New England Plant Conservation Program

Conservation and Research Plan

Sclerolepis uniflora (Walter) BSP
One-flowered Sclerolepis

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SUMMARY

Sclerolepis uniflora (Walter) BSP (Asteraceae), one-flowered Sclerolepis, is a regionally rare taxon according to the New England Plant Conservation Program (NEPCoP) *Flora Conservanda*: New England (Brumback and Mehrhoff et. al. 1996). This species is listed as endangered (S1) in Massachusetts, New Hampshire, and Rhode Island. In New England, this species occurs in two populations, one in Douglas, Massachusetts and Burrillville, Rhode Island, and a second in Bradford, New Hampshire. Elsewhere, it occurs from New Jersey south to Florida, and west to Louisiana. This species is ranked S1 or S2 in states along the mid-Atlantic coastal plain, and is abundant in South Carolina, Georgia, and Florida. It has recently been discovered in Louisiana.

The major conservation objective for this species in New England is to maintain the two extant populations in their current locations, at or above the current level. The long-term survival of the species in New England may be threatened by extremely high water levels, removal of the species from the shoreline, shoreline improvement or modifications, liming of lakes, presence of non-native species such as variable water-milfoil (*Myriophyllum heterophyllum),* and/or the efforts to eradicate such non-natives.

The primary conservation actions for *Sclerolepis uniflora* are to study, protect, and maintain this species. Detailed field studies should be conducted to document the distribution and abundance of the aquatic and terrestrial forms at both locations. Additional field and greenhouse studies should be conducted to answer questions about species biology, flower production, seed set, perennial nature, and ability to compete with non-natives. Both populations should be studied, as there appears to be differences in their biology at the two sites. Plants should also be studied to determine the effects of fluctuating water levels on their heterophyllous nature, ability to over winter, and flowering. Seed should be collected from at least one of the populations for seed banking. In addition, *S. uniflora* should be monitored to determine how it would be affected by efforts to eradicate a non-native invasive. At this time, land acquisition is not critical, as plants have persisted in both locations for over 90 years. However, local landowners, state foresters, town conservation commissions, and lake association members should be educated on how to protect and manage this species.

PREFACE

This document is an excerpt of a New England Plant Conservation Program (NEPCoP) Conservation and Research Plan. Full plans with complete and sensitive information are made available to conservation organizations, government agencies, and individuals with responsibility for rare plant conservation. This excerpt contains general information on the species biology, ecology, and distribution of rare plant species in New England.

The New England Plant Conservation Program (NEPCoP) is a voluntary association of private organizations and government agencies in each of the six states of New England, interested in working together to protect from extirpation, and promote the recovery of the endangered flora of the region.

In 1996, NEPCoP published "*Flora Conservanda*: New England." which listed the plants in need of conservation in the region. NEPCoP regional plant Conservation Plans recommend actions that should lead to the conservation of *Flora Conservanda* species. These recommendations derive from a voluntary collaboration of planning partners, and their implementation is contingent on the commitment of federal, state, local, and private conservation organizations.

NEPCoP Conservation Plans do not necessarily represent the official position or approval of all state task forces or NEPCoP member organizations; they do, however, represent a consensus of NEPCoP's Regional Advisory Council. NEPCoP Conservation Plans are subject to modification as dictated by new findings, changes in species status, and the accomplishment of conservation actions.

Completion of the NEPCoP Conservation and Research Plans was made possible by generous funding from an anonymous source, and data were provided by state Natural Heritage Programs. NEPCoP gratefully acknowledges the permission and cooperation of many private and public landowners who granted access to their land for plant monitoring and data collection.

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I. BACKGROUND

INTRODUCTION

Sclerolepis uniflora (Walter) BSP, one-flowered Sclerolepis, is a small aquatic herbaceous plant in the Asteraceae that occurs in two New England lakes. It exhibits a distinct, heterophyllous nature depending on water levels. When submerged, it forms a flexible aquatic strand, and when emerged it develops stiff, upright shoots that may flower. This species is most frequent in the vegetative aquatic form that forms dense mats in deep water.

In New England, *Sclerolepis uniflora* has a rank of S1 in Massachusetts, Rhode Island, and New Hampshire. One of the occurrences is within both Massachusetts and Rhode Island; for the purpose of this paper, it will be considered as a single site. Globally, this species is ranked as G4, as it is secure in other parts of its range. Outside of New England, *S. uniflora* can be found along the Atlantic Coastal Plain from New Jersey south to Florida and west to Louisiana. It is common enough to not be tracked by Natural Heritage Programs in South Carolina, Georgia, and Florida. However, in New England, populations may be threatened by high water levels, liming of lakes, shoreline improvement or modifications, non-native invasive species, and efforts to eradicate such non-natives.

This Conservation and Research Plan presents information on the distribution, taxonomy, ecology, biology, and conservation of *Sclerolepis uniflora*. A discussion of the threats to the taxon and recommended actions for conservation in New England are included.

DESCRIPTION

Sclerolepis uniflora is a sub-aquatic to aquatic, perennial herb. Leaves are entire, sessile, linear to linear-subulate, ca. 2 cm. in length and in whorls of three to six. When in the aquatic or submerged form, stems are flexuous and rooted into sediments. The submerged form is entirely vegetative and can grow from only a few centimeters to lengths ca. 50 cm. in deep water. As water levels drop, plants become stranded on sandy or peaty shores where it roots from the nodes of horizontal stems and develops upright erect shoots. When emerged, stems are erect, stiff and grow from a rhizomatous base. The emergent or terrestrial stage is generally unbranched and less than 25 cm tall. A solitary, terminal, flower head may form on the erect shoots. Receptacles are convex to conical and warty. Each head contains ca. 50 perfect flowers with funnel-shape, pink, lavender to white corollas. Style branches are narrowly linear or slightly clavate, distally flattened, densely long- papillose. Achenes are prismatic in shape, five ribbed, and less than two mm in length. The pappus usually consists of five thick indurate

short straw-colored scales which persistent on the top of the achene (King and Robinson 1987, Gleason and Cronquist 1991, Bremer 1994, Crow and Hellquist 2000 and D. Dunlop, personal observation).

TAXONOMIC RELATIONSHIPS, HISTORY, AND SYNONYMY

Sclerolepis uniflora is a monotypic genus and has been consistently recognized as a distinct genus since Cassini described it in 1816 (King and Robinson 1987). Generally, this genus is placed in the tribe Eupatorieae and aligned with *Trichocornois* and *Shinnersia*. The genus *Sclerolepis* is distinguished from these genera by the verticillate leaves and distinctive crests of the cells on the ribs of the achenes (King and Robinson 1987).

Historically, there have been few changes in the synonymy of the taxon. King and Robinson (1987) report the following synonymy:

Sclerolepis uniflora (Walter) Britton, Sterns and Pogg. *Prelim. Cat*. 25 1888.
Sclerolepis uniflora (Walter) Porter, *Mem. Torrey Bot. Club*. 5:311 1894.
Sclerolepis verticillata (Michaux) Cass. *Dict. Sci. Nat*. 48: 155 1827.
Type: *Sparganophorus verticillatus* Michaux *Fl. Bor. Amer*. 2:95 T. 42. 1803

SPECIES BIOLOGY

Very little is known about the biology of *Sclerolepis uniflora*. Although the species is fairly abundant in some parts of the range, there is little literature on this species except on its distribution, chromosome number, and systematics.

Life Cycle

Most characteristic of this species is its dimorphic or heterophyllous nature. From the aquatic form, it can change into a terrestrial form that has little resemblance to the former (Mehrhoff 1983). Based on observations, this species is predominantly vegetative in New England. In Lake Massasecum, most of the growth is rooted in water from a few centimeters to 3 meters deep. If water levels fall during the growing season, plant fragments cut by boat motors or jet skis will wash up on shore and take root. Once rooted, if there is no additional inundation, plants will grow and flower in early September or October. During growing seasons with abundant rain and very high water levels, plants do not become stranded and, therefore, do not flower. In New Hampshire, plants are not perennial in the terrestrial form (D. Dunlop, personal observation). Five years of observations show that plants do not survive in terrestrial locations over the winter. In the early summer, aquatic fragments must be washed on

to the shore. Based on the stability of subpopulation locations at Wallum Lake, plants may overwinter on the shore.

Reproduction

Herbarium records show flowering plants in Alabama, Florida, Georgia, and South Carolina as early as May and continue until October. Likewise, in New Jersey, plants flower from August to September. Plants in New Hampshire have been observed flowering in late August and early September, but in many years it is not until October (Mehrhoff 1983, D. Dunlop, personal observation). Flowering plants have been found at both Wallum Lake and Lake Massasecum. However, it is not known whether flowers set seed. I have been unable to find seed at Lake Massasecum during the past five years. Seed is abundant on herbarium specimens from the southern part of the range (South Carolina, Georgia, and Florida).

This species has a chromosome base number of 15 (King et. al. 1976, Ito et. al. 2000) and chromosome number ca. 30 (King and Robinson 1987).

HABITAT/ECOLOGY

In New England, *Sclerolepis uniflora* occurs in two deep water lakes that are characterized as mesotrophic or oligotrophic. In Wallum Lake, plants have been observed in the aquatic form in shallow water up to one meter deep, and in the terrestrial form has been observed on sandy shores or on peaty substrates. At Lake Massasecum, this species is widespread in the aquatic form to depths of three meters and is rare in the terrestrial form. If water levels drop during the growing season, terrestrial forms may grow on sandy beaches or on peaty shores. Interestingly, most herbarium records from the southern part of the range show the terrestrial form only. It is not clear whether this is a result of overlooking the aquatic form or whether it does not occur in this form. Label data from herbarium sheets and information from southern botanists show that this species occurs in a range of habitats. In Georgia, *S. uniflora* is found in openings and disturbed areas associated with bottomland hardwoods and around the bases of trees in cypress ponds. In North Carolina, plants are found in borrow pits, roadside ditches, drainage canals, swampy depressions, clay seeps along rivers, and on lakeshores. In New Jersey, *S. uniflora* is found in isolated peat bogs in the Pine Barrens.

THREATS TO TAXON

Water levels

Since the terrestrial form of the plant is required for flowering, if water levels remain high, flowering will not occur. Summer high-water levels would prevent flowering and

opportunities for genetic variation through sexual reproduction. It is assumed that for the long-term survival of this species, sexual reproduction would be beneficial to ensure some genetic variation. Water level management should be considered at Wallum Lake as there is a dam on the lake. There is no dam at Lake Massasecum, so water levels cannot be managed. Interestingly, flowers have not been observed to set seed at Lake Massasecum so, it is possible that all plants in this lake are one large clone.

Shoreline maintenance

Property owners on Lake Massasecum tend to view this plant as a pest and rake it off their beaches and shores. Great masses of *Sclerolepis uniflora* fragments are removed from some sand beaches on a weekly basis during the summer. This prevents the plant from forming into a terrestrial form that could flower.

Liming of lakes

Wallum Lake had been managed jointly by the State of Massachusetts and Rhode Island for fisheries by adjusting the water chemistry. In the past, it was determined that a higher pH would facilitate fish survival; hence, Wallum Lake has been limed at least three times. The history of liming is reported under the site description. What effect liming has on the growth and survival of *Sclerolepis uniflora* is not known. All liming should be halted until the effects are understood.

Presence of non-native invasives and eradication efforts

In Lake Massasecum, *Sclerolepis uniflora* has been threatened by the presence of a non-native aquatic plant, *Myriophyllum heterophyllum* (variable water-milfoil). This invasive appeared in 1996 and has been the target of eradication efforts, which are described under the Lake Massasecum site description. *Sclerolepis uniflora* grows in the same area with milfoil; therefore, any eradication efforts will impact both species. At first, New Hampshire Department of Environmental Services applied an herbicide that has been followed by hand-pulling of plants and attempts to suppress plant growth by the use of large synthetic bottom barriers. Most recently, harvesting from a pontoon boat has been used. However, large amounts of *S. uniflora* were observed (D. Dunlop, personal observation) in the piles of harvested materials.

DISTRIBUTION AND STATUS

General Status

Sclerolepis uniflora occurs in New England as two populations disjunct from a more southern distribution (see Table 1). Outside of New England, it occurs from New Jersey southward to Florida. Recently, it was discovered in Virginia (Fleming and Ludwig 1996). It is considered an S1 or S2-ranked species along the Atlantic Coastal Plain, but becomes more abundant in South Carolina, Georgia, and Florida (NatureServe 2000). West of Florida, it becomes rare with only one population known from Mississippi (Harvard Herbarium specimen) and a newly discovered occurrence in Louisiana (L. Smith, Louisiana Chapter of The Nature Conservancy, personal communication).

Status of All New England Occurrences - Current and Historic

Sclerolepis is known from only two stations in New England, Wallum Lake and Lake Massasecum (see Table 2). These are disjunct populations at the northern end of the range. In Massachusetts, Rhode Island, and New Hampshire this species is considered Endangered.

Table 1. Occurrence and status of *Sclerolepis uniflora* in the United States and Canada based on Information from Natural Heritage Programs.			
OCCURS & LISTED (AS S1, S2, OR T &E)	**OCCURS & NOT LISTED (AS S1, S2, OR T & E)**	**OCCURRENCE UNVERIFIED**	**HISTORIC (LIKELY EXTIRPATED)**
Delaware: (S2) Six extant occurrences	Alabama: (S?) not monitored but said to be rare	Not applicable.	Not applicable.
Rhode Island: (S1) One site same as MA	South Carolina: (SR) not tracked and known from 16 counties		
Maryland: (S2) Endangered and will be changed to threatened soon	Georgia: (SR) not tracked but known from 13 counties and locally abundant		
Massachusetts: (S1) One site same as RI	Florida: (SR) many sites		
New Jersey: (S2) 17-20 occurrences	Louisiana: one site newly reported [1]		
New Hampshire: (S1) One site	Mississippi: one site[2]		
North Carolina: (S2) On the watch list			
Virginia: (S1) One site known			

[1] Louisiana, St. Helena Meridian, T5S, R13E, Sec 31, (NE ¼ of NE ¼). Woods by trail in The Nature Conservancy Talisheek Wetlands Preserve), 2 June 1999, Latimore Smith s.n. (LSU- BR and ULM formerly Northwestern Louisiana now Louisiana at Monroe). (L. Smith, LA TNC (personal communication). Not seen by D. Dunlop.

[2] Mississippi, George Co.: 9.1 miles east of Mississippi Route 63 on U.S. 98. 26 May 1973, # 9441 D. E. Boufford and H. E. Ahles, (Harvard Herbarium) Verified by D. Dunlop.

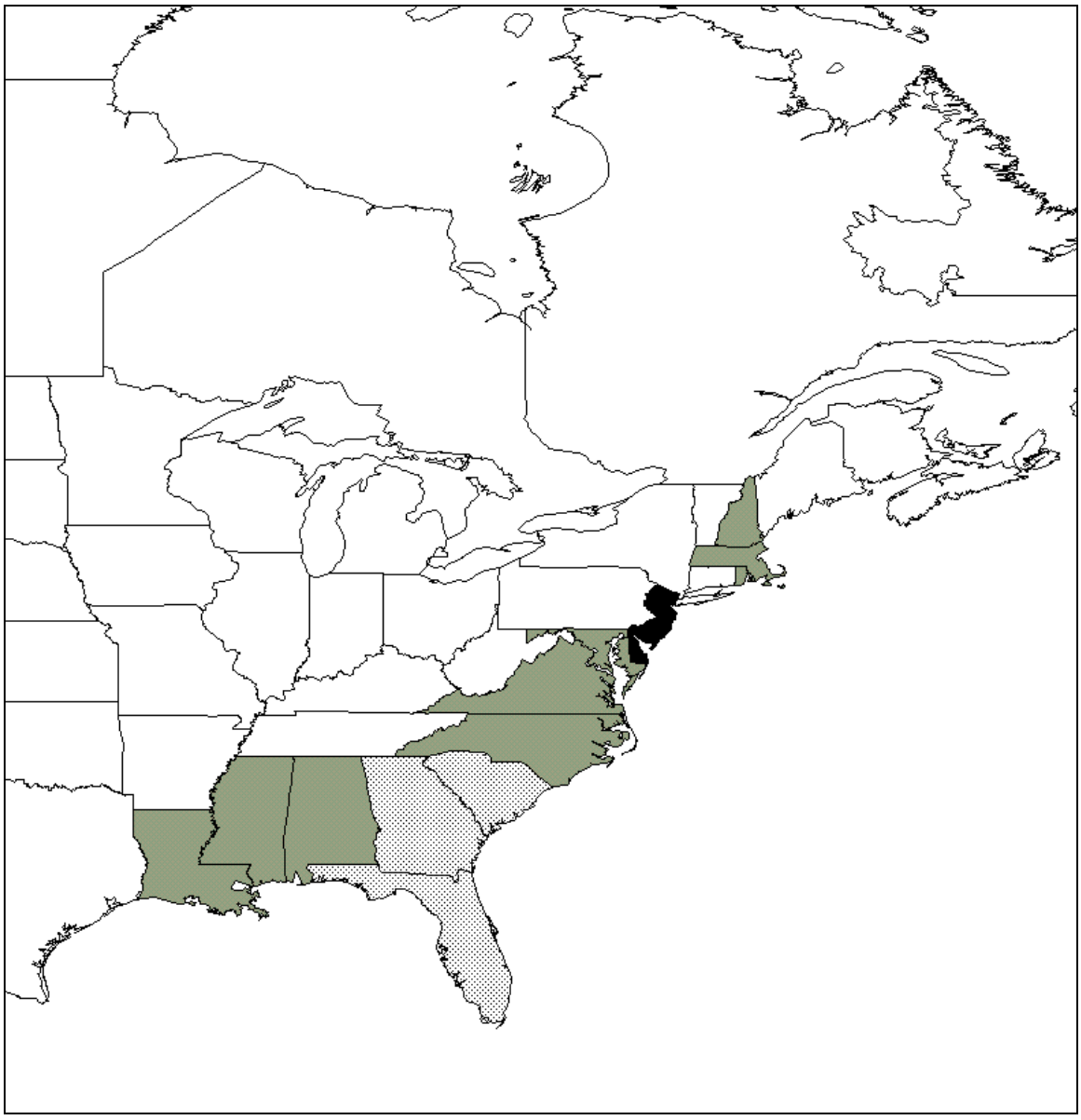

Figure 1. Occurrences of *Sclerolepis uniflora* in North America. States shaded in gray have confirmed, tracked occurrences of the taxon; states shaded in black have more than five confirmed occurrences. Stippled states have been ranked "SR" (see Appendix for explanation of Association for Biodiversity Information ranks), but in some cases, there is additional verification of the taxon's existence.

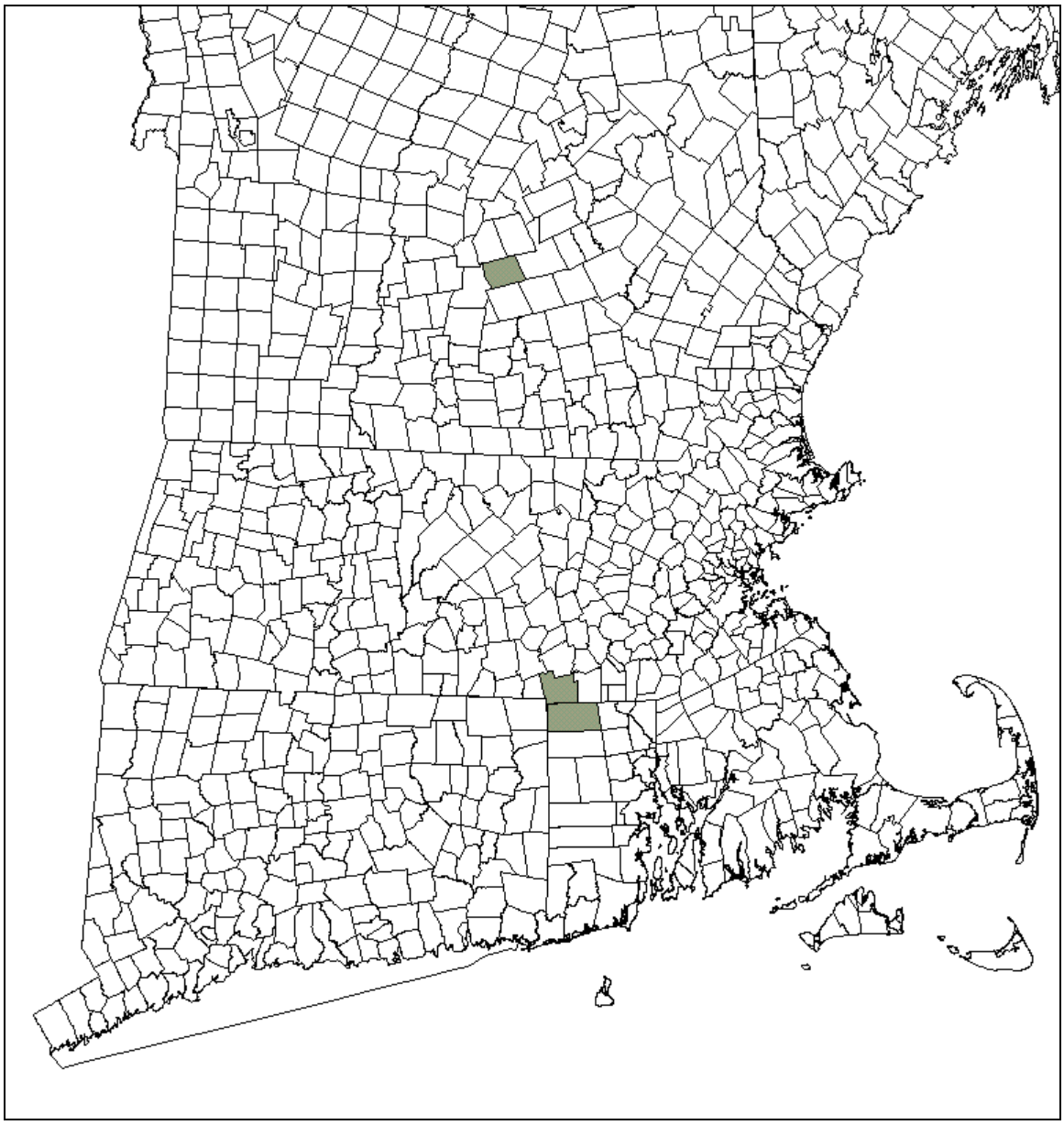

Figure 2. Occurrences of *Sclerolepis uniflora* in New England. Town boundaries for New England states are shown. Towns shaded in gray have 1 confirmed occurrence of the taxon. Note that the Rhode Island (Burrillville) and Massachusetts (Douglas) plants occur at one lake and probably constitute a single population.

Table 2. New England Occurrence Records for *Sclerolepis uniflora*. Shaded occurrences are considered extant.

State	Element Occurrence Number	County	Town
NH	**.001**	**Merrimack**	**Bradford**
MA	**.001**	**Worcester**	**Douglas**
RI	**.001**	**Providence**	**Burrillville**

Note that MA .001 and RI .001 are the same occurrence (same lake) but represent subpopulations in different states.

CURRENT CONSERVATION MEASURES IN NEW ENGLAND

Both Wallum Lake and Lake Massasecum are monitored by their respective state Natural Heritage Programs. The New Hampshire Natural Heritage is aware and involved through discussion on the eradication efforts for the milfoil. Massachusetts Heritage and Endangered Species Program last monitored Wallum Lake in 1996. Currently, there is no seed banked from either population. Chris Mattrick (NEWFS, personal communication) grew plants from Wallum Lake in 1997 but they did not survive due to unforeseen greenhouse disturbance.

II. CONSERVATION

CONSERVATION OBJECTIVES FOR THE TAXON IN NEW ENGLAND

The conservation objectives for *Sclerolepis uniflora* in New England are to maintain the two extant populations in their current locations, at or above the current level. This species has survived at these locations for at least 90 years. Recent surveys and site visits show that both populations appear to be thriving in the vegetative state.

If possible, seed for seed banking should be collected from each population. Plants have flowered at both sites in the past few years however, flowers have not produced seed at the NH .001 (Bradford) population and it is not known whether seeds are produced from the population at MA .001 (Douglas)/ RI .001 (Burrillville).

Currently, both populations are secure, but many factors may affect the long-term survival of this species in New England:

1. **extremely high or constant water levels** that prevent flowering
2. **liming of Wallum Lake** and associated fish stocking actions
3. **removal of *Sclerolepis*** from the shore line in beach areas
4. **invasions of non-native species** such as *Myriophyllum heterophyllum*
5. **procedures used to control or eradicate non-native invasives**

At this time it is not understood which factors may have the highest threat but they are. Therefore, the actions recommended are designed to reduce these threats.

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Appendix 1. An explanation of conservation ranks used by The Nature Conservancy and the Association for Biodiversity Information

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.

G1, for example, indicates critical imperilment on a range-wide basis—that is, a great risk of extinction. S1 indicates critical imperilment within a particular state, province, or other subnational jurisdiction—i.e., a great risk of extirpation of the element from that subnation, regardless of its status elsewhere. Species known in an area only from historical records are ranked as either H (possibly extirpated/possibly extinct) or X (presumed extirpated/presumed extinct). Certain other codes, rank variants, and qualifiers are also allowed in order to add information about the element or indicate uncertainty.

Elements that are imperiled or vulnerable everywhere they occur will have a global rank of G1, G2, or G3 and equally high or higher national and subnational ranks. (The lower the number, the "higher" the rank, and therefore the conservation priority.) On the other hand, it is possible for an element to be rarer or more vulnerable in a given nation or subnation than it is range-wide. In that case, it might be ranked N1, N2, or N3, or S1, S2, or S3 even though its global rank is G4 or G5. The three levels of the ranking system give a more complete picture of the conservation status of a species or community than either a range-wide or local rank by itself. They also make it easier to set appropriate conservation priorities in different places and at different geographic levels. In an effort to balance global and local conservation concerns, global as well as national and subnational (provincial or state) ranks are used to select the elements that should receive priority for research and conservation in a jurisdiction.

Use of standard ranking criteria and definitions makes Natural Heritage ranks comparable across element groups—thus G1 has the same basic meaning whether applied to a salamander, a moss, or a forest community. Standardization also makes ranks comparable across jurisdictions, which in turn allows scientists to use the national and subnational ranks assigned by local data centers to determine and refine or reaffirm global ranks.

Ranking is a qualitative process: it takes into account several factors, including total number, range, and condition of element occurrences, population size, range extent and area of occupancy, short- and long-term trends in the foregoing factors, threats, environmental specificity, and fragility. These factors function as guidelines rather than arithmetic rules, and the relative weight given to the factors may differ among taxa. In some states, the taxon may receive a rank of SR (where the element is reported but has not yet been reviewed locally) or SRF (where a false, erroneous report exists and persists in the literature). A rank of S? denotes an uncertain or inexact numeric rank for the taxon at the state level.

Within states, individual occurrences of a taxon are sometimes assigned element occurrence ranks. Element occurrence (EO) ranks, which are an average of four separate evaluations of quality (size and productivity), condition, viability, and defensibility, are included in site descriptions to provide a general indication of site quality. Ranks range from: A (excellent) to D (poor); a rank of E is provided for element occurrences that are extant, but for which information is inadequate to provide a qualitative score. An EO rank of H is provided for sites for which no observations have made for more than 20 years. An X rank is utilized for sites that known to be extirpated. Not all EO=s have received such ranks in all states, and ranks are not necessarily consistent among states as yet.