for Few-flowered Club-rush/Bashful Bulrush, excessive disturbance has been identified as a threat. Both natural (Coyote [*Canis latrans*] dens) and anthropogenic (hiking trails) disturbances (often resulting in erosion) were reported as damaging populations by White (2000).

High rates of deer browse were noted in Rouge Park during site visits in 2005 and may be a factor in its decline at that location. This was also identified as a potential threat to three sites in Cootes Paradise (O'Hara, 2001).

Competition from native (*Carex pensylvanica*, Crins, 1989) and introduced (*Lonicera* spp., White 2000) plants was also suggested as a potential threat.

During the 2001 field season, fungal infection and lepidopteran herbivory destroyed some fruit-clusters in the Cootes Paradise populations. The extent and significance of these factors are not known.

13. Habitat Identification

13.1 Habitat Needs

Few-flowered Club-rush/Bashful Bulrush is found in open-canopied deciduous and mixed forest with few shrubs in the understory and excellent drainage. In Ontario, the plants are found on warm, slightly disturbed sites with associated tallgrass habitat. Common associates are White Oak (*Quercus alba*), Black Oak (*Quercus velutina*), and White Pine (*Pinus strobes*). Herbaceous associates include Pennsylvania Sedge (*Carex pensylvanica*), Bellow-beaked Sedge (*Carex albicans*), Oval-leaved Sedge (*Carex cephalophora*), Longstalk Sedge (*Carex pedunculata*), Broad-leaved Sedge (*Carex platyphylla*), Hairy Woodrush (*Luzula acuminata*), Large-leaf Wood-aster (*Eurybia macrophylla*), and Bluestem Goldenrod (*Solidago caesia*).

The putative gap-phase specialization of Few-flowered Club-rush/Bashful Bulrush has serious implications for long term habitat requirements. It may be determined that individual populations suffer natural extinctions as canopy gaps close. If this is the case the persistence is dependent upon the ability of Few-flowered Club-rush/Bashful Bulrush to colonize new gaps as they form. Effective stewardship will therefore require a sound understanding of dispersal and seedbank dynamics for this species.

13.2 Critical Habitat

The Species at Risk Act (SARA) defines critical habitat as "the habitat that is necessary for the survival or recovery of a listed wildlife species". Extensive information is required to define critical habitat and the following is only a portion of what is believed to be the critical habitat for Few-flowered Club-rush/Bashful Bulrush. At this time, critical habitat will only be described to the extent possible and will be refined as additional information is acquired.

The survival of Few-flowered Club-rush/Bashful Bulrush is contingent on the protection of its occupied habitats in Cootes Paradise and Rouge Park. Critical habitat for Few-flowered Club-rush/Bashful Bulrush is being identified, to the extent possible, in the Recovery Strategy, and includes: (1) the eight sites of occupied habitat that have been identified at Cootes Paradise, six on the south shore and two on the north shore. These occupied habitats are contained within Dry-Fresh Oak-Red Maple Deciduous Forest Type and Dry Black Oak-White Oak Tallgrass Woodland Type as described by the Ecological Land Classification (ELC) for Southern Ontario (Lee *et al*. 1998); and, (2) one site of occupied habitat that is located in the Rouge Park within Dry-fresh Mixed Oak Deciduous Forest Type. All of these sites are warm, well-drained slopes, usually subject to slightly higher-than-average light levels, due to tree fall, proximity to trail, or steep slope (Crins, 1986). Further studies are needed to more fully identify the extent of critical habitat required to achieve long-term survival of the species and are identified in Section 13.4.

13.3 Examples of Activities that are Likely to Result in Destruction of the Critical Habitat

The primary activities that will likely result in destruction of critical habitat are:

- Trampling from the adjacent recreational use of trails and the creation of new trails.

13.4 Schedule of Studies

Further study is required to determine if additional critical habitat is required for the recovery of Few-flowered Club-rush/Bashful Bulrush. Very little is known about the biology and ecology of this species and Section 3 identifies many of the remaining questions that research efforts could help answer. Table 3 draws from this list to specifically address the research activities which will help determine if and where additional critical habitat is required for the recovery of Few-flowered Club-rush/Bashful Bulrush.

Table 3. Schedule of Studies

Description of Research Activity	Expected Results	Start Date*	Completion Date*
Update habitat mapping and assessment using Ecological Land Classification (ELC) for all sites	Identify the ELC vegetation type and its extent for each population.	April 2006	Oct 2007
Complete a Population Viability Analysis (PVA).	To determine population viability under current conditions and to help evaluate the number of individuals and amount of habitat required to attain viability.	Nov 2008	Mar 2009
Further define the abiotic and biotic habitat requirements for the species.	To help identify potential critical habitat for population expansion if deemed necessary by PVA.	April 2006	Nov 2009

* These are tentative dates and may be modified as necessary.

13.5 Habitat Protection / Ownership

The habitat for the vast majority of the extant sites is protected under the private ownership of Royal Botanical Gardens in Cootes Paradise Nature Sanctuary.

Rouge Park is publicly owned by the Toronto and Region Conservation Authority and managed under the direction of the Rouge Park Alliance. The Park's goal, as identified in Rouge Park's Management Plan (1994), is "to protect, restore, and enhance the natural...values of the park in an ecosystem context...". Both sites of Few-flowered Club-rush/Bashful Bulrush are zoned as Nature Reserve in Rouge Park's Management Plan. The policies regarding this zoning include management for the continuation of natural processes, and limiting development to walking trails, cross country ski trails and wildlife viewing.

Few-flowered Club-rush/Bashful Bulrush is listed as Endangered under the Species at Risk Act and is regulated under Ontario's Endangered Species Act. This provides protection to the plant and its habitat. Ontario's Provincial Policy Statement also offers protection by not permitting development or site alteration in its significant habitat.

14. Ecological Role

This species is an understorey herb. Otherwise, no specific ecological roles are known for this species.

15. Importance to People

The presence of this species could be capitalized upon by Royal Botanical Gardens and/or Rouge Park for ecotourism activities. Its protection could influence the alignment of trail systems, access for wildlife viewing and forest management practices for both properties.

16. Anticipated Conflicts or Challenges

The inconspicuous nature of the species presents challenges in conducting field research. Locating populations has proven to be difficult, and any surveys must be completed between late April and early June to be effective.

The pool of individuals with field experience to search for this species is limited given the difficulty in its identification. There are individuals within the Guelph and Aurora District offices of the MNR TRCA and at RBG with the requisite experience to continue to monitor and to search for new populations.

This species is associated with gap-phase succession limiting the ability of the species to persist in any suitable or optimal habitats. Vigilance is required to monitor known populations to record changes in the habitat. Opportunities for the creation of new canopy gaps need to be pursued if this is not occurring naturally.

17. Knowledge Gaps

17.1 Survey Requirements

The discovery of other populations in Canada could change the conservation priority of the species. It would certainly improve our understanding of its ecology. The inconspicuous nature of the plant has led several authors to speculate that it is likely under-reported (Crins 1989, Steyermark 1963, Strasbaugh and Core 1978). Crins (1986) identified major river valleys of Western Lake Ontario as potential sites for further investigation. Specifically, he named Jordan Valley, Grindstone Valley, Bronte and Oakville Creeks south of Highway 5, and Highland Creek. Maycock's collection from Eastern Lake Ontario suggests that searches in appropriate habitat around Cornwall may be fruitful.

Several of these areas were searched in 2001, but no new records of Few-flowered Club-rush/Bashful Bulrush were discovered. The Hendrie Valley Nature Sanctuary (Royal Botanical Gardens) portion of the Grindstone Creek was searched without success in both 2000 and 2001. This area has very similar habitat to the occupied sites in Cootes Paradise. It has now been searched intensively over several years, and it is unlikely that Few-flowered Club-rush/Bashful Bulrush could have been overlooked. Further searching upstream of Royal Botanical Gardens property may prove more successful. La Salle Park in Burlington was searched, as it has habitat comparable to the Cootes Paradise sites. In addition, Royal Botanical Gardens staff spent half a day searching the slopes and rim of the Bronte Creek Valley in Oakville.

17.2 Biological/Ecological Research Requirements

Basic biological information is lacking for this species; background ecological, habitat and genetic research is thus essential for effective recovery planning (see Section 3). What little is known about its ecological relationships suggests that it could present several interesting conservation challenges. After establishing the geographical distribution of the species through field surveys, demographic studies are critical in planning for recovery. As outlined in Schemske et al. (1994), these studies would include three distinct stages:

1) Assessing the biological status of the species using quantitative demographic studies:
   Are populations stable, declining, or increasing over time?
2) Identifying life history stages critical to overall population decline:
   Can population decline be linked to a particular life history stage?
   e.g. seedbank, seedling survival, seed-set, dispersal
3) Determining biological factors responsible for critical life history stage parameters:
   What is limiting the success of the critical life history stage?
   e.g. lack of genetic diversity, disturbance regime, missing disperser, climate change

Once completed, this research would enable the recovery team to establish appropriate goals with accompanying restoration actions.

17.3 Threat Clarification Research Requirements

The research outlined in Section 3 directly addresses threat clarification. As described in that section, once threats have been identified, more detailed studies and specific recovery actions will be described in a Recovery Action Plan.

18. Ecological and Technical Feasibility of Species Recovery

Based on current knowledge of Few-flowered Club-rush/Bashful Bulrush, it is recommended that recovery of this species is technically and biologically feasible.

The relationship between Few-flowered Club-rush/Bashful Bulrush and natural disturbances suggests that practical management practices could be found to protect and enhance Canadian populations. Basic biological data need to be collected before these practices can be appropriately defined.

Ecological Land Classification (ELC, Lee *et al.* 1998) surveys have been completed for the populations at Cootes Paradise. The results of the ELC survey show that all available habitats are not occupied in Cootes Paradise, and appropriate unoccupied habitat occurs in Hendrie Valley.

Quality habitat in Royal Botanical Gardens Nature Sanctuaries, and in Hamilton and Halton Regions generally, coincides with areas identified as tallgrass woodland remnants (Goodban et al. 1996). Few-flowered Club-rush/Bashful Bulrush is not listed as a component of the tallgrass flora (Rodger 1998, Packard and Mutel 1997). However, the conditions in dry-fresh tallgrass woodland communities correspond to those favoured by Few-flowered Club-rush/Bashful Bulrush: warm exposures, coarse well-drained soils, open understory, and occasional canopy gaps. Habitat mapping for Rouge Park was completed in the late 1980s and is presented in the Ecological Survey of the Rouge Valley Park (Varga et al. 1991). Updated mapping using current Ecological Land Classification standards would useful to assess the quality and availability of habitat in Rouge Park.

Open woodlands, tallgrass or otherwise, are becoming scarce in Hamilton and Halton (Goodban et al. 1996). The open character previously maintained by a natural fire regime is being lost. In the absence of fire, native and introduced forbs and shrubs are colonizing the understory. This lowers the light levels reaching the ground, creating a cooler, wetter microclimate. As a result the availability of potential habitat for Few-flowered Club-rush/Bashful Bulrush is being reduced.

Prescribed burns or physical removal of shrubbery could be effective tools to restore open habitats. A coordinated tallgrass woodland restoration program, incorporating these and other measures, would serve two related objectives. Immediately, it would help protect the flora and fauna of this endangered habitat. In the long term it could provide critical habitat for Few-flowered Club-rush/Bashful Bulrush (and also Hoary Mountain Mint (*Pycnanthemum incanum*), another endangered species that exploits forest gaps (Thompson 2000)). Similarly, threats from human disturbance are manageable at the Cootes Paradise and Rouge Park locations (via exclosures or trail re-routing).

Successful *ex situ* propagation techniques have been identified. Seeds collected from Cootes Paradise in 2000 were germinated after cold stratification in the Royal Botanical Gardens greenhouse. 17% germination was recorded in a test planting (5 out of 30 seeds germinated). A total of 80 seedlings have been produced. At the end of one season of growth most of the seedlings have four to six culms. These seedlings will not be planted out until the need is firmly established and a scientific introduction strategy is developed.

19. Recommended Approach / Scale for Recovery

The restoration of Few-flowered Club-rush/Bashful Bulrush would probably benefit other species such as those associated with tallgrass woodlands, according to the tallgrass communities recovery plan (Rodger 1998). Recovery efforts for Few-flowered Club-rush/Bashful Bulrush should coordinate with this community recovery plan and the

Hoary Mountain Mint recovery strategy since they share similar habitats and threats. There may also be opportunities to coordinate efforts with the Rouge Park Management Plan and TRCA's Natural Heritage Strategy. Long-term recovery for Few-flowered Club-rush/Bashful Bulrush will require research directed at identifying threats and opportunities specific to this species. Metapopulation dynamics may be critical in establishing the appropriate scale for recovery action.

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ADDENDA

Jurisdiction responses

Ontario

Acknowledgement of Receipt of the Recovery Strategy for the Few-flowered Club-rush in Canada (May 2006) by the Ontario Ministry of Natural Resources on behalf of the Province of Ontario

This draft Recovery Strategy for the Few-flowered Club-rush in Canada (May 2006) has been prepared in cooperation with the members of the Recovery Team, Canadian Wildlife Service (CWS) and the Ontario Ministry of Natural Resources (OMNR). It represents advice to the OMNR on the recovery goals, approaches and objectives that are recommended to protect and recover the species. It does not necessarily represent the views of all individual members of the recovery team, or the official positions of the organizations with which the individual team members are associated. The goals, objectives and recovery approaches identified in the strategy are based on the best existing knowledge and are subject to modifications resulting from new findings and revised objectives. Implementation of the plan is subject to policies, appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations

Received by:

Cameron Mack
Director, Fish and Wildlife Branch
Natural Resource Management Division
Ontario Ministry of Natural Resources
On *behalf of the Province of Ontario*

Date: September 2006

Species at risk – act today so they have tomorrow

DECLARATION FROM ENVIRONMENT CANADA

This recovery strategy has been prepared in cooperation with the jurisdictions responsible for the Few-flowered Club-rush/Bashful Bulrush. Environment Canada has reviewed and accepts this document as its recovery strategy for the Few-flowered Club-rush/Bashful Bulrush, as required under the *Species at Risk Act*. This recovery strategy also constitutes advice to other jurisdictions and organizations that may be involved in recovering the species.

The goals, objectives and recovery approaches identified in the strategy are based on the best existing knowledge and are subject to modifications resulting from new findings and revised objectives.

This recovery strategy will be the basis for one or more action plans that will provide details on specific recovery measures to be taken to support conservation and recovery of the species. The Minister of the Environment will report on progress within five years.

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this strategy and will not be achieved by Environment Canada or any other jurisdiction alone. In the spirit of the Accord for the Protection of Species at Risk, the Minister of the Environment invites all responsible jurisdictions and Canadians to join Environment Canada in supporting and implementing this strategy for the benefit of the Few-flowered Club-rush/Bashful Bulrush and Canadian society as a whole.

STRATEGIC ENVIRONMENTAL ASSESSMENT

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the *Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals*. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making.

Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that strategies may also inadvertently lead to environmental effects beyond the intended benefits. The planning process based on national guidelines directly incorporates consideration of all environmental effects, with a particular focus on possible impacts on non-target species or habitats. The results of the SEA are incorporated directly into the strategy itself, but are also summarized below.

This recovery strategy will clearly benefit the environment by promoting the recovery of the Few-flowered Club-rush/Bashful Bulrush. The potential for the strategy to inadvertently lead to adverse effects on other species was considered. It is anticipated that recovery actions for Few-flowered Club-rush/Bashful Bulrush could have a positive impact on tallgrass woodland communities. As a putative gap-phase species, Few-

flowered Club-rush/Bashful Bulrush may be sensitive to encroachment by exotic invasives, so recovery actions may require local control of non-native species; however, the effects of any such actions will be carefully evaluated beforehand. Overall, the SEA concluded that this strategy will clearly benefit the environment and will not entail any significant adverse effects.

RESIDENCE

SARA defines residence as: *a dwelling-place, such as a den, nest or other similar area or place, that is occupied or habitually occupied by one or more individuals during all or part of their life cycles, including breeding, rearing, staging, wintering, feeding or hibernating* **[Subsection 2(1)]**.

Residence descriptions, or the rationale for why the residence concept does not apply to a given species, are posted on the SARA public registry: www.sararegistry.gc.ca/plans/residence_e.cfm