New England Plant Conservation Program

Sabatia stellaris Pursh

Sea pink

Conservation and Research Plan for New England

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SUMMARY

Sabatia stellaris Pursh, Sea Pink, is a member of the Gentian Family (Gentianaceae) that grows on open sandy soils at the upper edges of salt and brackish marshes and interdunal depressions. The plant is widely distributed in the states along the Atlantic and Gulf Coasts, and is considered to be abundant in the southern portion of its range. It is rare in New York and New England at the northeastern limits of its distribution.

Sabatia stellaris is an annual that usually grows as one main stem with branching on the upper half. In the northern part of its range, plants grow to 20 cm. Flowers consist of a 4 to 7-lobed corolla that ranges from crimson-pink to light pink and sometimes white. The white-flowering form is widespread in the southern part of its range; however, this form constituted 75% of a Connecticut population in 2003, which is considered the first documentation of this form in New England.

As an annual, *S. stellaris* exhibits extreme variability in the number of plants found at an occurrence in a given year. For example, in 2002 the estimated number of plants at three of the extant New England populations numbered about 1000, with an absence of plants from the fourth occurrence. In contrast, a resurgence in 2003 was marked by a combined total of more than 22,000 plants at all four sites.

Currently, *S. stellaris* is known from seven extant sites in New England, four of which were observed in 2003 (two each in Connecticut and Rhode Island). The three remaining occurrences have not been reverified in at least four years, with the Massachusetts population not seen in 15 years despite repeated surveys. The principal threat to extant populations is the spread of invasive species, especially *Phragmites australis*; however, several populations have also disappeared despite no apparent alterations of the habitats. In these cases, it is suspected that population declines were precipitated by subtle changes in site conditions due to storms or other disturbances that resulted in increased salinity levels.

The conservation objective for *Sabatia stellaris* in New England is to secure long-term protection and management of all extant populations. In order to achieve this objective, land acquisition may be considered at one site, but the primary course of action involves the control of *Phragmites* at three locations. In addition, the surprising annual variability in population vigor of known populations suggests that other occurrences may have to date been overlooked, and a search for these populations is considered a secondary conservation objective.

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) of the New England Wild Flower Society 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

Sabatia stellaris Pursh is an annual member of the Gentianaceae. Its distribution extends from southern New England along the Atlantic and Gulf coasts to Louisiana, including most of Florida, and disjunctly to several of the Bahama Islands, Cuba, and northern interior Mexico.

Sabatia stellaris occurs primarily on open sandy soils at the upper edges of salt and brackish tidal marshes and interdunal depressions. In the southern part of the range, chiefly in Florida and Mexico, it is also found away from the coast in wet meadows and other open, generally sandy areas. Not considered to be a rare species on a global scale, at the northern limit of its distribution in New England it is known from less than ten occurrences. Currently, *S. stellaris* is present at two sites in Connecticut and four sites in Rhode Island, and is considered extant at one Massachusetts site where it has not been seen for 15 years. Based on this status, *S. stellaris* was listed in Division 2 of *Flora Conservanda* (Brumback and Mehrhoff et al. 1996), defining it as a regionally rare taxon with fewer than 20 occurrences in New England.

In addition to the fact that it has never been widespread in New England, its presence in the region is diminishing. Although some populations are being impacted by the invasion of habitats by *Phragmites australis* and other invasive species, some occurrences have also disappeared despite any apparent alteration of the habitat. Consequently, a conservation plan is needed to define actions to maintain viable populations in New England. This plan summarizes the biology and ecology of *S. stellaris*, identifies knowledge gaps, and proposes conservation measures to insure the persistence of New England populations. The most important actions needed at this time include on-site management of invasive plants, and surveys for the species in new locations.

DESCRIPTION

Sabatia stellaris is an erect annual with fibrous roots, usually growing as one main stem with branches borne on the upper half of the stem. In New England, plants grow between 10 and 20 cm. tall, but in the southern part of its range heights may reach more than 50 cm (Wilbur 1955). The stem is smooth, with narrowly elliptic to spatulate leaves that are narrowed to an acute base and tip. The leaves are sessile and oppositely arranged. (Fernald 1950, Gleason and Cronquist 1991). Flowers consist of a 4 to 7-lobed corolla that ranges from crimson-pink to white, and calyx lobes that extend 3/4 the length of the corolla.

Wilbur (1955) noted that *S. stellaris* is one of the most variable species of the genus. Plants in the northern part of the range tend to be more compact, less branched,

and have more broadly elliptical leaves. In contrast, specimens from Florida tend to be elongate, wiry, and slender with narrowly linear leaves (Perry 1971). Authors who have prepared the most comprehensive treatments of the genus *Sabatia*, Wilbur (1955) and Perry (1971), agree that the differences described above are not sufficiently consistent to warrant designation of a subspecies or variety within *S. stellaris*.

There are four native species of *Sabatia* documented from New England, and all four are listed in *Flora Conservanda* (Brumback and Mehrhoff et al. 1996). Along with *stellaris*, *Sabatia campanulata* is listed in Division 2, *S. kennedyana* is included in Division 1 (Globally Rare Taxa), and *S. dodecandra* is a Division 4 (Historic) species. The occurrence of *S. dodecandra* in New England is based on three records from Old Lyme, Saybrook, and Guilford, Connecticut; although specimens are lacking for these records Fernald (1916) considered them to be valid.

In addition, *Sabatia angularis*, a species of fields, prairies, and roadsides that reaches its easternmost distribution in Westchester and Queens Counties, New York, has been reported as a casual adventive in New England, at least as far east as Pembroke, Massachusetts (Fernald 1916). As well, the related western species, *Sabatia campestris*, has occasionally been found in fields and waste places, but apparently has not become established in New England (Fernald 1916).

The following key helps to distinguish the species of *Sabatia* potentially occurring in New England, providing a compilation of characteristics from those keys described in Fernald (1950), Gleason and Cronquist (1991), Radford et al. (1968), and Godfrey and Wooten (1981).

Key to the species of New England *Sabatia*

1. Flowers with 7-12 corolla lobes; plants perennial, often stoloniferous; flowers pink, rarely white.

    2. Calyx lobes hyaline-margined, firm, linear, widest at base, with 1-3 obscure nerves or nerveless, 0.5-1.5 mm broad; corolla lobes 0.6-1.5 cm broad, the basal yellow spot of each lobe 2.5-5 mm broad; primary branches often opposite; terminal flower short-stalked.....*S. kennedyana*.

    2. Calyx lobes not hyaline-margined, herbaceous, with 3 or more distinct nerves, 1-3 mm broad; corolla lobes 4-9 mm broad, the basal yellow spots 0.7-2.3 mm broad; primary branches usually alternate; terminal flower long-stalked..... .....*S. dodecandra*.

1. Flowers smaller, with 5-6 corolla lobes; plants annual or non-stoloniferous perennials; flowers usually pink, occasionally white.

    3. Branches of inflorescence opposite; flowers in a panicle or corymb of cymes; plants biennial.....*S. angularis*.

3. Branches of inflorescence alternate; flowers borne singly at tips of peduncles.

    4. Calyx tube wing-angled with 5 wings or ridges; leaves chiefly subcordate and clasping.....*S. campestris*

    4. Calyx tube not wing-angled or weakly ribbed; leaves narrower and not clasping.

        5. Plant perennial, from a short branched caudex; calyx lobes equaling the corolla; primary leaves linear to oblong with broad sessile base; lateral peduncles 1-2 bracted.....*S. campanulata*

        5. Plant annual, stems solitary from a base; calyx lobes shorter than the corolla; primary leaves narrowly elliptic to spatulate, tapering at base and apex; lateral peduncles bractless..*S. stellaris*

TAXONOMY, HISTORY, AND SYNONYMY

Wilbur (1955) is the source of the following information. The genus *Sabatia* was originally proposed by Adanson (1793) in commemoration of the Italian botanist, Liberato Sabbati. Previously, plants of this genus had been described by Gronovius (1739) as species of *Gentiana*, and Linnaeus (1753) had treated the four species known to him in two genera, *Chironia* and *Swertia.*

Pursh (1814) accepted *Sabatia* and included in it the American species of *Chironia*. The most recent taxonomic treatments of *Sabatia*, including Wilbur (1955) and Perry (1971), identify 17 species and two additional varieties in the genus; however, Kartesz (1994) recognizes 18 species and two varieties, the additional species being *S. formosa.*

Wilbur (1955) recognized five subsections in the genus *Sabatia*, with *S. stellaris* included in the subsection Campanulatae along with the species *campanulata, grandiflora*, and *brevifolia*. Members of the Campanulatae, along with those of subsection Angulares, are separated as the annual or weak perennial members of the genus *Sabatia*, with Campanulatae species distinguished from those of Angulares by alternate upper branches and the lack of basal rosettes. *Sabatia campanulata* and *stellaris* are the only species in the subsection Campanulatae occurring in New England. Gleason (as quoted by Wilbur 1955: 60) remarked that *S. stellaris* and *S. campanulata* "constituted the local extremes of a variable population which may represent only one species, or as many as four," the other two being *S. brevifolia* and *S. gracilis*. Later work by Perry (1971) confirmed that *S. gracilis* is synonymous with *S. campanulata*, as originally determined by Wilbur (1955), and that the three (*campanulata, brevifolia*, and *stellaris*) should be retained as separate species based on differences in chromosome number, crossability, and morphology.

Recognized synonyms of *Sabatia stellaris* include the following: *S. maculata* (Benth.) Benth. & Hook. f.; *S. palmeri* Gray; *S. purpusii* Brandeg.; and, *S. simulata* Britt. (Kartesz 1994).

In addition, several misidentified collections of *Sabatia* have emerged in New England botanical history, but most have been resolved. For example, a specimen identified as *S. stellaris* collected in 1885 from a mowing field in Salisbury, Massachusetts was later attributed to *S. angularis* (Fernald 1916). As well, a report by Sears (1908) on the flora of Essex County listed *S. stellaris* for the town of Amesbury (without specimen verification); however, Fernald (1922) suspected the record was also probably *S. angularis.*

Interestingly, Fernald (1916) also identifies an old record from York, Maine, footnoting the source as Goodale, *Proceedings of the Portland Society of Natural History* i. 60 (1862). He continues to point out that it is unsupported by a specimen, but that "....there may originally have been material."

Bicknell (1915) also discusses the confusing series of *Sabatia* records from Nantucket where it was originally collected in 1827 and labeled *S. stellaris*, and later referenced as this species in a report prepared by Hitchcock in 1833. A subsequent report by Oakes in 1841 referred to *S. campanulata*, and Sorrie and Dunwiddie (1996) cite *S. kennedyana* from Nantucket based on an 1889 record; however, the latter reference does not include *S. stellaris* as a species recorded from Nantucket.

Perry (1971) noted there were no published accounts of artificial of natural interspecific hybridizations in the genus *Sabatia*, and then reported on the artificial hybridization experiments he conducted over a two-year period. He determined that although hybridization between species of *Sabatia* occurred in the laboratory, the evidence of natural hybridization was lacking due to an array of cytological, ecological, ethological, seasonal, and spatial isolating factors. His study revealed that species of *Sabatia* that tended to be sympatric were not intercrossable; however, there was some evidence that *S. stellaris* and *S. grandiflora* were both sympatric and intercrossable. The fact that hybrids of these two species were not found in nature was not evidence that hybridization could not occur, but rather the establishment of hybrids was probably prevented by competition as hybrid seeds of *Sabatia* are often smaller than normal and contained less nutritive tissue. In addition, Perry concluded that even if hybrids did become established, gene exchange would be restricted by F1 sterility barriers.

SPECIES BIOLOGY

Perry (1971) provides a detailed discussion on the breeding systems within the genus *Sabatia*, and a summary of this material as related to *S. stellaris* is as follows. All species of *Sabatia* are self-compatible. Most species are protandrous, and in *S. stellaris* the time between anther dehiscence and stigmatic receptivity is 2 days, the sequence commencing three days after bud opening. Full release of pollen usually takes less than

24 hours, insuring that there is little overlap in stigmatic receptivity and presence of pollen. The chromosome number for *S. stellaris* is *n*=18. The size of pollen grains range from 16.7-22.7 microns, with an average of 19.9 microns.

Perry (1971) also reports that *S. stellaris* flowers throughout the year in southern Florida, but that elsewhere, the flowering time is July and August. At the northern limits of its range in New England, a review of field forms and specimen labels indicates the peak flowering period in this region to be mid-August to mid-September. Earlier dates have been reported; for example, 80% of the CT.021 (Old Saybrook) population flowering on July 28, 2002. Likewise, in some years flowering may extend through October. At the RI .002 (North Kingstown) occurrence, 1% of the population was still in flower on October 28, 1998.

Although no specific pollinators were listed by Perry (1971) for *S. stellaris*, it is reported that for large-flowered members of the genus, bumblebees (*Bombus*) are typical pollinators, while smaller-flowered species (including *S. stellaris*) are visited by smaller bees, mostly of the family Halictidae. Observations by the author of Halictid bees visiting flowers have been made at all southern New England populations.

Perry (1971) also determined that seed development of *S. stellaris* takes about two months, and that an average of 600 seeds per capsule are produced. Limited seed trials at the New England Wild Flower Society (NEWFS) were conducted in 1997 using seed collected the previous fall from the RI .002 (North Kingstown) location. Seed sown in flats and refrigerated for three months showed a 30% germination rate (30 of 100 seeds) (William Brumback, NEWFS, personal communication).

The genus *Sabatia* includes annual, biennial, and perennial species - all manuals identify *S. stellaris* as an annual. Fernald (1916) reported that all specimens examined by him from throughout the plant's range were annual, or possibly biennial; however, no additional information has been located regarding the species' occurrence as a biennial.

HABITAT/ECOLOGY

Fernald (1916) described *Sabatia stellaris* as a halophytic annual, and as such it is associated with brackish/saline habitats throughout most of its range. In some treatments, the habitat has been generalized as “saline or brackish marshes and meadows”(Fernald 1950), “salt or brackish marshes” (Gleason and Cronquist 1991), or simply “brackish marshes” (Radford et al. 1968), and this description may be adequate in the northern part of the range. However, in the southeast where the species is more abundant, it is found in a wider variety of habitats including wet marl prairies, marl pits, marly spoil banks and flats, and interdunal depressions (Godfrey and Wooten 1981). In Florida and Mexico, *S. stellaris* grows away from the coast in open sandy areas, and Bahamian habitats have also included crevices in dry aeolian limestone and roadside ditches (Perry 1971).

In New England, *S. stellaris* tends to grow in sandy soils at the upper edge of tidal marshes where inundation is very infrequent. Based on field forms filed with state Natural Heritage Programs, associated species are typical members of this community including *Spartina patens, Juncus gerardii, Panicum virgatum, Solidago sempervirens, Pluchea purpurascens, Aster subulatus, Agalinis maritima* and *Limonium carolinianum*. Other species occasionally present include *Hibiscus palustris, Oenothera biennis, Phragmites australis, Myrica pensylvanica,* and *Agalinis purpurea*.

Further south, along with its presence at the margins of salt marshes, *S. stellaris* is also a constituent of low-lying meadows and swales on the mid-Atlantic coastal barrier islands. On Fisherman Island, Virginia, Boulé (1979) described a swale community with an elevation at or near the water table where the major component was *Spartina patens,* with *Setaria parviflora, Schizachyrium scoparium,* and *Chamaesyce polygonifolia*. Listed as occasionally occurring in this habitat were *S. stellaris, Strophostyles umbellata, Cyperus polystachyos, Andropogon gyrans,* and *Fimbristylis* sp.

A more comprehensive description of a similar community is provided by Godfrey and Godfrey (1976) for the Outer Banks of North Carolina. They describe a zone of maritime grasslands running down the center of the Outer Banks that are composed of four basic, intergrading habitat types: barrier flats, dune strands, dune slacks, and mesic meadows. *Sabatia stellaris* was found chiefly in mesic meadows, described as overwash terraces deposited during the 1950s and 1960s where the water table is less than 1.0 meter below the surface. The mesic meadow habitat is further divided into two types -- open and closed grasslands, the basic difference being a standing crop 30 times higher in the closed type. It is in the closed type where *S. stellaris* is most frequently found with *Eragrostis pilosa, Fimbristylis* sp., *Muhlenbergia capillaris, Eustachys petraea, Gaillardia pulchella,* and *Spiranthes vernalis*. In the opinion of Godfrey and Godfrey (1976), the closed mesic meadow habitat is the most diverse type on the barrier island.

In Georgia, Hillestad et al. (1975) described 22 plant communities on Cumberland Island. One of these is an interdunal grass-sedge meadow distinguished by two phases (high and low) based on topography and fluctuations in the water table. Low-meadow species, described as being tolerant of standing water for infrequent periods included *S. stellaris, Fimbristylis spadicea, Cyperus esculentus, Juncus bufonius, Eragrostis refracta,* and *Hydrocotyle bonariensis*.

In Louisiana, *S. stellaris* is also considered a typical inhabitant on sandy barrier islands in a community identified as swales or dune slacks (Mendelssohn 2001). This habitat is characterized by a lower elevation, and hence higher moisture, and a vulnerability to storms that limits the spread of woody vegetation, such as *Myrica, Baccharis,* and *Iva frutescens*. Associated species include *Sabatia campestris, Fimbristylus castanea, Hydrocotyle bonariensis, Dichromena* sp., and *Phyla nodiflora*. In addition, specimens at the Louisiana State University Herbarium (2002) indicate that *S. stellaris* is found infrequently on delta land with *Vigna* sp., *Strophostyles* sp., *Mimosa* sp., and *Aster* sp.; on sand beaches with *Eclipta* sp., *Chloris* sp., and *Spartina patens*; and, on

sand ridges with *Eustoma* sp., *Sesuvium* sp., *Batis maritima*, *Salicornia* sp., and *Fimbristylus castanea*.

Additional habitat descriptions from specimens housed at the Louisiana State University Herbarium include "field, sand dunes and beach," "beachfront." "dry sand," "pure sand dunes up to 4 feet high and surrounding sand flats," "on beach," and "south shore of Lake Poncitrain." Additional associated species referenced on herbarium labels include *Eragrostis oxylepis, Heterotheca subaxillaris, Pluchea foetida,* and *Croton* sp. (Louisiana State University 2002).

Within the United States, *S. stellaris* exhibits its widest ecological diversity in the state of Florida where, along with typical coastal marsh habitats, it is also found at inland sites with little maritime influence. An example reported by the Florida Lakewatch Program is for Silver Lake in Putnam County, more than 30 miles from the Atlantic coast in the Central Lake District. A plant survey of this pond recorded *S. stellaris* with typical freshwater species including *Lachnanthes caroliniana, Pontedaria cordata, Rhexia mariana, Nymphaea odorata, Rhynchospora inundata,* and *Hydrocotyle umbellata.* As well, Wilbur (1955) makes special note that *S. stellaris* is not restricted to a salt marsh or littoral environment in the southern part of its range, and that in Florida it is more commonly collected at inland sandy areas.

THREATS TO TAXON

Because *S. stellaris* is a relatively secure species throughout most of its range, no particular threats have been identified outside of the Northeast. In New England, the continued existence of this species is threatened by two factors, the most notable being the invasive spread of *Phragmites australis*, and to a limited extent *Lythrum salicaria*. This issue has been identified at three New England occurrences.

The second threat is more difficult to define, but involves the apparent loss of several *S. stellaris* populations from sites where there has been no recognizable alteration of the habitat. In these situations (most notably MA .001 [Dartmouth] and RI .005 [South Kingstown]), populations of associated species appear to remain stable and invasive species are not present. Based on historical data, which for the populations above has spanned over thirty years, numbers of flowering individuals gradually declined until 1988 and 1996 respectively, from which time none have been found during repeated annual surveys.

The reason for these losses is unclear, but observations made at all New England populations suggest some limiting factors. Comparisons of habitat conditions indicate that depauperate and declining populations occur in closer proximity to the open ocean, occupying more typical salt marsh communities where there is a greater frequency of periodic inundation with high salinity waters. The more robust populations of *S. stellaris*, which in the year 2003 contained thousands of plants, tend to occur at a greater distance

from the open ocean in brackish marsh and beach habitats. These are inundated only during moon tides with lower salinity waters.

One scenario suggests that small occurrences, such as MA .001 (Dartmouth) and RI .005 (South Kingstown), are remnants of what may historically have been much larger populations. Both were last found occupying tiny portions of large estuaries where more suitable habitat was likely present in the past, but has been lost through a combination of manmade (filling, development) and natural (storm) factors.

The sensitivity of *S. stellaris* to higher salinity conditions is also evidenced by the apparent loss of one Massachusetts population (MA .002 [Tisbury]) and possibly one Rhode Island population (RI .008 [New Shoreham]) following the construction of permanent breachways into formerly brackish coastal ponds. In regards to the Rhode Island example, the historic presence of *S. stellaris* on Block Island is only conjectural (see account under Rhode Island occurrences); however, creation of a breachway there has been implicated in the loss of *Hydrocotyle verticillata* and *Ranunculus cymbalaria*, two species also inhabiting brackish marsh/pondshore habitats (Enser 2002).

These observation also suggest that predicted changes in sea level could be posing a threat to some populations. Currently, monitoring in southern New England indicates that sea level is rising in this region at a rate of 2.7mm/year, or 27cm/century (Jon Boothroyd, University of Rhode Island, personal communication).

DISTRIBUTION AND STATUS

General Status

Sabatia stellaris grows along the Atlantic and Gulf coast from southern Massachusetts to Louisiana, including most of Florida, with outlying populations on several Bahama Islands, western Cuba, and central Mexico (Wilbur 1955). The disjunct distribution of *S. stellaris* is somewhat perplexing, as termed by Wilbur (1955: 63), due to its complete absence from the Texas coast where "there seem to be enormous stretches of territory offering an environment apparently similar to that in which it is found so abundantly in the Atlantic and Gulf Coastal Plain." From its southernmost United States occurrence in Louisiana, *S. stellaris* reappears in the central plateau (not on the coast) of eastern Mexico.

Perry (1971) concluded that *S. stellaris* likely had a wider distribution in the past, having now disappeared from Texas where there appears to be suitable habitat, leaving disjunct stands in Mexico. (Although all treatments reviewed for this report do not list Texas within the range of *S. stellaris*, the website of the Herbarium of the Missouri Botanical Garden lists a specimen collected in Trinity, Texas in 1992 by R. Thomas.)

The occurrence and status of *S. stellaris* in North America is outlined in Table 1. It is most abundant in the southern part of its range, becoming less so in the Northeast,

where it is listed as a rare species in Massachusetts, Rhode Island, Connecticut, and New York. Although listed in New York as an S2 species, the neighboring state of New Jersey considers it to be an S5 species, or demonstrably secure in that state. *Sabatia stellaris* has a global rank of G5 (Globally Secure).

In New England, it occurs in Massachusetts, where it is ranked S1 and is listed as State Endangered; Rhode Island, where it is ranked S1 and listed as State Threatened; and, Connecticut where it is also ranked as S1 and listed as State Endangered.

Table 1. Occurrence and status of *Sabatia stellaris* in the United States 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 REPORTED OR UNVERIFIED	HISTORIC (LIKELY EXTIRPATED)
Connecticut (S1, E): 2 extant and 2 historic occurrences	Delaware (S4)	Texas (SR): see text	Pennsylvania (SX)
Massachusetts (S1, E): 0 extant and 2 historic occurrences	New Jersey (S5)	Maine (SR): see text	
New York (S2)	North Carolina (S3S4): 9 counties	Georgia (SR)	
Rhode Island (S1, E): 4 extant and 3 historic occurrences		Louisiana (SR)	
		Maryland (SR)	
		Mississippi (SR)	
		Virginia (SR)	
		Alabama (SR)	
		Florida (SR): 40 counties	
		South Carolina (SR): 8 counties	

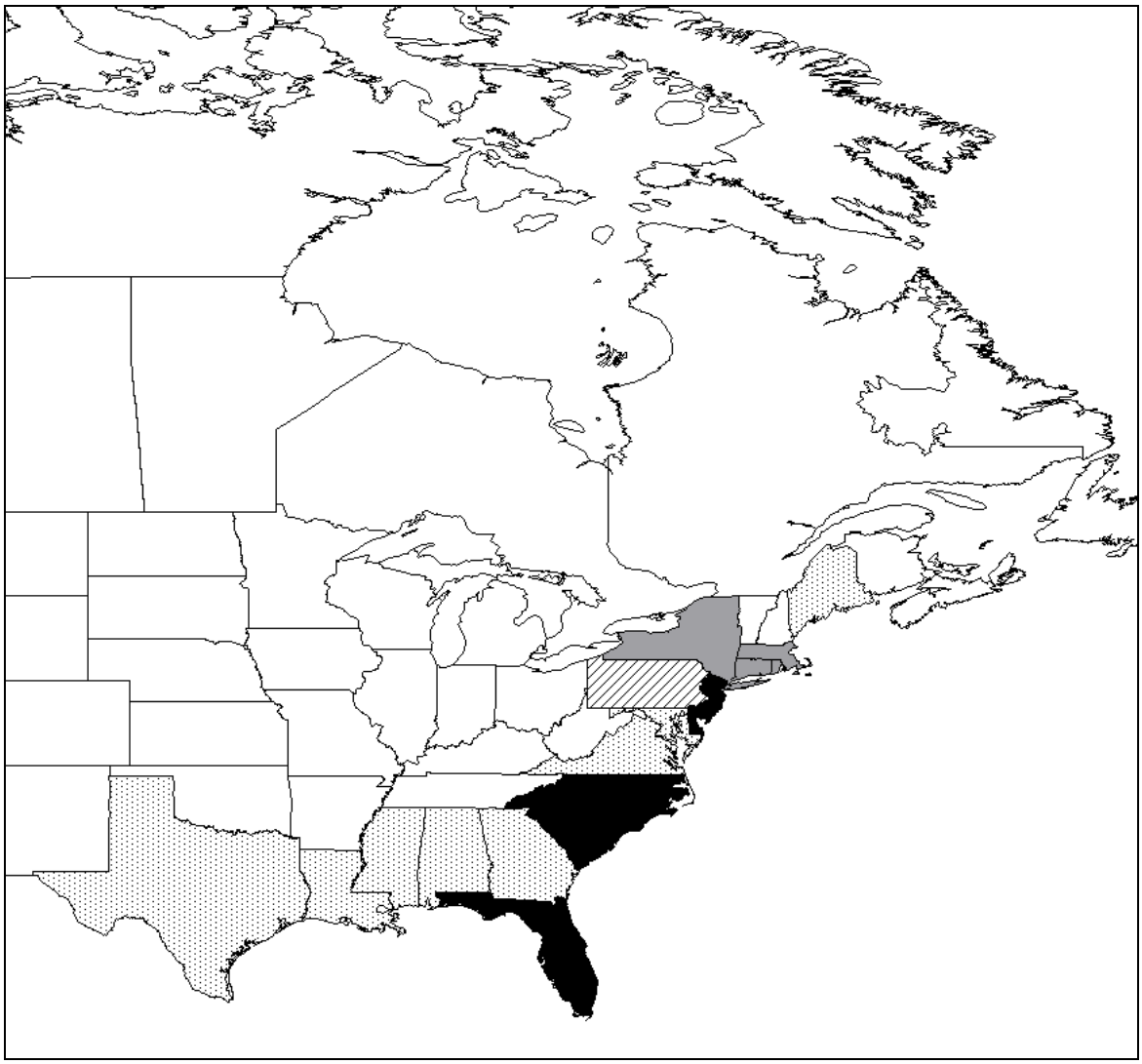

Figure 1. Occurrences of *Sabatia stellaris* in North America. States shaded in gray have one to five (or an unspecified number of) current occurrences of the taxon. States shaded in black have more than five confirmed occurrences. The state (Pennsylvania) with diagonal hatching is designated "historic," where the taxon no longer occurs. States with stippling are ranked "SR" (status "reported" but not necessarily verified). See Appendix for explanation of state ranks.

Status of All New England Occurrences — Current and Historical

The status of current (7) and historical (13) New England occurrences is summarized in Table 2, Figure 2, and Figure 3.

At this point, special note should be made of the annual variability that this species exhibits at individual sites. The 2002 season for *Sabatia stellaris* might be termed a disaster in southern New England, with the species being confirmed at two Connecticut sites and only one Rhode Island site, with about 1000 total flowering plants combined for the three locations. Conversely, in 2003 there was a resurgence of the species and an estimated number of more than 22,000 flowering plants were recorded at four sites (two in each state), with the number of plants at each site exceeding all previously recorded figures.

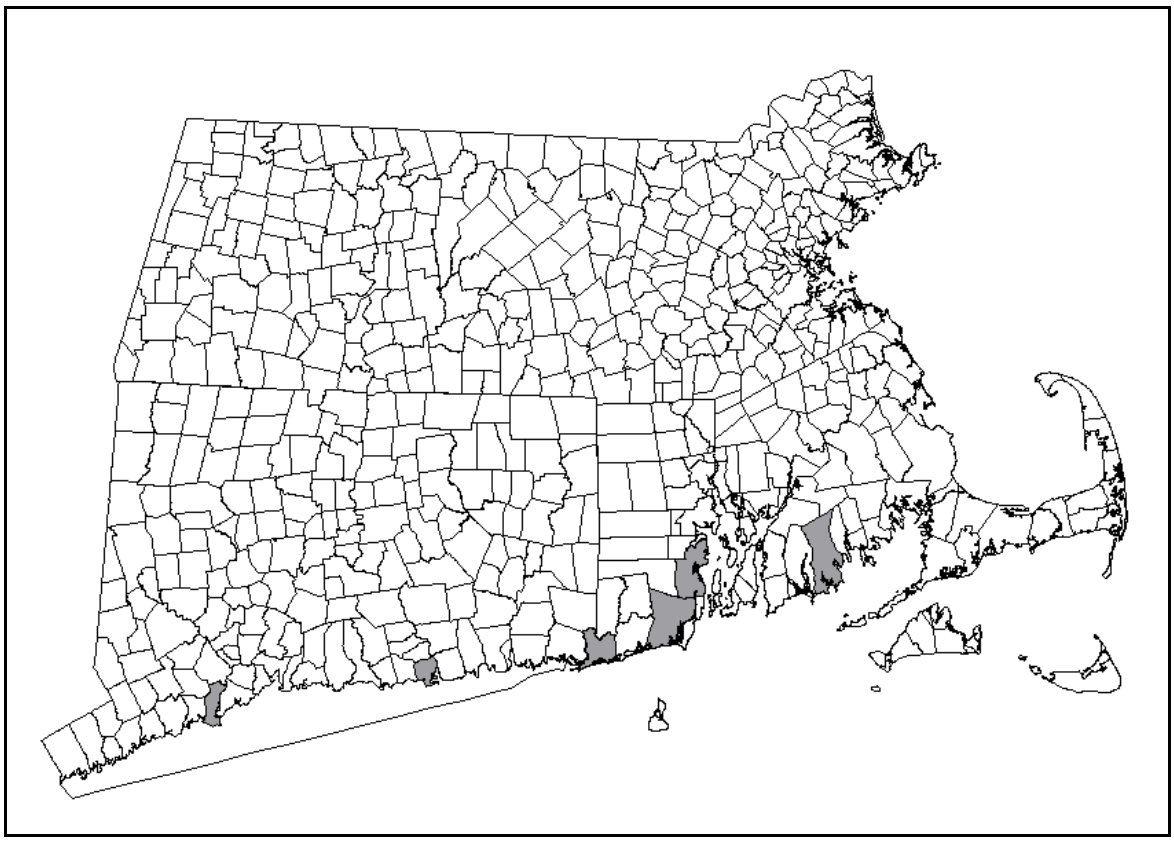

Figure 2. Extant occurrences of *Sabatia stellaris* in New England. Town boundaries for southern New England states are shown. Towns shaded in gray have one to five extant occurrences of the taxon.

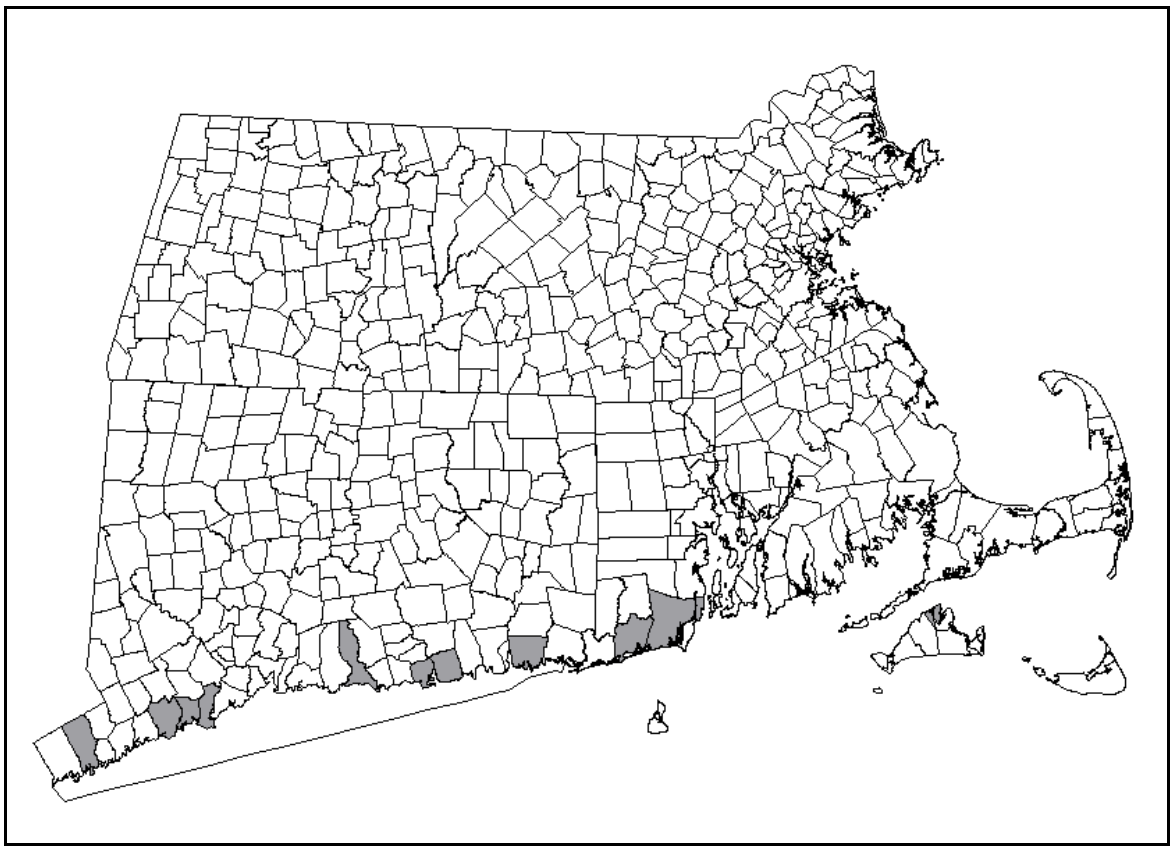

Figure 3. Historical occurrences of *Sabatia stellaris* in New England. Towns shaded in gray have one to five historical records of the taxon. Note that the putative New Shoreham record (Seymour 1982) has not been confirmed and is not mapped here.

Table 2. New England Occurrence Records for *Sabatia stellaris.* Shaded occurrences are considered extant.			
State	**EO #**	**County**	**Town**
MA	**.001**	**Bristol**	**Dartmouth**
MA	.002	Dukes	Tisbury
RI	**.001**	**Washington**	**Westerly**
RI	**.002**	**Washington**	**North Kingstown**
RI	.003	Washington	Narragansett
RI	**.004**	**Washington**	**South Kingstown**
RI	**.005**	**Washington**	**South Kingstown**
RI	.006	Washington	Charlestown
RI	.007	Washington	South Kingstown
RI	.008	Washington	New Shoreham
CT	**.001**	**Fairfield**	**Stratford**
CT	.002	Middlesex	Old Saybrook
CT	.003	New London	Old Lyme
CT	.005	New Haven	Madison
CT	.006	Fairfield	Fairfield
CT	.007	Tolland	Stratford
CT	.010	Fairfield	Stamford
CT	.017	Fairfield	Bridgeport
CT	**.021**	**Middlesex**	**Old Saybrook**
CT	.027	New London	Groton
CT	.028	New Haven	Madison

II. CONSERVATION

CONSERVATION OBJECTIVES FOR THE TAXON IN NEW ENGLAND

It is apparent that *Sabatia stellaris* has always been rare in New England at the northern extent of its range. However, the number of populations in this region has declined during the past century, and surveys conducted during the past two decades indicate that surviving populations are also in decline. The main objective for conservation of this taxon in New England is to protect and maintain all existing populations; however, based on recent surveys only five of the seven extant populations appear to have conservation potential. This conclusion assumes that two populations (not seen in seven or more years) have likely been extirpated, although it is recommended that expanded inventory efforts continue to relocate these populations. However, results of surveys in 2003 have shown that four populations have the potential for periodically producing large numbers of individual plants at protected sites, thereby insuring the persistence of this species in the region.

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IV. APPENDICES

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1. An Explanation of Conservation Ranks Used by The Nature Conservancy and NatureServe

1. An Explanation of Conservation Ranks Used by The Nature Conservancy and NatureServe

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 are known to be extirpated. Not all EOs have received such ranks in all states, and ranks are not necessarily consistent among states as yet.