Conservation Biology Research Grants Program
Natural Heritage & Nongame Research Program
Division of Ecological Services

Report for the 1994-1995 Status Survey for *Sparganium glomeratum* in Minnesota

Conducted for the Natural Heritage and Nongame Research Program,
Minnesota Department of Natural Resources under a grant by:
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Dec. 29,1995 (Revised April 19, 1996)

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Preface

The 1994-1995 Status Survey for *Sparganium glomeratum* in Minnesota was conducted under a grant provided by the Natural Heritage and Nongame Research Program of the Minnesota Department of Natural Resources. The Report for 1994-1995 Status Survey for *Sparganium glomeratum* in Minnesota summarizes with text, maps, and figures two years of field, herbarium, and literature research on *Sparganium glomeratum*. This report should not be considered the final word on Sparganium glomeratum in Minnesota but rather as a beginning towards more intensive research on this species and other members of its genus.

Abstract

1. *Sparganium glomeratum* (clustered bur reed) is an aquatic emergent plant species with an interruptedly circumboreal distribution that until recently was known from only 8 stations in North America (2 in Canada and 6 in Minnesota). A spate of discoveries of new *S. glomeratum* populations in Minnesota between 1990 and 1993 prompted questions regarding the species' actual range, distribution, and abundance in the state. In 1994 under a grant from the Minnesota Department of Natural Resources (MDNR) a status survey of *S. glomeratum* in Minnesota was begun.

2. Three new sites (Peyla, Blackhoof, and Rice Lake Township), 5 new populations (Duluth) and 1 historical site (Twig) were located during the 1994 Status Survey, plus two more colonies in Superior, Wisconsin during work on other rare plant surveys. The 1994 and 1995 Status Survey investigated 112 wetland sites for *S. glomeratum* in southwestern, southern, and northern St. Louis County, Cass County, Clearwater County, Carlton County, and Lake County. As a result of the 1995 Status Survey *S. glomeratum* was found at I 1 sites 8 of which are reports from new sites. Seven new sites for *S. glomeratum* were found in St. Louis County, and 1 in Carlton County in 1995. From sites discovered in 1994 1 new colony was found in Duluth, 1 in Rice Lake Township, and 1 in Skelton. After extensive searches during both years of the Status Survey 2 historical sites (Knife River and Minnesota Point) were determined to be extirpated, and 1 was determined to still be extant (Twig). Two other historical sites (Itasca County and Basswood Lake) were not revisited. Two colonies at a recently discovered site in Clearwater County were confirmed end 5 others were found in the same area. Recently discovered sites in Cass County could not be relocated arid no new sites were found in Cass County. During work on other rare plant surveys in Wisconsin 5 new sites were discovered in Douglas and Washburn counties and additional colonies were found in Superior, Wisconsin.

3. *S. glomeratum* populations were found to be typically small and scattered. The size of any particular population did not seem to be connected to the size of the wetland. Human disturbance to habitat appeared to be detrimental to *S. glomeradum* in urban areas but less so in rural areas, where it was sometimes found in recently cleared ditches. The number of associated species found with *S. glomeratum* was 141. Of this number 65 are typically boreal species and many are circumboreal in their distribution. Most are also species of minerotrophic rather than ombrotrophic wetlands. Habitats where *S. glomeratum* was found shared several common features including shallow water, fine textured organic soils, and associated species of emergent graminoids.

Introduction

Taxonomy

4. Sparganiaceae (bur reed family, class Monocotyledonae), a family composed of rhizomatous, perennial, aquatic plants, contains only one genus, *Sparganium*, with 20 species worldwide including *Sparganium glomeratum* Laest. (Komarov 1968, Cook and Nicholls 1986). All members of *Sparganium* are monoecious, that is, they bear separate staminate flowers (pollen producing or "male") and pistillate flowers (ovule producing or "female") on the same plant (Cook and Nicholls 1986). Pistillate flowers are subjacent to the staminate flowers and are borne on the same stem. Pistillate flowers are borne in condensed clusters that may be axillary or supra-axillary, sessile or pedunculate while staminate flowers are borne only in sessile clusters. Branching patterns of the inflorescence vary from simple (as in S. minimum) to complex (as in S. eurycarpum). The fruit of Sparganium is dry, spongy, indehiscent and, depending on the species, may contain 1-2 (3) seeds (Cook and Nicholls 1986).

5. Fruiting stems of *Sparganium glomeratum* are robust, erect, measuring around 30 cm tall, terminating with a simple inflorescence bearing (1) 3-5 (7) densely crowded, mostly sessile, extra- or supra-axillary, pistillate heads (0.3-1.2 cm). The pistillate heads subtend 1 or 2 crowded staminate heads located at the shoot apex on a very short (< 0.5 mm) internode. The leaves of *Sparganium glomeratum* are also erect, rarely floating, those of the inflorescence are inflated at the base, sharply keeled and most exceed the flowering portion of the stem. Achenes are fusiform with an obconic base, sometimes slightly constricted just above the middle, about 3-5 mm long, shiny green or brown. Perianth segments are about 1/3-1/2 the length of the achene. (After Cook and Nicholls 1986, and Walton pets. observ.).

6. Plasticity of shoot morphology and possible hybridization has made species classification within the genus problematic for certain members such as *S. androcladum* and *S. americanum* (Brayshaw 1985) and for *S. hyperboreum* and *S. minimum* (Harms 1973). *S. glomeratum*, however, has long been regarded as a distinct species (Cook and Nicholls 1986). North American members of the genus are being studied by Kaul for the flora of North America project. Of all the species in the genus considered by Kaul for the project *S. glomeratum* has proven to be the most difficult because of its rarity on this continent and the resulting lack of information (R. B. Kaul, University of Nebraska, Lincoln, pets. comm. 1994). Lakela (1941) noted that her Duluth *S. glomeratum* specimens differed in some important respects from European *S. glomeratum*. Beyond her observations and the species determination done by Fernald (Lakela 1941) no taxonomic studies of North American *S. glomeratum* have been conducted. A key to the *Sparganium* species of Minnesota is provided with this report in the section Taxonomic Considerations.

7. Taxonomic studies on the genus *Sparganium* or its individual members include Rydberg (1909) who contributed a monograph on the genus for the first North American flora; Fernald's (1922 and 1925) discussion on the nomenclature and taxonomy problems of the American species; Truman (1931) who noted differences between the pollen grain surfaces of *S. androcladum* and *S. americanum*; Beal (1960) who discussed the taxonomy problems of three southeastern United States species; Kaul's (1972) study on the internal leaf anatomy of four emergent and aquatic species of *Sparganium*; Harms (1973) who did a taxonomic treatment on *S. minimum* and *S. hyperboreum*; Crow and Hellquist (1981) who described the *Sparganium* species of New England; Brayshaw's (1985) paper on the bur reeds and other aquatic monocotyledons of British Columbia; and Cook and Nicholls (1986 and 1987) who have done a taxonomic revision of the genus.

Range and distribution

8. *Sparganium* is found primarily in the northern hemisphere but some species occur in Australia and New Zealand (Berry 1924, Cook and Nicholls 1986). This disjunct distribution is believed to indicate a very ancient lineage and this is borne out by a fossil record that dates back reliably to the Eocene (Berry 1924).

9. *Sparganium glomeratum* is one of many species of plants found in Minnesota that are circumboreal in their distribution. The global range of *S. glomeratum* may be best described as interruptedly circumboreal (Gleason and Cronquist 1991) as its distribution is rather sporadic (Map 1). Contrary to other reports (Sather and Van Norman

1988) *S. glomeratum* is not known to be widespread in Europe but is on that continent restricted to Scandinavia, particularly Finland, roughly between the 55th and 65th parallels, and to Russia near the Sukhona River (Map 2). The total Eurasian and Asian range (Cook and Nicholls 1988) of *S. glomeratum* actually consists of 5 centers separated from one another by great distances (see Map 1). One of the largest disjunctions is the area between Moscow and Kamchatka which measures about 3,800 miles. The range and distribution of *S. glomeratum* in the Soviet Union has been studied by Alekseev (1975). Until 1990, *S. glomeratum* was known from only 8 stations in North America (Lakela 1941, Scoggan 1978, Coffin and Pfanmuller 1988) with 2 in Canada and 6 in the United States (Map 3). Its presently known North American distribution is marked by a region of "concentration" in parts of northern Minnesota and northwestern Wisconsin with scattered stations in Canada (Map 4). The Canadian stations are in Newfoundland, Quebec, Alberta, British Columbia, Yukon, and Saskatchewan (Scoggan 1978, Brayshaw 1985). The historically known U. S. stations are Minnesota Point and Knife River (both extirpated), Basswood Lake, Clearwater County, Itasca County, and Twig. The recently discovered stations are in St. Louis, Carlton, Itasca, Becker, Clearwater, and Cass counties in Minnesota, and Douglas and Washburn counties in Wisconsin (Map 5). This sparse distribution places *S. glomeratum* among the rarest plants in North America.

Life history characteristics and habitat needs

10. Based upon its known global distribution *S. glomeratum* is not a common plant and in certain areas it is infrequent to rare. The life histories of many plant species, rare and common, are poorly known (Falk and Holsinger 1991, Karron 1991) and *S. glomeratum* is certainly no exception. The life history characteristics of one species of *Sparganium, S. erectum* (Cook 1962) are known, but information on other *Sparganium* species is incomplete. Studies relevant to the life history of *Sparganium* species include embryological studies by Campbell (1899) and Asplund (1973), and Belavskaia (1984) who discussed fruit morphology of Russian *Sparganium* species. Other studies relevant to *Sparganium* life history are those of Leereveld (1984) who discussed the possibility of pollination by syrphid flies in *S. erectum*; Cook and Nicholls (1986) who included ecological notes in their monograph on the genus; and Leif and Oelke (1990), who describe the development of *S. eurycarpum*.

11. Sather and Van Norman (1988) sought to find a relationship between water chemistry, associated species, and the presence of *S. glomeratum*. They were puzzled by the absence of *S. glomeratum* from seemingly suitable habitat based on chemistry and other factors. They speculated on the dispersal of *S. glomeratum*, suggesting that at maturity the stems become weak and fall over, with the seeds remaining where they fall because the shallow, still waters cannot carry them anywhere. They believed that this might explain the observed clumps of plants in some parts of the "bog" but not in others. Somehow other *Sparganium* species with similarly weak stems were widely distributed within the wetland, but this was not considered. The rhizomatous structure of the plant was not seen as a possible explanation for the observed "clumps. The "clumps" are actually very sparse in terms of shoots per area. The "clumps" formed do not result when a mass of seeds germinate in the same place but are the result of numerous branching rhizomes, which send up sterile and fertile shoots (Walton pens. observ.). In fact, it appears that seed germination or seedling establishment is infrequent in nature, as seedlings have not yet been observed (Walton pens. observ.). Apart from their speculations and the anecdotal observations of others, nothing is known of the life history characteristics of *S. glomeratum*. For example, what role do aquatic mammals play in maintaining habitat? Do ruminants such as deer and moose serve as seed vectors? How do waterfowl figure in as seed dispersers? What are the requirements for seed germination and seedling establishment in *S. glomeratum*? How much time passes between seed germination and first flowering?

Historical background

12. *S. glomeratum* was first reported from North America in 1893 by Aiton near Lake Itasca (Lakela 1941). While Lakela notes the specimen is in the herbarium at the University of Minnesota-St. Paul (MIN), I have been unable to locate any specimen of Aiton's under *S. glomeratum* nor have I seen any under his name that were later identified as another species. A search at the herbarium at the University of Wisconsin-Madison (WIS) also did not turn up any specimens of *S. glomeratum*, correctly or incorrectly identified, collected by Aiton. The best confirmed first report of *S. glomeratum* in North America is from Natashquan, Quebec (Lewis 1931 cited by Lakela 1941). There is a specimen at MIN collected by Abbe (no collection number on label) from Natashquan, Quebec in 1929 identified as *S. angustifolium* which we believe is actually *S glomeratum*. The best confirmed first U. S. *S. glomeratum* is the one

Lakela discovered on Minnesota Point in 1936 (Lakela 1627 DUL and MIN). She originally identified it as *S. fluctuans* but later annotated the specimen as *S. angustifolium*. Her specimens were annotated by Moyle as *S. fluitans*, a synonym for *S. glomeratum*. The Minnesota Point population was later destroyed by the construction of a roadway and airstrip. Lakela found *S. glomeratum* at several other places in Minnesota including Basswood Lake, Knife Rive, and Twig. In 1977 *S. glomeratum* was discovered by Wheeler and Glaser (collection 2071 at MIN) in Itasca County.

13. Due to the paucity of reports for *S. glomeratum* in Minnesota, and the presumed destruction of three of those sites, the species was placed on the endangered list. The number of known sites for *S. glomeratum* in Minnesota remained the same until 1990 when Townsend discovered it along Anchor Hill Road in Clearwater County on the edges of small ponds just 5 miles west from Lake Itasca, Aiton's lost site. In 1992 Townsend collected *S. glomeratum* again in Clearwater County from the same group of ponds and also in southern Cass County. Myhre also collected *S. glomeratum* in Cass County in 1992 from Uram Bay on Leech Lake (K. Myrhe pens. comm.). Townsend described the habitat where these colonies were found as bogs or as floating sedge or shrub mats. Many of the associated species listed by Townsend have affinities for acidic, low nutrient wetlands (Larsen 1982). In 1993 a historical *S. glomeratum* site was rediscovered near Twig, Minnesota by Walton and Townsend. This was the site of Lakela's collection (Lakela 18779 Dul) which she had described as floating bog. It is about 18 miles north of Duluth on HWY 53 in plain view on the west side of the road. New populations of *S. glomeratum* in Duluth and in Carlton County, the latter constituting a county record and southern range extension, were discovered by Walton in 1993. That same year *S. glomeratum* was found for the first time in Wisconsin by Dr. Monson just 5 miles west from Lakela's Minnesota Point site. Knowledgeable people have informed me that they had seen clustered bur reed plants in rural areas of Douglas County, Wisconsin as early as 1972. My own personal observations have confirmed the reported locations do indeed have colonies of *S. glomeratum* present.

14. In 1993, Walton and Townsend also discovered *S. glomeratum* with another rare circumboreal aquatic, *Caltha natans*, in a black spruce swamp at the headwaters of Wynne Creek near Biwabik, Minnesota. Both plants were found together in shallow pools at the bases of overturned trees. Another colony of *S. glomeratum* was found on Wynne Creek in a beaver pond. Several other large colonies of *C. natans* were also found that year downstream of the spruce swamp on Wynne Creek. *C. natans* has a history of rarity in Minnesota (Lakela 1943 and 1954) and Wisconsin (WDNR 1993a). It is on the rare plants list in Canada (White and Riley 1983) where its distribution is sporadic (Scoggan 1978). While considered rare in Alaska there is reason to believe it is more widespread (R. Lipkin, University of Alaska, Anchorage, pens. comm.). By 1984 all known Minnesota sites were thought to be possibly extirpated (Coffin and Pfannmuller 1988). The discovery of *C. natans* by Walton and Townsend in the Wynne Creek drainage was the first time the species had been seen in Minnesota for nearly a decade. It appears that the Wynne Creek drainage contains the largest known population of *C. natans* ever found in Minnesota. At the time of the discovery all colonies were found in natural bodies of water. Changes in land use associated with residential and recreational development projects have probably comprised some portions of this population by altering natural water flow patterns. The recent discovery of tiny patches of *C. natans* near Chisholm and in Duluth, Minnesota, as exciting as they are, cannot make up for the loss. Historical sites near Zim were reported to have been found in 1993 but could not be located again in 1995.

15. The sudden increase in the known number of *S. glomeratum* sites yielded new information on the species' habitat preferences that was at odds with previously held ideas. Based on some parts of associated species lists and the habitat descriptions found on herbarium labels attached to several Minnesota specimens (Lakela 1607, 1703, 9148, and 118779, all DUL, and Townsend 90002 and 92240 all DUL) the assumption developed that *S. glomeratum* grew in bogs. This happened despite the fact that many other associated species lists and habitat descriptions suggested marsh-like wetlands. Even a MDNR study (Sather and Van Norman 1988) labeled its S. *glomeratum* study site "the clustered bur reed bog". This misunderstanding regarding the habitat may have been responsible for fruitless search efforts. That Townsend found *S. glomeratum* at all in Clearwater County was a fortunate accident based on those wetlands' resemblance to bogs *(Sphagnum,* spruce, tamarack, and leatherleaf plants). Many of the wetlands along Anchor Hill Road are much more complicated and appear to be mosiacs of several distinct plant community types. The 1993 discoveries of S. *glomeratum* in Wisconsin, Duluth, Biwabik, and Carlton County were not from begs but swamps and marshes, habitats with higher nutrient levels and a variety of species that are seldom found in omtbrotrophic bogs (Larsen 1982, MDNR 1993). The

first reported Wisconsin site was a *Carex lacustris* meadow in a willow swamp; the new Duluth wetland sites were in shallow water tracks of a black ash swamp and in an ephemeral pool; the Biwabik wetland sites were in a windthrown black spruce swamp (tall, not stunted trees, forming a dense canopy) and a beaver pond; the Carlton County site was in a ditch running along a mixed hardwood/conifer swamp.

16. There is a puzzling statement in Coffin and Pfanmuller (1988) regarding the habitat of S. *glomeratum* where, after describing Lakela's Minnesota Point site as a "bog", it is stated that the "other collections are from floating mats in emergent wetlands." This statement regarding the pre-1990 Minnesota collections is difficult to maintain as none of the sites had ever been described in terms equivalent to "floating mats in emergent wetlands". *S. glomeratum* habitat that could best be described as "floating mats in emergent wetlands" was not discovered and described as such until 1994 near Lake Vermilion (Walton 1994).

Summary of the Results of the 1994 Status Survey

17. A status survey for *S. glomeratum* and *C. natans* was conducted from late spring to early fall in 1994 to relocate historical sites and locate new ones. It was concluded that two of the historical populations of *S. glomeratum* (Knife River and Minnesota Point) were extirpated. Two others were presumed extant based on recent collections (Sather 87-050 at MIN and Lederla 844501 at DUL). The Twig site, first seen by Lakela in 1954, was rediscovered in 1993 and confirmed in 1994. A total of 10 new colonies were discovered in St. Louis and Carlton Counties. In some cases 2 or 3 colonies were present at a site while others were isolated occurrences. The largest number of colonies were found in the Piedmont and Duluth Heights neighborhoods in Duluth. Only one new *C. natans* colony was discovered along Miller Creek in Duluth, Minnesota. It is within 1 mile of most of Duluth's known *S. glomeratum* colonies. New sites were discovered in Peyla, Rice Lake Township, and Blackhoof, Minnesota.

18. Field work in 1994 on *S. glomeratum* revealed how little is known regarding this species' phenology. Most writings on *S. glomeratum* state it blooms and sets seed from late July to early August (Lakela 1965, Coffin and Pfannmuller 1988) or that it can be reliably identified only in August (Sather and Van Norman 1988). In conjunction with rare plant surveys in Wisconsin I found that *S. glomeratum* blooms and produces fruit from June into late September end that it was possible to identify the species based on fragmentary fruit clusters as late as November (Walton 1125 DUL) and as early as April (Walton 1137 DUL). A colony in Carlton County had both flowers and maturing fruit on June 16, 1994 (Walton 1293 DUL). Other known colonies were in a similar condition at around that time.

19. Additional information was obtained regarding habitat preferences of *S. glomeratum* during the 1994 Status Survey when new populations were discovered in habitats that lacked moats and were deficient in ericaceous vegetation such as floating cattail marshes, *Scirpus/Carex* marshes, black ash swamps, beaver meadows and ponds, and alder/willow swamps. Silty soil deposited in slow moving or still water and derived from materials such as tree leaves, twigs, and herbaceous plants was commonly observed. *Sphagnum* was often present, especially in forested habitat, but was by no means the most frequent moss species. Other bryophyte genera frequently observed include *Mnium* and *Climacium.* Frequently seen hepatophytes are *Bazzania* and *Porella.*

20. In 1994 historical *C. natans* sites were not revisited either because the locations were imperfectly given or, as in the case of Sparta, the sites were utterly destroyed. Only one new site (Duluth) was discovered. Potential habitat in Carlton County was searched but was fruitless. New populations were found near Chisholm by Roger Lake (MDNR). A subpopulation of *C. natans* on Wynne Creek first seen in 1993 was revisited on May 26, 1994. It was discovered that *C. natans* blooms very early in the spring because the plants already had maturing fruit in addition to flowers. This is in contrast to what is written, that the flowers bloom in July and August (Gleason 1968, Gleason and Cronquist 1991). Lakela (1965) reported that *C. natans* blooms from May to July, apparently contradicting her earlier report that the species blooms and sets fruit into September (Lakela 1954). Personal observation of *C. natans* plants found fruit is matured very quickly after the flowers fade. Walton's discovery of *C. natans* in Duluth on Aug. 30, 1993 aid later visits in September found it blooming and fruiting right into the fall. Beyond the continuous bloom period, little else was learned about *C. natans* other than its presence in shallow, slow moving or still water over organic substrates.

21. The status survey did not address questions on dispersal, propagation, or life history for either *S. glomeratum* or *C. natans* wind there is as of yet no information based on controlled investigation. The 1995 status survey was reduced to search only for *S. glomeratum* although visits were made to the newest *C. natans* sites on the Iron Range.

Objectives and Scope of the 1995 Status Survey *Sparganium glomeratum*

22. This phase of the status survey had the following objectives:

1) To search black ash swamps within the Toimi drumlins, which have had less human contact than those in Canton County and the Duluth-Superior area.
2) To search large wetlands at Peyla, Blackhoof, and Skelton to see if *S. glomeratum* is growing far from the edge of the wetland and how extensive the populations are.
3) To search se Itasca and sw St. Louis counties with MDNR personnel to assist them with the field characteristics of *S. glomeratum*.
4) To revisit Cass and Clearwater counties with MDNR personnel to assess abundance, habitat characteristics, and look for additional populations.
5) To characterize global plant geography of the species found with *S. glomeratum* and those growing where it was not found.

Materials and Methods

23. The lack of reliable information on habitat, community type, associated species, and phenology made it difficult to decide were and when to look. Topographical maps and personal acquaintance with potentially productive sites were used in determining broad search areas. Narrowing down the search areas was based on the following criteria:

1) Based on records of associated species from the previous status survey the presence of *Carex lacustris, Scirpus cyperinus, Glyceria grandis, G, canadensis, Typha latifolia, Fraxinus nigra, Bidens cernua, B. frondosa*, or *Sium suave* in saturated soils or shallow standing water were considered to be indicators of good *S. glomeratum* habitat. Also considered to be of importance was the presence of other *Sparganium* species, especially *S. chlorocarpum* and *S. amencanum*, which had been found at some sites.

2) Previous records of or the discovered presence of the one or more of the following boreal and circumboreal species in the vicinity: *Ranunculus gmelinii, Petasites sagittatus, Eleocharis nitida, Juncus vaseyi*. These species have been found frequently with *S. glomeratum* in Superior, Wisconsin and floristic maps and herbarium records indicated that at least some had been found near historical and more recent *S. glomeratum* sites in Minnesota.

3) When *S. glomeratum* was found in a particular area similar looking habitat nearby was searched.

24. Collection of voucher specimens and documentation of sites was conducted according to the following procedures:

4) Where appropriate voucher specimens of *S. glomeratum* were collected. Estimates of population size and density were made. Associated species were listed in a notebook or collected if they were not easily identifiable in the field. Voucher specimens of any associated *Sparganium* species were also collected.

5) In some cases photographs of habitat and/or plants were taken for documentation purposes.

6) Latitude and longitude of populations was in most cases determined using a Garmin GPS. The locations of populations were indicated on 7.5 USGS topographical maps using a 40 Acre Land Locator by Template Designs to determine quarter sections. The Land Locator was also used to make estimates of wetland acreage on 7.5 USGS topographic maps.

Results of the 1995 Status Survey

25. Potential habitat for *S. glomeratum* was investigated in Cass County, Clearwater County, northern and southwestern St. Louis County, Lake County, and Carlton County. Of 7 new sites found 5 were in northern St. Louis County (includes the Toimi drumlins) 1 in southern St. Louis County (Hermantown), and 1 in Carlton County (Carlton). New populations were found in Duluth (Hartley Park) and new patches were found at wetlands where S. *glomeratum* had been discovered last year (Oak Bend Wetland Site, Trinity Wetland Site). New populations were also found on the Duluth-Rice Lake Township lines as part of another project (Walton 1995a). Additional colonies were found along Anchor Hill Road in Clearwater County and previously reported populations were relocated. *S. glomeratum* was also reported from Becker County (K. Myrhe pens. comm.) and in the Marcell District of the Chippewa National Forest in Itasca County by Tom Suddendorf. Southeast Itasca was not searched due to schedule problems and later, high water and poor weather. The *Polemonium occidentale* var. *lacustre* site near Spider Creek in southwest St Louis County was searched with Roger Lake (MDNR), but no *Sparganium* species were found in this wetland. Permission to search wetlands in Peyla could not be obtained but nearby wetlands along Sassas Creek were searched as part of another project for the Laurentian District of the Superior National Forest. Only sterile *Sparganium* plants were found but in what was deemed to be good *S glomeratum* habitat. Wetlands near Blackhoof were searched but *S. glomeratum* was not found even though the habitat appeared suitable. *S. glomeratum* was not found in Cass County although one shallow wetland pool contained *Ranunculus gmelinii* var. *hookeri*; Townsend's site was not relocated either. One promising site was located at Sugar Lake in Cass County. In a beaver channel that cuts along the western edge of an old bay located on the north side of Sugar Lake and nearly covered by a floating mat of vegetation encroaching from the shore, several patches sterile *Sparganium* plants were observed. Other wetlands in a draw that leads to this old bay had no *Sparganium* species.

26. At some locations certain rare or scarce circumboreal, boreal, and Great Lakes endemics were found with or near *S. glomeratum*. In Carlton County a county record and range extension was made for *Sparganium minimum*, a circumboreal species uncommon in Minnesota. New sites and additional local populations were discovered for the following rare or scarce circumboreal, boreal, and Great Lakes endemic species: *Eleocharis nitida, Carex flava, Juncus vaseyi, Viola novae-angliae, Petasites sagittatus, Botrychium matricariifolium, Ranunculus gmelinii, Vaccinium vitis-idaea* ssp. *minus*, and *Sparganium minimum*. *County records for these temperate species, Symplocarpus foetidus, Botrychium dissectum, and .Salix* exigua, were also made in Canton County during the 1995 Status Survey.

Historical Sites Revisited During the 1995 Status Survey

Knife River, Minnesota Point, and Twig

27. Historical sites near Knife River and on Minnesota Point were revisited in 1995 to be sure that nothing was missed in 1994. It seems very likely that Lakela's original *S. glomeratum* colonies have been completely destroyed from Knife River and Minnesota Point. A ditch between the highway and parking lot just north of the Knife River was searched one more time. The only discovery of note was that of *Juncus vaseyi*, a species found in sedge meadows (primarily *Carex buxbaumii*) adjacent to the *S. glomeratum* sites in Superior, Wisconsin (Monson and Walton 1995). Species of note from Minnesota Point include *Petasites sagittatus* and *Equisetum palustre*, boreal and

circumboreal wetland plants found in the vicinity of *S. glomeratum* at some Wisconsin sites. *Botrychium matricariifolium* was also found on Minnesota Point, a new record for the flora of Duluth. The site near Twig was still in existence but beavers or muskrats had been clearing channels, breaking up stands of *S. glomeratum* in the process. Very few flowering or fruiting plants were seen this year at the Twig site.

Sites Found in 1993 and Revisited During the 1995 Status Survey

Duluth Heights, Duluth, St. Louis County, Minnesota (T50N, R14W, ne/ne Sec. 20)
28. Although there is a large amount of apparently suitable habitat within this 10 acre wetland only two small colonies are present here. One is behind Robin Avenue in an ephemeral pool, the other is in a flooded black ash swamp along Maple Grove Road. About 10 more acres of wetland were searched in the Duluth Heights neighborhood but no *Sparganium* species were found.

29. The Robin Avenue colony was discovered in 1993 (Walton 1089 DUL) in a shallow ephemeral pool (Fig 1). At that time only 2 fruiting stems were found among several sterile shoots. One specimen was collected but a deer ate the other shoot. The colony has increased slightly in size but produced only 2 fruiting shoots in 1995. Deer browsed S. glomeralum has been observed elsewhere in Minnesota and the possibility that deer aid in its dispersal would be interesting to investigate. In Wisconsin, Sparganium species have been reported to be among the heavily used plant foods of white-tailed deer in the spring and summer (Hamerstrom and Blake 1939).

30. When first discovered in 1993 all plants observed at the Maple Grove Road colony were sterile. In 1994 flowering and fruiting plants were found (Fig. 2). This site was examined once in 1995 to determine the full area covered by *S. glomeratum* here. Low rainfall in June made it easier to walk on this floating mass of *Calamagrostis* and mud. *S. glomeratum* was found throughout a nearly 500 ft^2 area. There were 30 flowering and fruiting shoots and about 300 vegetative shoots. *S. glomeratum* shoots were growing among *Eleocharis palustris* in the mud shaded by *Calamagrostis canadensis*. Other associated species include *Calla palustris* and *Typha latifolia*. A small patch of *S. glomeratum* was found growing in a very sluggish, silt-clogged stream under alders with *Chrysosplenium americanum* and *Potamogeton obtusifolius*. Unusual flowering specimens were found here, with the staminate portion of the shoot extending to about 1 cm in length. Aberrant *Sparganium* plants were found at several places in Minnesota. They are described in this report in the section Taxonomic Considerations.

31. The Maple Grove Road and Robin Avenue colonies in Duluth Heights are on privately owned land which is platted for housing and a road. Past and recent changes to area hydrology include impediments to water flow from roads, filling of a 52,500 ft^2 portion in 1993, and the construction of a shopping center that reduced the size of the upland watershed and further fragmented the forest. Despite 4 ephemeral pools in the woods and numerous areas of standing water in the remaining black ash swamp, *S. glomeratum* is restricted to less than 1% of the wetland habitat.

Gilbert Road, Skelton, Carlton County, Minnesota (T47N, R19W, Sec. 23, 24 and T47N, R18W, Sec. 30)
32. In Carlton County *S. glomeratum* was first found in a ditch along Gilbert Road, Skelton township (T47N, R19W, sw/sw Sec. 24 and se/se Sec. 23) in early September 1993 (Walton 1055, DUL). Another colony was discovered on Gilbert Road in 1994 (T47N, R18W, nw/nw Sec. 30, Walton 1372 DUL). The first Gilbert Road colony was revisited 5 times during 1995 to observe the growth of *S. glomeratum*. That proved to be impossible when on June 16, the second visit, no *S. glomeratum* plants had yet emerged. Subsequent visits found no more than a few small submerged plants that may be *S. glomeratum*. What happened to the colony here? Nearly all of the associated species that lived in the ditch with *S. glomeratum* are gone. *Equisetum fluviatile* is present but not abundant, *Sium suave, Bidens cernua, Lemna minor*, and *Eleocharis obtusa* are gone. Only *Utricularia vulgaris* is common. None of the species in the adjoining swamp appears to be missing and the ditch across the road looks completely normal. There is no sign that the ditch was cleared mechanically. I can only conclude that herbicide was used to kill plant life in the ditch.

33. The second population (Walton 1372 DUL) discovered farther east on the same road in 1994 appears to be alright for now. This colony is connected to a larger wetland complex by a culvert under HWY 61. I expected *S. glomeratum* to be in the wetland complex, and in early summer 1995 I observed and collected it from along the edge (T47N, R18W, ne/nw Sec. 30, Walton 1675 DUL). How the new culvert under the recently paved bike trail will affect the larger wetland remains to be seen.

Sites Found During the 1994 Status Survey and Revisited in 1995

Trinity Road, Duluth, St. Louis County, Minnesota (T50N, R14W, nwsw 29)
34. The original *S. glomeratum* population (Walton 1414 DUL) at the Trinity Wetland Site was discovered in a shallow, muddy pond associated with a black ash/white cedar swamp. Aerial photographs and mounds of soil near the ponds suggest that this pond and two others near it may actually be artificial, dating back to 1971. Smaller colonies of *S. glomeratum* were found later under alders in a seepage area southeast of the ponds.

35. The Trinity Wetland Site is a perched wetland on a gabbro outcrop (Schwartz 1949, Taylor 1964) rising about 80 feet above Central Entrance and has a maximum elevation of almost 1,400 feet above sea level. Wetlands comprise about 7 of the 20 acres of natural habitat here. The north and west sides are fairly steep rock walls with some woody vegetation while to the east and south the slopes are more gradual. On the north the predominant species are quaking aspen, paper birch, yellow birch, Canada yew, and hazel. On the west side the predominant species are quaking aspen, white spruce, *Salix humilis,* and hazel. There is some seepage at the shady northwest corner and a thick growth of the hepatophyte *Bazzania* has developed. The remaining uplands vegetation away from the steep rock walls is largely sugar maple, basswood, and red oak. *Actaea rubra* and *A. pachypoda* are very common in this forest. Wetlands are of the black ash/white cedar type. Some mature cedar remain but in general white cedar is now present as cut stumps.

36. The black ash/white cedar swamp at the Trinity Wetland Site was investigated more thoroughly in 1995 and 4 new *Sparganium* colonies were found here. One colony identified positively as *S. glomeratum* (Walton 1781 DUL) was in a transect line made by the bulldozers. The other three (Walton 1723, 1782, 1783 all DUL) are in shallow water tracks under a heavy canopy of black ash and black alder. These particular colonies were very unusual in that the internode between the uppermost pistillate inflorescence cluster and the lowermost staminate inflorescence cluster could be 1, 2, 4, or even 8 mm long. This is not typical for *S. glomeratum* which is described as having virtually no internode between male and female portions of the flowering stem. Anomalous specimens like these were observed and collected from several different locations in Minnesota and Wisconsin this year. Even though the pistillate portion of the inflorescence is tightly congested the plants may not be *S. glomeratum* on the basis of staminate inflorescence and other characters. There are many small open water tracks with little vegetation other than *Lemna minor* and no *Sparganium* species. About 50 ft^2 out of several thousand have *S. glomeratum* in them.

37. Two new colonies of *S. glomeratum* were found growing along Trinity Road at the base of the rock outcrop in a shallow pool and in a roadside ditch (Walton 1780 DUL). It appears that the ditch used to be part of the shallow pool with the source of water apparently seepage from the cliff. Associated species in the ditch include *Typha latifolia, Potamogeton natans* (?), *Polygonum* spp., *Impatiens capensis, Onoclea sensibilis, Equisetum fluviatile, Carex lacustris, Juncus* sp., *Eleocharis palustris*, and *Lemna minor*. Species in the pool include *Typha latifolia, Carex psuedocyperus, Salix lucida, S. gracilis*, and *Calamagrostis canadensis*. On July 30, 1995 there were 75 flowering and fruiting stems in the ditch colony. A visit to this site on Aug. 4 found the entire ditch mowed. Because *S. glomeratum* is a herbaceous perennial that can spread by rhizomes this is probably not a problem in the short run. However, frequent mowing could interfere with photosynthesis, and seed production and dispersal. The pool by the cliff is very brushy and for that reason it was probably not mowed.

38. Several ditches along Central Entrance and Trinity Road were searched for *S. glomeratum* but neither it nor any other *Sparganium* species were found. These ditches are nearly pure stands of *Typha latifolia* and various hybrid forms of *T. latifolia x angustifolia*, with some *Alisma plantago-aquatica, Phalaris arundinacea*, and *Phragmites communis* and superficially resemble marshes.

39. The desire of some to turn this sugar maple forest and cedar/ash swamp into another retail shopping center has already severely injured the forest and swamp. Bulldozers have plowed transects into the forest and swamp and soil surveys have left deep pits in some of those transects. The destruction is beginning before the permits are even applied for. Recently the Duluth City Council voted in favor of rezoning this parcel to commercial use (Lincoln 1995). Wetlands on top of the hill will not be directly affected by filling and deliberate draining. However, changes in hydrology caused by the removal of thousands of cubic yards of rock and the loss of upland watershed will have an impact. Pollutants from the parking lot will affect water quality in the wetlands which should not be regarded as cesspools. The cumulative effects of urban and suburban development within upland watersheds are singled out by the Committee on Characterization of Wetlands (1995) as being detrimental to the vegetation, nutrient cycling, and hydrology in wetlands. Two large patches of *S. glomeratum* at the northern base of the hill will be completely destroyed. In addition, a very fine maple/basswood forest with a rich assortment of native flowering plants including *Actaea pachypoda* will be nearly eliminated.

Oak Bend Drive, St. Louis County, Minnesota (T50N, R14W, sw/ne Sec. 21)
40. This colony was discovered in 1994 at the Oak Bend Wetland Site but no vouchers were collected. It was revisited in 1995 in the early spring and late summer. Additional fruiting stems were observed in two locations this year. Another *Sparganium, S. minimum*, found last year in the pond and abundantly in flower and fruit at the time, was nearly absent in 1995 and no flowers or fruit were observed. Pressures from real estate development threaten the survival of the hardwood forest and the hardwood/conifer swamp that surround this wetland. The total wetlands area here is about 8 acres.

Stockholm Road, Rice Lake Township, St. Louis County, Minnesota (T51N, R14W, se/se Sec. 28)
41. The Stockholm Road Wetland Site was revisited and the habitat more carefully mapped. In this tiny patch of black ash swamp, about 1-2 acres, is a shallow pool about 40 feet long with *S. glomeratum* and *S. chlorocarpum*. The pool is nearly pinched off in places by encroaching vegetation. Within the pool S. chlorocarpum is restricted to the south end while *S. glomeratum* is only at the north end. There were about 13 fruiting shoots and 40 sterile shoots of *S. glomeratum* and 4 fruiting and 25 sterile shoots of *S. chlorocarpum*. The wetland habitat is fragmented and may not survive continued changes to hydrology resulting from the piecemeal filling of the swamp. Disturbed wetlands at the edge of the swamp did not contain *S. glomeratum* or any other *Sparganium* species.

Blackhoof, Carlton County, Minnesota (T47N, R17W, sw/se Sec. 30)
42. This particular *S. glomeratum* colony was all but obliterated during road construction by the Carlton County Highway Department in September 1994. Most of the plants were removed by me in cooperation with the Canton County Highway Department and the MDNR and transplanted to Herding Island in the Duluth Harbor. The success of that transplant is unknown at this time. Some plant fragments were inevitably left behind. In 1995 I revisited the Blackhoof site and found 2 clumps of *S. glomeratum*, one 4 ft^2 and one 16 ft^2, along with a few isolated shoots. These plants had been partially buried by sand that slid down the embankment. During construction the mucky soil from the ditch was removed and spread into a water collection pond at the junction of HWY 5 and HWY 6. I observed only a few plants that could be sterile submerged rosettes of either *Sparganium* or *Typha*.

Lat. 460 31.163' N
Long. 920 32.171' W

Rediscovered Sites and New Sites Found During the 1995 Status Survey

Clearwater County

43. The earliest report of *S. glomeratum* from Clearwater County (and from North America as well) is that by A. B. Aiton in July 1893 from "Lake Ithasca, Minn." (Lakela 1941). The plant, according to Lakela, had not been reported from there since. Nearly one hundred years later Townsend discovered S. glomeratum in the southeast

Clearwater County in several small ponds and pools in the Anchor Hill area about 5 miles west of Lake Itasca. One of the goals of this survey was to relocate *S. glomeratum* in Clearwater County.

Potential habitat investigated and results

44. Walton visited the White Earth Indian Reservation in southeast Clearwater County on Aug. 7, 1995 with Nancy Sather of the MDNR to try to relocate Townsend's clustered bur reed colonies. Upland tree cover had been described by Townsend as maple/basswood but Marschner's map (1930) shows that the original vegetation of this part of Clearwater County to have been quaking aspen/birch/conifer associations (boreal components), jack pine with oak, aspen, and hazel brush, and some small areas of conifer swamp. Observations made during the Status Survey found quaking aspen/paper birch/ associations (white pine, white spruce, and balsam fir) with red maple, bur and red oak, and big tooth aspen. Maple/basswood formed a relatively small, isolated portion of the upland vegetation.

45. According to herbarium labels, the bur reed colonies were found in wetlands along the Anchor Hill Road. We followed an unnamed forest road and searched 4 wetlands without finding *S. glomeratum*. Three of the wetlands judged to be suitable habitat partially met the descriptions of herbarium labels, i.e., they had shallow pools, channels or moats. *No Sparganium* species were found in any of these wetlands. It appeared from the map that we were near, not at, Townsend's site. Anchor Hill Road, about 0.6 miles south of the other road and clearly marked from the highway, was the right road to follow. A total of 36 different wetlands varying from shallow pools, sedge marshes to emergent marshes and lakes were observed from the edge of Anchor Hill Road over a distance of 7.8 miles. We personally investigated 17 of the wetlands seen. Some wetlands were discounted because they were lakes or ponds, others because they appeared to be nearly monotypic stands of sedge with no apparent open water. A few were not investigated because they appeared to be recently formed and no emergent vegetation community could be seen. Of the 17 wetlands investigated 7 had colonies of *S. glomeratum*. Only 2 of the 7 colonies (found in wetlands # 15 and #26) could definitely be attributed to Townsend's original report. Below is a description of the 7 wetlands where *S. glomeratum* was found along Anchor Hill Road in Clearwater County.

Wetland #1 (T143N, R37W, Sec. 28)

46. Located about 2.1 miles from the intersection, this wetland, a small circular pond with about 1/10 of its northern end cut off by the road, is most unbog-like. A small stream trickles in from the adjacent woods and is stained orange by bacterial colonies. In the center of the pond is a floating mat of woody vegetation consisting of *Salix gracilis* and other *Salix* spp., *Glyceria striata, G. grandis, Sium suave, Typha latifolia, Potentilla palustris, Carex lacustris* and other *Carex* spp., and *Bidens* spp., all common plants found throughout northern Minnesota in great abundance. Observed growing at the fringes were *Sparganium* sp. (sterile shoots), and *Sparganium glomeratum* (fruiting stems). Around this mat is a moat of shallow (probably no more than 4 feet deep), slightly brown but clear water. Plants actually growing in the moat rather than on the shores include a linear leaved *Potamogeton s*p., some *Lemna minor,* and *Utricularia* sp. Also seen in the moat was an abundance of freshwater sponges. Along the shoreline were growing *Lemna minor, Glyceria grandis, Bidens sp., Scirpus cyperinus, Carex lacustris, Iris versicolor, Lysimachia thyrsiflora, Lycopus* sp., *Scutellaria* sp*., Impatiens capensis, Potentilla palustris, Ranunculus pensylvanicus. S. glomeratum* runs from the western edge of the stream all the way along the shore to the road. Associated species, and especially the floating island of *Salix*, suggest that this is not a colony of *S. glomeratum* reported by Townsend. sites. This particular wetland is very much like one in Hartley Park, Duluth where *S. glomeratum* was found this year (described later).

Latitude: 47° 9.951' N
Longitude: 95° 22.681' W

Wetland #8 (T143N, R37W, Sec. 22)

47. A *Typha/Carex* marsh in mixed white-red pine/spruce-fir/aspen-birch forest, wetland #8 is about 4.4 miles from the intersection. Twenty-seven fruiting stems of *S. glomeratum* were found in Wetland #8. *Typha/Carex* marshes as well as *Carex/Scirpus* marshes have not been considered habitat for *S. glomeratum*. This particular wetland is one of at least four (numbers 6, 7, 8, and 9) that are connected to one another by swales or shallow depressions to one another. Wetland # 6 is a pool in a black ash swamp; # 7 is a large black ash swamp; #9 is a recently flooded black ash swamp. Wetland #8 is adjacent to #9 and connected to it by a low area. Associated species include *Typha latifolia, Carex lacustris, Calla palustris, Lemna trisulca, Utricularia minor*, and at the edges, *Alnus rugosa*. Some

Larix laricina and Fraxinus nigra were also seen. Associated species suggest that wetland #8 is not a colony of *S. glomeratum* reported by Townsend.

Latitude: 47° 11.119' N
Longitude: 95° 21.612' W

Wetland #13 (T143N, R37W, se/nw Sec. 23)
48. This is another wetland cut by Anchor Hill Road. This wetland and the next 2 are connected to one another by shallow damp depressions. Their approximate distance from the intersection is 6 miles. There is a moat pond surrounding a floating vegetation mat of *Alnus rugosa, Carex lasiocarpa, C. lacustris, Salix* sp., *Sium suave*, and *Epilobium leptophyllum* with a single red maple and a few dead paper birch. In the moat were *Potentilla palustris, Bidens* spp,, and *Utricularia vulgaris. S. glomeratum* occurs only in the larger half of the wetland. Nine fruiting stems of *S. glomeratum* were counted growing in one patch in the moat near the road. It is uncertain whether this a colony of *S. glomeratum* reported by Townsend.

Wetland #14 (T143N, R37W, se/nw Sec. 23)
49. Wetland # 14 is connected to Wetland # 13 by a small damp depression that runs from east to west. The center of the wetland is dominated by a floating mat of *Chamaedaphne calyculata* and stunted *Alnus rugosa* with *Carex lacustris, C. lasiocarpa*, and *Glyceria canadensis*. In the moat were *Sium suave, Bidens* sp., *Potentilla palustris*, and *Galium tinctorum*. Most of the *Sparganium* plants observed were sterile shoots and they extended around the moat for roughly 20 feet. About 10 fruiting stems were seen. Associated species and the *Alnus/Chamaedaphne* island suggest that Wetland # 14 is this is not a colony of *S. glomeratum* reported by Townsend.

Wetland #15 (T143N, R37W, se/nw Sec. 23)
50. This wetland is connected to # 14 by a shallow depression. Judging by the description of a floating mat with tamarack and the location of the patches of *S. glomeratum* on it this appears to be the location of Townsend's collection 92240 (DUL). Figure 3 is a photograph of Wetland # 15.

Wetland #26 (T143N, R37W, ne/se Sec-14)
51. Wetland #26, about 6.75 miles from the intersection, may also be the location of one of Townsend's collections (92238 at DUL). There is a mat of *Alnus rugosa, Chamaedaphne calyculata*, and *Carex lacustris* with *S. glomeratum* growing on the ne edge of the mat. *Lemma minor, Utricularia vulgaris*, and *Polygonum* sp., were observed in the moat. *Iris versicolor* and *Salix discolor* were present on the shore.

Wetland #36 (T143N, R37W, se/nw Sec. 14)
52. This is a huge floating mat of *Carex lacustris, C. lasiocarpa*, and *Typha latifolia* ringed by a narrow shallow moat, very unlike a bog, and the least impacted by the road which is 0.8 mile from it. The wetland is At the north end it appears to be connected to a nearby lake through a narrow cut in a hill. At the south end is a beaver lodge but there is no evidence of any recent use. The stems of dead alders and willows in the center of the mat indicate that water levels may have changed recently. For most of its length the moat had no *Sparganium* species of any kind. Six patches with a combined total of 108 fruiting stems and covering about 110 ft^2 were counted along the north side. Associated species in the moat included *Lemna minor, Cicuta bulbifera, Sium suave, Bidens frondosa*, and *Utricularia minor*. The thin, unstable *Carex* mat and the nearby plant community of maple/basswood match Townsend's description for collection 90002 (DUL), but because the plants were not found throughout the mat as he described it is not certain this is the location. Latitude: 47° 12.319' N, Longitude: 95° 19.818' W

New Sites in Northern St. Louis County, Minnesota

53. There are no previously known sites for *S. glomeratum* near the Dewey Lake Area (T60N, R19W and R21 W) which is north of Chisolm. The nearest known sites are in Biwabik and Peyla, both about 24 miles east. There are two recent *Caltha natans* sites near Paavola Creek found by Roger Lake of the MDNR and a rediscovered site near Zim. Lakela had first found *C. natans* in Zim in 1956. These sites were visited to search for more *C. natans* and to locate any *S. glomeratum* that might be there as well. Walton also visited the known *Polemonium occidentale* var. l*acustre* sites in this part of St. Louis County with Roger Lake. *Polemonium occidentale* var. *lacustre* is not known to be associated with *S. glomeratum* habitat but it seemed a good idea to investigate any nearby wetlands while we were there.

Potential habitat investigated and results

54. Potential habitat included two recently discovered *C. natans* sites, black ash swamps and associated wetland communities, and wetland communities near the *Polemonium occidentale* var. *lacustre* sites. *S. glomeratum* was found at three different wetlands. The first was near a *Polemonium occidentale* var. *lacustre* site near Paavola Creek, the second with *Caltha natans* in a black ash swamp, and the third in a shallow drainage ditch along a black ash swamp and associated shrub swamps and marshes.

The *Polemonium occidentale* var. *lacustre* site near Paavola Creek (T60N, R19W, Sec. 3, 4, 9, and 10)

55. An interesting and productive site was that near the *Polemonium* study site. Of particular note was a circumboreal species, *Vaccinium vitis-idaea* ssp. *minus*, found at the edge of a recent clearcut in the black spruce stand in T60N, R19W, Sec. 3. There is a historical collection of this species, rare in Wisconsin, from Superior not far from some of the recently discovered *S. glomeratum* populations (Walton 1994b).

56. At the junction of Sec. 3, 4, 9, and 10 in T60N, R19W 4 colonies of *S. glomeratum*, with a combined total of 119 fruiting stems, were found along with numerous sterile shoots. Two other *Sparganium* species, *S. chlorocarpum* and *S. angustifolium* were seen here, too. Some colonies (numbers 1 and 2) of *S. glomeratum, S. chlorocarpum and S. angustifolium* were found in cold water spring fed streams that were ditched running parallel to the forest road. Colonies 3 and 4 were found in an abandoned beaver pond with *S. chlorocarpum*.

56. Associated species at colonies 1 and 2 include *Lemna minor, Typha latifolia, Sparganium chlorocarpum, S. angustifolitim, Phalaris arundinacea, Potamogeton* sp., *Calla palustris, Caltha palustris, Polygonum* spp., *Utricularia vulgaris*, and *Sium suave*.

57. Associated species at colonies 3 and 4 include *Ranunculus gmelinii* var *hookeri, Sparganium chlorocarpum, Riccia fluitans, Scirpus cyperinus, Carex* spp., *Eleocharis palustris, Epilobium leptophyllum, Campanula uliginosa, Callitriche verna, Eupatortum maculatum, Scutellaria* sp., *Agrostis scabra, Alnus rugosa, Salix* spp.

The *Caltha, natans* sites near Paavola Creek (T60N, R19W, Sec. 3, 4, 9, and 10)

58. A *C. natans* site was discovered last year by Roger Lake on a game trail that runs through a black ash swamp (T60N, R19W, nwsw Sec. 4, Lat. 47° 42.531' N, Long. 92° 46.529' W). Actually, the swamp is in parts more like a savanna because of the sparse understory and shrub layer and the higher percentage of grasses and sedges compared to woody plants. This is unlike the black ash swamps in Duluth where *S. glomeratum* has been found which have a denser overstory, a shrubby understory, and more fern, forbe, and sedge species frequent in the herbaceous layer. Viola novae-angliae was observed in some of the dry to moist areas of the trail. This is interesting because Viola novae-angliae has been found in close proximity to colonies *of S. glomeratum* in Superior, Wisconsin (Monson and Walton 1995) and elsewhere in Minnesota.

59. The game trail, apparently a former logging trail, is up to 30 feet wide in places, with soil varying from dry to saturated. *C. natans* is present as 6 small patches along the game trail. Although suitable habitat was present in the saturated areas, *S. glomeratum* and *C. natans* were present in only one location. The plant community here could

best be described as emergent marsh with *Carex lacustris, C. rostrata, Glyceria grandis,* and *Calamagrostis canadensis* forming the major components. Other species include *Typha latifolia, Scirpus cyperinus, Eleocharis palustris, Juncus brevicaudatus, Caltha palustris,* and *Bidens sp.* Some patches of *Sphagnum* were also seen. Forty-nine fruiting stems of S. *glomeratum* were found with 4 of the 6 patches of C. *natans.* One C. *natans* patch was associated with sterile shoots of *Sparganium. C. natans is* not a commonly seen associated species with S. *glomeratum,* seen once before (in our region, at least) with S. *glomeratum* in Biwabik and never in Wisconsin.

60. This group of C. *natans is* not comparable to those found along Wynne Creek in 1993 and 1994. The individual plants are small and crowded by grasses and sedges. The Wynne Creek colonies are large, covering many square feet and often occupying those areas exclusively. It is interesting because of the direct association of S. *glomeratum* with C. *natans* and because V. *novae-angliae* was present in other parts of the wetland. The future of this population of C. *natans* on the game trail is very precarious as it could be easily damaged by persons driving over it.

Sturgeon River and Zim *Caltha natans* Sites

61. A population of C. *natans* on the Sturgeon River (T60N, R20W, se Sec 33) was devastated by heavy rains and high water this year. Three patches, 2 showing damage from the floods and 1 with 6 plants in fruit were found. No *S. glomeratum* was found here although a species tentatively identified as S. *americanum* was abundant in the river. In some sloughs healthy colonies of *Ranunculus gmelinii* var. *hookeri* were observed. The presence of *R. g.* var. *hookeri,* a circumboreal aquatic plant, is significant because it has been found growing with S. *glomeratum* in Wisconsin end Minnesota. C. *natans* could not be relocated at Zim in the dense reed canary grass along the ditch where the plant was reported.

Shannon River Grouse Habitat Management Area (T60N, R21W, Sec. 36)

62. A small group of S. *glomeratum* was found in roadside ditch in the management area (T60N, R21 W, ne/ne Sec. 36). This road cuts across a black ash wetland which drains through shrub swamp and marsh into a small unnamed stream. Plants observed in the ditch, many in fruit, are S. *glomeratum,* but specimens collected from the stream (T60N, R21 W, se/ne Sec. 36) were only in flower. The identification of these specimens is uncertain. The stems are lax and the pistillate flower clusters are not tightly crowded, characters more consistent with S. *angustifolium.* Unless more mature specimens are collected from this stream it seems premature to state that S. *glomeratum is* here, too.

Investigation of the Toimi Drumlins in St. Louis and Lake Counties, Minnesota

63. S. *glomeratum is* not previously known from this area, with the nearest site at Biwabik about 20 miles northwest. The Toimi drumlins are in both Lake County and St. Louis County. These glacial formations are closely spaced, long, narrow hills, composed of sandy, stony soil with a large amount of gabbro fragments, which run from the northeast to southwest (Wright et al. 1969). The hills are forested with aspen/birch/conifer associations. In their valleys are small streams and rivers. Much of the land is swampy and beavers have contributed to the formation of many shallow marshes where *Sparganium* species could grow. Original vegetation maps (Marschner 1930) describe the pre-settlement vegetation as conifer swamp and quaking aspen. Many of the wetlands investigated were conifer swamps (black spruce and tamarack) or mixed conifer/hardwood swamps (white cedar and black ash) within quaking aspen/paper birch/balsam fir/white spruce associations.

Potential habitat investigated and results

64. Wetland sites chosen for investigation were along forest roads and trails that cross large expanses of wetlands. These are Forest Road 425, Forest Road 418, Forest Road 409, and Seven Beaver Trail. Wetland areas adjacent to Nelson Creek, Breda Creek, Store Creek, and Whiteface River were also searched. Two sites, colonies in ditches adjacent to wetlands, were found on HWY 16 near Fairbanks and the Whiteface Campground at the southwestern edge of the drumlins. Some promising wetlands associated with beaver ponds could be searched only from the edge because of high water caused by recent rains. It was expected, based on the information supplied by others, that the drumlins would contain black ash swamps. However, conifer swamps with various combinations of cedar, black

spruce, and tamarack, were frequently seen. Black ash was usually in white cedar swamps. Approximately 50 acres of wetlands were covered.

Forest Road 425 (T57N, R12W, Sec. 31)
65. A 0.5 acre portion of an abandoned drying beaver pond/meadow cut by a small stream about 0.4 mile east of the Whiteface River was examined. Apparently this was a tamarack/spruce swamp and alder/willow swamp before beavers built their dams. The surrounding uplands are balsam fir, quaking aspen, white spruce, paper birch, and red maple. No S. *glomeratum* was found but a large colony of S. *americanum* with S. *chlorocarpum* var. *acaule* measuring nearly 200 ft^2 fringes the edges of the stream and pond.

66. Besides S. *americanum* and S. *chlorocarpum* var. *acaule* other wetland species present include *Bidens cernua, Glyceria grandis, Scirpus cyperinus, Lemna minor, Juncus brevicaudatus, Impatiens capensis, Potamogeton sp., Calamagrostis canadensis, Utricularia sp., Typha latifolia, Epilobium coloratum, Viola sp., Galium tinctorum, Callitriche verna, Scutellaria lateriflora, Carex tenera, Ranunculus pensylvanicus, Lycopus americanus, Mentha arvense, Eupatorium maculatum, Aster puniceus, Scutellaria galericulata, Eleocharis palustris.*

Forest Road 418 (T57N, R12W, Sec. 10,11,15, 21, 22, 28)
67. Eight different wetlands with a combined acreage of about 25 acres were investigated along this unimproved one lane dirt road. S. *glomeratum* was found in only one of these, Wetland # 1 (Fig. 4). Two other wetlands (#3 and #4) had *Sparganium* species other than S. *glomeratum.* Other notable finds along this road are *Eleocharis nitida, Carex flava, Ranunculus flammula,* and *Viola novae-angliae. R., flammula* and C. *fllava* were collected with V. *novae-angliae* at the margins of a shallow pond near Solon Springs, Wisconsin this year (Walton 1702, 1772 DUL).

68. Wetland # 1 is at the headwaters of an intermittent stream that flows west towards the North Branch of the Whiteface River. Despite the culvert a large volume of water is backed up on the east side of the road and a plant community of emergent aquatics, primarily *Equisetum fluviatile* (abundant), *Typha latifolia* (only occasional), *Scirpus cyperinus, Carex psuedocyperus,* and C. *rostrata,* has developed. Thus, the wetland appears to be the result of the forest road. Low woody vegetation rings the pooled water and is in two layers: willows *(Salix serrisima, S. discolor, S. planifolia)* closest to the water and then alders *(Alnus rugosa).* Farther upstream the alders give way to young black ash *(Fraxinus nigra).* Groundlayer species in the alder-ash include seedling *Abies balsamea, Dryopteris spinulosa, Aster puniceus, A. macrophyllum, Eupatorium maculatum, Rubus pubescens, R. strigosus, Glyceria striata, Ribes hudsonianum, R. triste, R. hirtellum, Sphagnum* moss, *Carex leptalea, C. intumescens, Viola renifolia, Calamagrostis canadensis, Impatiens capensis,* and *Caltha palustris. Ribes hudsonianum,* a boreal species, has been found in Wisconsin wetland complexes that support S. *glomeratum* (Walton *pers. observ.).* Upland vegetation is boreal forest of paper birch, quaking aspen and balsam fir.

Lat. 47° 25.245' N
Long. 91° 50.998' W

69. S. *glomeratum is* restricted to a small section of the southwest corner of Wetland # 1 among sedges and water horsetail. Forty-one fruiting stems were seen. Just a few yards away is another *Sparganium* species, S. *minimum. S. minimum,* a species with circumboreal distribution and more common farther north, has been seldom reported from Minnesota.

70. The forest on the west side of the road is quaking aspen, paper birch, and red maple with an understory of black alder, a sharp contrast to the emergent marsh. A stream, which originates in the emergent marsh, flows part way through this forest but the wetlands are more floodplain than a swamp or marsh. S. *chlorocarpum (?)* occurs infrequently along the stream banks. Eventually the stream dries up where it enters a boulder field. Upland forest cover is boreal, quaking aspen, paper birch, balsam fir, white spruce, with some red maple and mountain maple *(Acer spicatum).* The dry stream bed stops at the edge of an old beaver pond. The beaver pond has been long abandoned and most of the water has drained away leaving a meadow dominated by *Scirpus cyperinus.* Various willows (*Salix gracilis, S. discolor*, *S. bebbiana*), all about 5-8 feet high are also very common. The lodge and food caches still remain at the center of the pond where there is standing water about 2-3 feet deep. This water is permanent enough to support large colonies of four *Sparganium* species, *S. chlorocarpum, S. minimum, S.*

angustifolium, and *S. glomeratum*. Other *Sparganium* specimens collected from this pond remain undetermined with some having characteristics of both *S. glomeratum* and *S. chlorocarpum* or *S. angustifolium*.

Lat. 46° 41.288' N
Long. 92° 04.79TW

71. Of the wetlands investigated along FR 418, Wetland # 3 and Wetland # 4 were the only others with any *Sparganium* species. In Wetland #3, a stream flowing through an emergent marsh, I found *S. americanum and S. chlorocarpum* var. *acaule*. Wetland #4 is adjacent to a black spruce swamp and very different from the other wetlands seen along this road. Here I found *S. minimum, S. americanum*, and *S. chlorocarpum* var. *acaule. Sphagnum* moss covers most of Wetland #4. S. minimum grows in small shallow bodies of water in the moss while *S. americanum*, and *S. chlorocarpum* var. *acaule* are present as a few isolated patches in the *Sphagnum*. Alders, willows, *Spiraea alba*, and some young tamarack and black spruce form the woody vegetation. There are small areas of open water with *S. minimum*. Other common species include *Bidens cernua, Aster puniceus, Solidago uliginosa, Typha latifolia, Scirpus cyperinus, Carex rostrata, Equisetum fluviatile, Glyceria grandis, G. canadensis, Dryopteris cristata, D. spinulosa, Potamogeton epihydrus or natans, Utricularia minor* (?), and *Drosera rotundifolia*. A bulldozed area next to Wetland # 4 has filled with water and *Eleocharis nitida, Ranunculus flammula,* end *Carex flava* were found here. Across the road from Wetland # 4 the forest is a mixture of black spruce and quaking aspen and not very wet.

FR 409 (T37N, R10W, Sec. 18)

72. Two wetlands with a combined acreage of about 3 acres were surveyed on this road. The first was a *Scirpus/ Carex* meadow with a thick stand of *Solidago uliginosa*. While it looked promising because of a high species diversity it actually was unsuitable habitat. *Sphagnum* moss was nearly everywhere and there were no standing bodies of water. Upland vegetation consisted of second growth aspen after a clearcut with maturing white spruce and balsam fir in the uncut areas.

73. The second wetland may have *S. glomeratum* in it. This site is a shallow circular pool just off the forest road about 0.3 mile west from HWY 2. Distinct rings of vegetation can be seen from the edges inward. The outside ring is primarily *Calamagrostis canadensis*, next *Scirpus* (probably *S. cyperinus*, all sterile) and *Carex rostrata*, then *Glyceria striata* at the margins of the open water. The water supports *Potamogeton natans (?), Polygonum natans* (?), *Callitriche versa, Utricularia vulgaris*, and *Sium suave*. Upland vegetation was quaking aspen, balsam fir, black spruce, red maple, and paper birch. Three patches of sterile *Sparganium* plants were found in this pool. Since *S. glomeratum* has been found before in pools like this one it is very possible that these sterile plants are *S. glomeratum*, too. It is worth revisiting this small pool to confirm the identity of these plants.

Seven Beaver Trail (T57N, R10W, Sec. 24, 25)

74. No *S. glomeratum* was found here but there were some sterile shoots that may have been *S. glomeratum* were seen along the edge of a large floating wetland community. Total area searched was about 5 acres. Water levels seemed higher than usual after heavy rains. This huge wetland, about 20 acres located on the south side of a massive logging road, appears to have been a large conifer swamp (probably cedar and spruce) that was inundated after the construction of the road. Much of the vegetation is composed of *Carex* spp. now. Beaver dams also contribute to the high water levels but the logging road is by far the more effective dam completely bisecting the swamp. On the south side of the old logging road the vegetation is largely sedges, grasses, and cattails, on the north side forest cover is intact. There were many areas with sterile *Sparganium* shoots emerging from the water but the vegetation mat was unstable making it impossible to walk very far into the wetland to look for flowering or fruiting stems. Wetlands on the north side did not appear to be affected by the logging road and were heavily forested with black spruce, tamarack, and white cedar with some black ash. *Sparganium chlorocarpum* was found among white cedar and black ash opposite the beaver dam. A ditched area along the road did have colonies of *S. angustifolium* that extended partly into to the swamp and the floating marsh. *Carex flava* was seen here, too, in standing water along the road.

75. The special concern species (proposed threatened) Eleocharis nitida occurs in several places along the trail in areas of shallow water and moist sandy soil. All colonies of E. nitida observed were in recently disturbed areas where the competing vegetation and some topsoil had been removed.

Nelson Creek, Breda Creek, Store Creek, Whiteface River

76. Accessible areas were searched for *S. glomeratum* but without success. *Sparganium, fluctuans* was seen in Store Creek (T56N, R12W, nw/nw Sec. 12) and *Sparganium chlorocarpum* was found in a ditched stream that leads into Nelson Creek on County HWY 353 (T56N, R12W, sw/ne and se/nw Sec. 2). *Sparganium chlorocarpum* was also found along Breda Creek (T56N, R12W, se/sw Sec. 1). Sterile plants of *a Sparganium* species were found in a beaver pond built on an unnamed stream (T56N, R 11 W, sw/sw Sec. 6). *Eleocharis nitida* and *Viola novae-angliae* were found on Township Road 6205 (T57N, R12W, sw/sw Sec. 36).

HWY 16 near the Whiteface Campgrounds and Fairbanks

77. Both sites are at the west central edge of the Toimi drumlins. A small population of *S. glomeratum* was discovered in a ditch along HWY 16 (T56N, R14W, Sec. 31, Lat. 47° 22.285' N, Long. 92° 07.104' W.) that was once part of larger wetland about 3/10 of a mile east of FR 417 which leads to the Whiteface Campgrounds. Much of this wetland has been filled in order to provide access to a logging site. Water still flows from it into a stream on the opposite side of the road and some *S. glomeratum* plants were found here, too, growing on Superior National Forest land. The surrounding upland forest is quaking aspen, paper birch, and balsam fir. Principal vegetation in the stream and associated marsh includes *Scirpus cyperinus, Glyceria canadensis, Typha latifolia, Calla palustris*, and *Utricularia intermedia. Scirpus cyperinus* and *Glyceria canadensis* are common in the ditch but there is much open water. Near Fairbanks at the junction of the DM & IR railroad tracks and HWY 16 (T56N, R13W, sw/ne Sec. 1) very robust *S. glomeratum* was found in a ditch running along a black spruce swamp that is part of the Superior National Forest. Associated species noted include *Typha latifolia* and *Cicuta maculata*.

New *S. glomeratum* Sites and Colonies Discovered in the Duluth Area in 1995

Duluth, Hermantown, and Rice Lake

78. Apart from the population on Minnesota Point, which is extirpated, all previously known populations from this area were discovered in 1993 and 1994. They are, in order of discovery, Robin Avenue Wetland Site (Sept. 2, 1993), Trinity Wetland Site (July 10, 1994), Maple Grove Wetland Site (Aug. 12, 1994), Chambersburg Wetland Site (Aug. 22, 1994), Oak Bend Wetland Site (Aug. 26, 1994), and Woodland Wetland Site (Sept. 13, 1994). The Stockholm Road Wetland Site in Rice Lake is about 1.5 miles northwest of Woodland. There are no previous reports of *S. glomeratum* from Hermantown with the nearest populations about 2 miles away in neighboring Duluth.

Potential habitat investigated and results

79. Several promising wetland sites amounting to about 15 acres were searched along Skyline Drive, Hartley Park, Arlington Avenue, Hugo Avenue, Orange Street, the UMD campus, Woodland Avenue, Martin Road, and Haines Road. S. glomeratum and plants like *S. glomeratum* were found at Hartley Park (Duluth), in the vicinity of Martin Road (Rice Lake/Duluth), and also Haines Road (Hermantown). The other sites either had no *Sparganium* or supported species other than *S. glomeratum*.

80. Original vegetation in Duluth was of two kinds: mixed hardwood (maple, basswood, hornbeam with white pine) or aspen/birch/conifer association (Marschner 1930). Most of Duluth's aspen/birch/conifer association no longer exists. The aspen/birch/conifer association in Duluth was continuous with what Finley (1976) described as "boreal forest" in Superior, Wisconsin remnants of which still persist. On their maps both Marschner and Finley list the same species but under different headings. Curtis (1959) also describes the boreal forest as composed of these same species as do Takhtajan (1986), Barbour and Christensen (1993) and Brouillet and Whetstone (1993).

81. Marsohner's map does not report conifer swamps within Duluth's mixed hardwood forests although they are present as small inclusions within them. His map does show extensive conifer swamps in the area of Rice Lake Township, Hermantown, and the Duluth International Airport. Finley also reports conifer swamps in Superior Bay, Superior, Wisconsin. The remaining conifer swamp in Superior Bay differs from those reported on the Duluth side in that it is floating, has a high percentage of bog species (including ericaceous plants and tamarack), and has no cedar or black ash (Walton pens. observ.). Species components listed for the conifer swamps are the same on both Marschner's and Finley's maps. Most of the areas in Duluth mapped as conifer swamps are black ash swamps with some conifers and a high percentage of alders, willows, sedges, and marsh grasses. Whether they were always that way is uncertain. One swamp in Duluth near Oak Bend Drive does appear to be a true conifer swamp with cedar, black spruce and tamarack more common than ash or yellow birch. It also has a thick layer of *Sphagnum* and supports some species of ericaceous plants. At its west end the swamp grades into a shallow pond, while at the east end it grades into black ash swamp. It is in an area mapped by Marschner as "mixed hardwood" which still exists in fragmented form today.

Hartley Park, Duluth (T50N, R14W, nw/se Sec. 11)
82. Several small colonies of *Sparganium* were found in a small area of a 1-2 acre black ash swamp and in a shallow pool but not all of these can be assigned to *S. glomeratum*. Those in a black ash swamp are in heavy shade while those in the pool receive more sunlight from about noon to sunset. The remaining natural forest cover in this part of the park is a mixed hardwoods association: red maple, paper birch, quaking aspen, white cedar, white pine, balsam fir, and sugar maple. Other parts of Hartley Park have been planted with Scot pine (*Pinus sylvestrus*) and red pine (*P. resinosa).*

83. The colonies in the black ash swamp are about 75 ft' and occur in several water-filled depressions and water tracks. The plants were slender, lax, and most were sterile. Those that bore flowers or fruit had an elongate internode between the pistillate and staminate portions of the inflorescence. While mature fruit matches that of *S. glomeratum* other characters of the inflorescence do not. Their determination as *S. glomeratum* cannot be made at this time.

Lat. 46° 49.564' N
Long. 92° 05.429' W

84. The shallow pool (Fig. 5) is very similar to one seen in Clearwater County (Wetland # 1). In the center is a brushy island of *Salix lucida* and other Salix spp. , while along the edges and in the several water channels that cut into the mat are *Sium suave, Glyceria grandis, G. borealis, Iris versicolor, Calls palustris, Scirpus cyperinus*, and *Carex intumescens*. The moat is relatively clear. Both *S. glomeratum* and plants with some characteristics of *S. glomeratum* grow along the margins of the moat and the island.

85. About 250 feet north is Congdon Creek. In the park the creek was dammed by beavers resulting in a huge pond. At the present time it appears that beavers are not active in this portion of the creek. However, a large sedge meadow approximately 20 acres in size has formed on the bed of the pond which is still highly saturated and also partly flooded. Searches at both ends of the pond and in the sedge meadow, likely habitat for *Sparganium*, discovered only a few small patches of *S. chlorocarpum* (?). This is a large beaver meadow, nearly 1/4 mile long, and future searches may eventually turn up populations of *S. glomeratum*. Another pond in the park created by an artificial dam across Tischer Creek is similarly devoid of *S. glomeratum*, but not all habitat was searched.

Martin Road and Rice Lake Road (T51N, R15W, Sec. 25, 36 and T51N, R14W, Sec. 30 and 29)
86. A 1.25 mile section of gasline right-of-way which crosses Martin Road and Rice Lake Road was searched for *S. glomeratum* under contract for Northern Natural Gas company (Walton 1995a). Five colonies of *S. glomeratum*

were found along here. Forest cover along this part of the route is largely quaking aspen, paper birch, balsam poplar, and white spruce with some red maple in wetter areas. A few alder/willow swamps, black ash swamps, marshes, streams, and a beaver pond are also present.

87. About 300 feet south of Martin Road two colonies were found in shallow water under alders and young black ash about 15 feet to the east of the right-of-way. Total area of the two colonies is about 836 ft' but consisted of leafy shoots and one fruiting stem.

88. North of Martin Road two more colonies (Fig. 6) were found within the right-of-way in small marshes dominated by *Typha latifolia*. Associated species included *Calamagrostis canadensis, Glyceria grandis, Carex lacustris,* and *Scirpus cyperinus*. Each colony was in a small, mucky depression measuring 21 ft^2 and 36 ft^2, respectively. While the colonies are not large in size they did have 15 fruiting and 46 fruiting shoots, respectively.

89. Just north of Rice Lake Road a fifth colony with only 4 fruiting stems and no vegetative shoots was found in a large sedge meadow near a black ash swamp with *Carex lacustris, C. stricta, Iris versicolor,* and *Typha latifolia.* Other associated species noted include *Gentiana andrewsii, Aster simplex, Chelone glabra, Eupatorium maculatum, Scirpus cyperinus, S. atrovirens,* and *Calamagrostis canadensis*. A small stream flows about 100 feet south of this patch and harbors a very unusual looking Sparganium chlorocarpum var. acaule.

90. Peculiar plants (Fig. 7) with some characters of *S. glomeratum* were found in a channelized stream that crosses the right of way. Achene color and dimension, style and stigma lengths, and arrangement of pistillate heads are within the range for *S. glomeratum*, but staminate heads are borne on elongate axes up to 2 cm with long internodes and number from 1 to 4.

Near the Duluth International Airport on St. Louis County Highway 4 (T50N, R14W, Sec 8)

91. There is a considerable acreage of black ash and shrub swamp as well as sedge meadows and marshes around the Duluth International Airport. Most of these wetlands are part of the Miller Creek drainage. It seemed that wetlands near the headwaters of Miller Creek might be likely habitat for *Caltha natans* and *S. glomeratum*. *Ranunculus gmelini*i had been previously found in this wetland complex and some moat ponds with shrubby vegetation mats were also seen in here, too. Two areas off of Rice Lake Road near the Duluth International Airport were investigated. The first site was a shallow pond with a thick stand of *Sparganium chlorocarpum* (?). In the center of the pond was a mat *ofAlisma plantago-aquatica, Calla palustris, Scirpus cyperinus, Carex sp. (all sterile), Polygonum sp., Glyceria borealis,* and *Bidens* sp. These species along with *Impatiens capensis, Alnus rugosa*, and *Salix gracilis* were also present along the edges of the pond. *Sparganium chlorocarpum* (?) was found throughout. The surrounding forest was largely second growth quaking aspen.

Latitude: 46° N 50.765'
Longitude 92° W 9.522'

92. The second site is a black ash swamp being used for a trash dump. From Rice Lake Road it is not apparent that wetlands are here but once inside the property it is obvious that a swamp is being filled in not with clean fill, as the sign requests, but trash. As filling proceeds trees are first cut down then covered with soil and building debris. I found about 12 ft' *S. glomeratum* in a small stand of cattails in silty soil with *Typha latifolia, .Scirpus cyperinus, Carex* sp. between the filled area and remaining swamp.

93. More *S. glomeratum* was found in the black ash swamp (Fig. 8 & 9). Three patches measuring 10 ft^2, 10 ft^2, and 15 ft^2 each were in shallow pools among the ash and alders. Shade was fairly heavy and this may be why two of the colonies were completely sterile. Other than *Lemna minor* no other species of vascular plants grew directly in the pools. These species were common in the swamp growing on hummocks and other raised areas: *Carex leptalea, Lycopus* sp., *Aster umbellatus, A. puniceus, Onoclea sensibilis, Dryopteris spinulosa, Calamagrostis canadensis*,

Chelone glabra, Equisetum arvense var. *boreale, Galium* sp., *Viola cuculata*, and *V renifolia*. Woody plants included *Alnus rugosa, Cornus stolonifera, Acer spicatum, Ribes americanum* and *R. hirtellum*.

Latitude: 46° N 50.488'
Longitude 92° W 9.374'

Hermantown (T50N, R15W, se/ne Sec. 13)
94. A shallow emergent marsh on Haines Road, Hermantown was investigated. *S. chlorocarpum* is very abundant in this marsh covering many square feet on nearly all sides. *S. glomeratum*, consisting of about 40 fruiting stems observed, is restricted to a small area of the east side. It appears changes in the recent past have altered water flow in this wetland. There are patches of sedge (mostly *Carex psuedocyperus*) surrounded by a cattails, *Carex lacustris* and similar species, *Glyceria* spp., and other emergent vegetation. Large boulders, apparently natural, are scattered in various places. Muskrat use this marsh extensively creating many channels, maintaining areas of open water and feeding upon a variety of plants including *Sparganium*. The slope of the land and direction of water flow through culverts suggest that this wetland was once more intimately connected with Miller Creek, Duluth's only known population of *Caltha natans*. In fact, the distance separating these two sites is about 0.4 mile.

New *S. glomeratum* Sites and Colonies Discovered in Carlon County

95. *S. glomeratum* was first discovered in Carlton County growing in a roadside ditch along Gilbert Road, Skelton township (T47N, R19W~Sec 2V) m early September 1993 (Walton 1055, DLTL). At that time only one clump of aerial stems was seen with about 40 fruiting stems. Later investigations in 1994 found more *S. glomeratum* in this ditch. The site was revisited several times in 1994 and additional areas in the adjacent wetland were searched for more *S. glomeratum*. While no *S. glomeratum* was discovered two other uncommon species, *Ranunculus gmelinii* var. *hookeri* and *Petasites sagittatus*, were. *R. g.* var. *hookeri* and *P. sagittatus* had been found earlier in 1993 about 3 miles west near the West Fork of the Moose Horn River and constitute new records for Canton County. Their significance is related to the fact that both species have been found growing with or near *S. glomeratum* at several sites in Wisconsin. *R. g.* var. *hookeri* and *P. sagittatus* are frequent along the West Fork of the Moose Horn River in Skelton where wetlands were searched for C. natans and S. glomeratum in 1994 and 1995. A third *S. glomeratum* colony was discovered in 1994 near Blackhoof at a road construction site near a black ash swamp. *S. glomeratum* was reported near Scott's Corner in 1995 (G. Coyer, MDNR), but I have not seen the plants.

96. Original vegetation in the areas of Carlton County included in this survey was reported to be conifer swamp, quaking aspen/birch/conifer, mixed hardwoods (pines and maple and other species besides aspen), and wet prairie in the Skelton-Mahtowa area and conifer swamp, white and red pine, and wet prairie in the Carlton area. (Marschner 1930). Conifer swamps still exist in both areas but there is a high percentage of mature black ash in them. The quaking aspen/birch/conifer associations are still present in the Skelton-Mahtowa area and occur near Carlton, too, but with more large pines. White spruce is common on slate outcrops near Carlton. Wet prairies are described on Marschner's map as being composed of marsh grasses, reeds, and similar plants and also willows and alders. These plant communities still exist in the areas indicated on Marschner's map.

Potential habitat investigated and results
97. Search areas were chosen on one or more of the following criteria: black ash association, beaver ponds, and previous records for R. gmelinii or P. sagittatus. Wetlands on County 3 and HWY 210 just outside of Carlton, at the junction of I-35 North and HWY 45 near Scanlon, County 5, along part of the M. T. Nelson Road, Mahtowa, and along the W. F. of the Moose Horn River in T47N, R19W, Sections 15, 16, and 22 were investigated. Wetlands near HWY 210, HWY 45 near Scanlon, County 5, and the M. T. Nelson Road did not contain any Sparganium species.

County HWY 3 near Carlton (T48N, R16W, nw/nw Sec. 6)
98. Northeastern Carlton County is well known for the Thomson Formation. This formation, which includes slate and graywacke sandstone, comprises the long stone ribs (roches moutonees) protruding from the landscape (Schwartz 1949). In between these ribs are narrow basins with nearly impervious bottoms. Many are filled with

water and have developed wetland communities (Fig 10). This area was chosen because of the many small ponds and isolated wetlands, some with black ash and white cedar, and because of a very old report of *Petasites sagittatus* (Sandberg, June 1891, at MIN). I was unable to locate P. *sagittatus* in any of these wetlands but did discover *Ranunculus gmelinii* var. *hookeri* and *Sparganium glomeratum* growing together in two emergent wetlands. The black ash and white cedar swamps searched did not contain any *Sparganium* species.

1994-1995 Status Survey for Sparganium glomeratum in Minnesota

99. Two rock encased ponds, near the junction of HWY 45 and County 3 and named here as Pond # 1 and Pond #2 (Fig. 10), were investigated. A small patch of S. *glomeratum* (7 fruiting stems) was found with *Ranunculus gmelinii* var. *hookeri.* An unusual group of specimens with some characters of S. *glomeratum* were also found in Pond #2. The infructescence is extremely crowded like that of S. *glomeratum.* It differs in having elongate internodes between the uppermost pistillate inflorescence and lowermost staminate inflorescence. Also, the mature achenes are more rounded at the base of the style. At this time it is not possible assign these to any species. Pond # 1 yielded a county record, S. *minimum,* extending the southern range of this species in Minnesota by about 10 miles from the previous southernmost site in Duluth (Walton 1524 DUL) and 18 miles south of the last southernmost Minnesota site near Island Lake in St. Louis County (Lakela 18820 DUL). Other notable fords include *Viola novae-angliae* which grows on the slate ridge. Muskrat feed on *Sparganium glomeratum* and other *Sparganium* species in these and in the wetland described below.

Lat.46°40.359'N
Long. 92° 25.782' W

100. Across the road from Pond #2 are more slate outcrops with shrub swamp and marshes in between. Plants that could be definitely assigned to *S. glomeratum* were found in a *Typha/Carex* marsh with *Ranunculus gmelinii* var. *hookeri.* The habitat in this marsh consists of shallow, open water divided by mats of sedges, grasses, cattails, and some willows. The substrate is organic and formed from partly decomposed graminoid stems and leaves and parts of other plants. Associated species include *Typha latifolia, Carex rostrata, C. lacustris, Eleocharis palustris, Potentilla palustris, Utricularia vulgaris,* and *Salix gracilis. Botrychium multifidum* and *Viola novae-angliae* were found growing on the slate ridge.

Lat. 46° 40.465' N
Long. 92° 25.598' W

West Fork of the Moose Horn River in Skelton, Carlton County, Minnesota (T47N, R19W, Sec. 15, 16, 22)
101. Two areas in Section 16 were searched. The first was a moist to swampy area with black ash and red maple about 1/4 mile south of the river. Most of the land lacked areas of standing water or highly saturated soil except in a few places where *Saxifraga pensylvanica* and *Chrysosplenium americanum* grew. These areas were still not moist enough to support any *Sparganium* species. The remaining land investigated was a northern hardwoods forest composed of quaking aspen, balsam fir, sugar maple, and paper birch on dark colored, better drained soil that sloped towards the river.

102. To the north of the black ash/red maple and northern hardwoods forests is the West Fork of the Moose Horn River, a shallow, meandering stream about 12 miles long originating in the Fond du Lac State Forest. County 157 (formerly 13) crosses the river three times. It was at the second crossing (Fig. 11) that I headed upstream into a mixture of alder, *Calamagrostis* meadow, and sparse black ash to search for S. *glomeratum* and other *Sparganium* species. I had previously found *Ranunculus gmelinii* var. *hookeri* on the opposite side of the bridge 2 years ago. Most of the upper reaches of the West Fork of the Moose Horn River are home to active beaver colonies. Some dams and ponds are very large indicating a long period of occupancy. In the area I investigated there were 3 large dams within the space of about 1 mile. The banks of the river are cut by numerous channels. The huge expanse of the *Calamagrostis* marsh with sheets of water passing over the soil are more like a grassy river than a meadow. In one of the beaver channels was a colony of S. *glomeratum* growing with *R. g.* var. *hookeri.* There were large beds of another *Sparganium* growing in sloughs with *R. g.* var, *hookeri* and in the river channel. S. *glomeratum* occupied about 20 ft^2 with 13 fruiting stems counted. Lat. 46° 33.515' N, Long. 92° 44.464' W.

103. Parts of section 15 and 22 were searched for S. *glomeratum.* These wetlands along the river are also beaver-influenced and contain a mixture of alder-willow, *CalamagrostislCarex* meadow, black ash, and balsam poplar. Only *S. chlorocarpum* and *S.fluctuans* were found. *R. g.* var. *hookeri* was found in sloughs, on the river bank, and in shallow pools among *Carex.* A small colony of *Petasites sagittatus* was found under willows near the river.

The Significance of Associated Species and the Biogeography of *Sparganium glomeratum*

104. A total of 141 wetland plant species were recorded from habitats where S. *glomeratum* was found in Minnesota and Wisconsin. Of this number 65 are species with boreal or circumboreal distributions (Hulten 1937, Komarov 1968, Tutin 1968, Scoggan 1978, Gleason and Cronquist 1991. Most of these species are frequent to common in wetland habitats throughout Alaska, Canada, northern Minnesota, and elsewhere in the northeastern United States (Gleason and Cronquist 1991). Within this set is a smaller group of species that are at or near their southern limits in Minnesota, Michigan, and Wisconsin (Voss 1972 and 1986, Ownbey and Morley 1991, Gleason and Cronquist 1991). Species in this group include: *Eleocharis nitida, Carex flava, Juncus vaseyi, Petasites sagittatus, Equisetum palustre, Caltha natans, Ranunculus gmelinii, Ribes hudsonianum, Vaccinium vitis-idaea ssp. minus,* and *Sparganium minimum.* Some of these species (E. *nitida, J. vaseyi, P. sagittatus, E. palustre, C. natans, R. gmelinii, Ribes hudsonianum,* and V. *vitis-idaea ssp. minus)* are very rare in Wisconsin being found in a few northern counties (WDNR 1993a and WDNR element occurrence records) where cool climate and wetland conditions prevail (Curtis 1959). While these species (except *E. nitida* and C. *natans)* are more common in Minnesota they are restricted largely to the northern 1/3 of the state (Ownbey and Morley 1991). Elsewhere in the continental United States they are represented by a few isolated occurrences just south of the U. S.-Canadian border (Stevens 1950, Bogle 1968, Barker and Barkley 1977, Seymour 1989) or at high elevations in the Rocky Mountains along with these other boreal and circumboreal species: *Sparganium hyperboreum, Ranunculus pygmaeus, Ranunculus hyperboreus,* and *Ranunculus petafidus* (Benson 1948, Kearney and Peebles 1951). In the United States S. *glomeratum* is only known from Minnesota and Wisconsin where its distribution roughly parallels or is well within the southern range limits of *E. nitida, C. flava, J. vaseyi, P. sagittatus, E. palustre, C. natans, R. gmelinii, V. vitis-idaea ssp. minus,* and S. *minimum.* The distribution of these species is typically sparse although there may be locally large populations. For example, in Superior, Wisconsin the state listed species *Eleocharis nitida, J. vaseyi, P. sagittatus,* and *R. gmelinii* occur with S. *glomeratum* (Fig. 12) and have relatively large populations within a 3 mile^2 area but are scarce elsewhere in the state. While these and other rare boreal and circumboreal species were found near or with S. *glomeratum* in Wisconsin, C. *natans* was not found at all.

105. The distribution of the circumboreal species and that of S *glomeratum* are likewise similar in Asia and Europe (Hulten 1937, Komarov 1968, Tutin 1968, Ohwi 1965). S. *glomeratum is* reported from Hokaido and the mountains of the north central district of Honshu (Ohwi 1965) where *Equisetum palustre, Ranunculus pygmaeus, Iraccinium vitis-idaea ssp. minus,* and *S'parganium hyperboreum* are at or very near their southern limits in Japan. Across northern Asia, Russia, and Scandinavia the distribution of S. *glomeratum* is remarkably similar to and frequently north of the southern limits of *Equisetum palustre, Sparganium hyperboreum, S. minimum, Vaccinium vitis-idaea ssp. vitis-idaea, V. v. ssp. minus, Caltha nadans, Ranunculus gmelinii, R. pygmaeus, R. hyperboreus,* and *R. petafidus* (Komarov 1968) and the genus *Petasites* (roman 1972).

106. The peculiar distribution pattern of S. *glomeratum* with this smaller group of boreal and circumboreal species is strong evidence that it is a species native to North America requiring conditions similar to those same species. Variations in the distribution patterns observed are probably the result of local and regional extinctions during the ice age and differential rates of recolonization from refugia into the new landscape at the end of the ice age (Hulten 1937, Daubenmire 1978, Larsen 1982).

107. Many wetlands searched in northern Minnesota and northwest Wisconsin did not contain *S. glomeratum* and frequently did not have any *Sparganium* species. Very often there was little difference in species composition between wetlands with and wetlands without *S. glomeratum*. One Superior wetland with substantial colonies of *Petasites sagittatus* and *Ranunculus gmelinii*, open bodies of shallow water, active muskrat, and recently active beaver populations had only 2 very small clumps of *S. chlorocarpum* and no *S. glomeratum* (Monson and Walton

1995). This wetland is approximately 20 acres and is within 2 miles of several populations of *S. glomeratum*. It is difficult to understand why this wetland which is like others in Superior barely supports any *Sparganium* species at all. Not only are species components similar, but is has areas of shallow open water which would be attractive to waterfowl that might disperse *Sparganium* seeds. There are also deer trails running through this wetland that could serve as dispersal routes for *Sparganium* seeds. Small wetlands in Superior could also be devoid of *S. glomeratum,* too. These wetlands, all floating marshes with Typha and emergent graminoids and some very close to known populations of *S. glomeratum*, appeared to be suitable habitat with essentially the same associated species yet S. glomeratum was not present (Monson and Walton 1995, Walton 1995b).

108. Similar situations appeared in Minnesota near known populations in Blackhoof and Skelton. Black ash swamps, beaver ponds, and ephemeral pools with a variety of the usual associated species had no *Sparganium* species present. Seventeen wetlands were investigated along Anchor Hill Road in Clearwater County yet only 7 of them supported *S. glomeratum*. Three of the wetlands had other *Sparganium* species. Most of the Anchor Hill Road wetlands were very similar to one another in terms of habitat and associated species.

109. The presence of particular species, even boreal and circumboreal species, does not mean S glomeratum will also be found in the same wetland. It is probably more true that their presence is indicative of suitable conditions within that wetland and possibly elsewhere in the local geographic area. In the case of Superior, Wisconsin, the existing wetlands are also no longer contiguous, having been broken up into many fragments by railroad beds, streets, and other human activities. Thus, the observed absence of *S. glomeratum* and other *Sparganium* species from so many apparently suitable sites may be partly related to disturbance and degradation of the habitat.

Fossil Evidence and the Native Status of *Sparganium glomeratum*

110. Seven shallow wetlands in Carlton County, Duluth, MN, and Superior, WI were cored to a depth of about 0.5 meters to search for subfossil remains of *S glomeratum*. Wetlands with and without living *S glomeratum* present were cored. To date no *Sparganium* seeds or fruit have been recovered from cores taken at these sites. Peat layers were not deep and possibly fire has kept peat from accumulating. The locations of the Minnesota wetlands were within the boundaries of severe fires that occurred earlier in this century. Because these wetlands are shallow, periodically drying out in mid-summer, it is also possible that seeds and other remains of *S. glomeratum* decayed. It is interesting that seeds of other plant species, more abundant in these wetlands than *S glomeratum*, were also absent except on the surface layer. Silicaceous remains of diatoms, chitinous skins of crustaceans, and pollen were abundantly present in the soil samples, collected in Duluth. Cores taken at other wetlands with more constant water levels such as those in Clearwater County and possibly at certain sites in Carlton County might produce subfossil seed and fruit remains of *S. glomeratum* and other plant species. Peat deposits under floating cattail and sedge marshes in Superior, Wisconsin might similarly yield subfossil seeds and fruit of *S. glomeratum*.

111. Seeds of *S. glomeratum* and two other **Sparganium** species, *S. chlorocarpum* and *S. eurycarpum*, have been recovered from glacial deposits estimated to be 60,000 years old in northwestern Minnesota (Rosendahl 1943). The list of plants recovered from this site is very similar to species lists for many existing *S. glomeratum* sites, both uplands and lowlands, in Minnesota. The plant remains indicate a cool climate that favored a mixed coniferous/hardwood forest of white spruce, birch, tamarack, and balsam fir, near shallow wetlands with areas of open water. This is not unlike some places in Clearwater County and in the Toimi drumlins in Lake and St. Louis counties today. Subfossil remains of other *Sparganium* species have been recovered from Pleistocene deposits elsewhere in Minnesota and associated plant remains also suggest a cool coniferous/hardwood forest near shallow wetlands (Fries et al. 1961, Wright et al. 1969).

Population density at sites and the distribution of *S. glomeratum* across Minnesota and Wisconsin

Distribution

112. The presently known distribution of *S. glomeratum* across Minnesota and Wisconsin is shown on Map 5. As shown on the map it appears that *S. glomeratum* is a plant found in wetland habitats found within the northern coniferous forest. This forest type contains many elements of the boreal forest, which it gradually grades into farther north. The boreal forest is defined by a particular set of tree species including white spruce, balsam fir, paper birch, and quaking aspen. Swampy areas of the boreal forest include to some degree the previous species but typically include tamarack, black spruce, and white cedar, sometimes black ash. White pine and red pine are more frequent components at the southern edge of the boreal forest (Curbs 1959).

Population Sizes

Clearwater County

113. *S. glomeratum* was found in 7 different wetlands in Clearwater County. Individual wetlands varied in size but populations of *S. glomeratum* were small, ranging from 9 to 108 fruiting stems, regardless of wetland size. The latter was in a wetland (#36) estimated to be 3 acres with 110 ft^2 of S. glomeratum located in a shallow channel on the west side and nowhere else in this wetland.

Northern St. Louis County

114. At T60N, R19W, Sec. 3,4, 9,10 near the *Polemonium occidentale* site we observed 119 fruiting stems of *S. glomeratum* and numerous sterile shoots, some of which might belong to *S. chlorocarpum* and *S. angustifolium* which were also seen here, within an area of about 2 acres. At the *Caltha natans* sites (T60N, R19W, sw Sec. 4) *S. glomeratum* occurred as 5 small patches totaling to 49 fruiting stems. On Forest Road 276 (T60N R20W, Sec. 7) the total *S. glomeratum* consisted of 12 fruiting stems in an area of about 15 ft^2.

Southern St. Louis County

115. Between 1993 and 1995 10 sites were discovered in southern St. Louis County. Many of these are in Duluth in wetland habitats that have been disturbed to some degree by human activities. Vegetation in these wetlands is largely native. Water quality is probably altered to a degree by runoff from roads. Wetland sites in Duluth are named after the nearest street or road that goes by them. Duluth sites are listed first, then Hermantown, Rice Lake, and Twig.

116. At the Trinity Wetland Site in Duluth, there are approximately 7 acres of forested, shrub, and shallow emergent marsh wetlands with an estimated 50 ft^2 of *S. glomeratum* and other *Sparganium* species present. The Chambersburg Wetland Site, with about 3 acres of black spruce, black ash, and ephemeral pool wetlands, has an estimated 18-22 ft^2 of *S. glomeratum* present (Fig. 13). Fifty-eight flowering and fruiting stems were counted in 1994. At the Robin Ave. Wetland Site, an ephemeral pool measuring 50 feet across, *S. glomeratum* covers about 4 ft^2 and has produced 2 fruiting stems for the last 3 years. The Maple Grove Wetland Site is about 4 acres and contains forested, shrub, and shallow emergent marsh wetlands. Here *S. glomeratum* occupies a larger area, about 500 ft^2, but is sparsely distributed within it with 30 flowering and fruiting shoots and about 300 sterile shoots. At the Woodland Wetland Site *S. glomeratum* is in a shallow pool created when a marshy area was excavated several years ago. There were 31 fruiting stems in an area of about 10 ft^2 in 1994. At the Oak Bend Wetland Site *S. glomeratum* is confined to a few square feet of the pond's edge and also in a shallow depression about 200 ft^2 which is cutoff from the rest of the pond. The Hartley Park Wetland Site has about 50 acres of available habitat but only about 125 ft^2 is occupied by *S. glomeratum*

117. Populations of *S. glomeratum* in Rice Lake Township are found near Stockholm Road and along a section of gas pipeline right of way between Martin Road and Rice Lake Road. The Stockholm Road Wetland Site had 13 fruiting and 40 sterile shoots at one end of a 40 foot long shallow pool. Between Martin Road and Rice Lake Road

are 5 colonies measuring 66 ft^2, 750 ft^2, 21 ft^2, 36 ft^2, and 2 ft^2. The first 2 colonies were composed almost entirely of vegetative shoots in shallow meandering water tracks in an alder swamp. The next 2 were found in small, isolated shallow marshes and had 15 and 4 fruiting stems. The latter was in a large wetland complex of several acres.

118. In Hetrnantown *S. glomeratum* was found in shallow emergent marsh approximately 1.5 acres. While *S. chlorocarpum* was fairly abundant throughout, *S. glomeratum* was not. It was confined to a small strip on the east side with about 40 fruiting stems observed.

119. At the Twig Site, *S. glomeralum* is confined to the stream exiting the beaver pond and to shallow channels on the east side of the pond between the vegetation mat and the adjoining woods. The wetland is about 6 acres but S. glomeratum is sparsely distributed in less than 1000 ft^2.

Toimi area

120. All colonies found here were small even those in large wetlands. Estimates of size are 41 and 6 fruiting stems at the two wetlands on FR 418, 20 fruiting stems at the colony near Whiteface Campground, and 30 fruiting stems at the colony near Fairbanks.

Carlton County

121. Populations on Gilbert Road are about 25 ft^2 collectively. At Blackhoof 87 fruiting stems of *S. glomeratum* were found in about 200 ft^2. In Skelton by the West Fork of the Moose Horn River there are 13 fruiting stems in 20 ft^2 out of one square mile of wetland investigated. In Carlton 27 fruiting stems were counted in 2 wetlands. The area covered was about 100 ft^2.

Wisconsin

122. Sixteen colonies of *S. glomeratum* were found in Wisconsin in 1995 in addition to 5 others found in 1993 and 1994. In Superior there are 7 colonies of *S. glomeratum* measuring 3 ft^2, 25 ft^2, 10 ft^2, 25 ft^2, 32 ft^2, 4 ft^2, and 3 ft^2. Another small population (size not known) is found in the Superior Municipal Forest. All but 2 of the populations in Superior are confined to about 1,600 acres of remnant, highly disturbed wetland fragments between railroad rights-of-way in a 5.5 square mile area (Monson and Walton 1995). Of this 1,600 acres of wetland about 100 acres or 6.5% are suitable habitat with only 102 ft^2 known to have S. glomeratum. In Parkland (Fig. 14) two colonies were found measuring 14 ft^2 and 15 ft^2 in beaver ponds along a 0.9 mile long stream with about 110 acres of wetland habitat. Five colonies were found along US HWY 53 between Minong and Gordon, Wisconsin during a rare plant survey in 1994 and 1995 (Barton-Aschman Associates 1995). There are 3 separate colonies at the Minong site in a huge wetland complex that extends over many miles. The amount of wetland habitat that was surveyed here is over 100 acres within the proposed 27 mile right-of-way between Minong and Solon Springs.

123. Of the populations observed at 15 sites since 1993 it was found that *S. glomeratum* rarely forms dense stands and rarely occupies large areas. Colony size did not seem to be entirely dependent on wetland size or remoteness from human activities. Large and small wetlands could have one to several small patches that cover less than 200 ft^2. Remote habitat could have a few small colonies scattered over a large area. Sometimes *S. glomeratum* forms large stands as the one seen near Gordon, Wisconsin (Walton 1764 DUL) which was about 324 ft^2 in an isolated, shallow ephemeral pool or the colony of sterile shoots near the Martin Road in Duluth, Minnesota which was 750 ft^2. But these are rare exceptions. Other *Sparganium* species, such as *S. eurycarpum* and *S. americanum*, normally form large, dense stands. *S. eurycarpum* is a dominant species for many miles in the shoreline marshes along the St. Louis and Pokegama Rivers. *S. americanum* was observed in dense, large stands on Shell Creek in Wisconsin and in artificial ponds with *S. androcladum* in Parkland, Wisconsin (Walton pens. observ.). A stand of *S. americanum* measuring nearly 0.25 acre was seen near Twig, Minnesota while S. glomeratum barely occupied 1000 ft^2. Species such as *S. minimum, S. angustifolium*, and *S. chlorocarpum* sometimes have been observed forming large stands (Cook and Nicholls 1986).

Disturbance Characteristics of *S. glomeratum* habitat

124. Disturbance to habitat is observed at all *S. glomeratum* sites. In many cases, even in remote locations, it is human generated but it is possible in urban areas to witness disturbance generated by animal activities or weather. Human disturbances are wetland ditching, impediments to water flow caused by roadbeds, and filling of wetlands. Natural disturbances produced by the activities of animals include beaver impoundments and channels, muskrat channels, and herbivory. Weather can disturb habitat by uprooting trees to create pools of water, or when too much or too little rain falls changing water levels in the wetland.

125. How dependent *S. glomeratum* is upon disturbance to its habitat in order to establish and maintain populations cannot be addressed without life history studies. *S. glomeratum* has been found in 6 ditches constructed along or in wetland habitats. It was also found in one artificial pool created when a sedge marsh was excavated (Walton 1994a). Twelve artificial shallow ponds in emergent wetland communities in Parkland, Wisconsin (Monson and Walton 1995), 4 artificial ponds in Duluth, Minnesota, and several miles of ditches in both states were searched for *S. glomeratum*. All searches were fruitless. The Parkland ponds were very interesting because they contained 4 other species of *Sparganium* and because they were within 0.5 mile or less of a beaver-influenced stream which supported these species plus *S. glomeratum* (Monson and Walton 1995). Ponds and ditches in Duluth were also close to known populations, often within 1 mile.

126. *S. glomeratum* was observed in a number of different habitats that may be broadly classed as emergent marshes, forested swamps, shrub swamps, pools, moats, streams, and beaver ponds/channels/meadows, and also in ditches. Disturbances seen in these various wetland types are described below.

1) Emergent marshes
These may be *Typha* marshes, sedge marshes, and Cyperaceae/Poaceae dominated marshes, floating or not floating. Disturbances seen include predation of *Sparganium* by muskrats and other herbivores, possibly voles. Muskrats also create small pools and other open areas where *Sparganium* may grow. Some emergent marshes are disturbance communities that resulted after forested wetlands were flooded by changes in drainage caused by roadbeds or beaver dams.

2) Forested swamps
Included here are only those forested swamps where the dominant tree species are alive. Tree cover may be coniferous or hardwood or a combination of both. Black ash swamps in the Duluth area have experienced the most disturbance which consists of logging, filling, reduction of upland watersheds, and pollution from salty runoff. In Biwabik, Minnesota disturbance to habitat occurred when spruce trees where uprooted and the space left behind filled with water. Other natural disturbances are seasonal fluctuations in water level.

3) Shrub swamps
The dominant species are alder and/or willow. Some alder swamps observed during the Status Survey appear to be regenerating black ash swamps, but the trees are mostly shorter than the surrounding vegetation. These alder swamps may represent a disturbance community which developed after trees had been removed. Depending on where they are located, willow swamps may be disturbed by floods or beavers. Willow swamps can also be disturbance communities that resulted after tree cover was removed or when water levels changed in a wetland.

4) Pools
This habitat category includes only isolated ephemeral pools without islands of vegetation. Excluding previous human activities on the landscape the disturbance here is natural consisting of fluctuating water levels. There is evidence from one pool that deer eat *S. glomeratum* seed heads and leaves.

5) Moats
Any pool or pond with either a floating or anchored island of vegetation is a moat. The island may be composed of

Sphagnum and other bog species, willow, or graminoid-type plants. Typically, *S. glomeratum* is not growing on the island but along its edges or the mainland edge of the moat. Some moat habitats have fluctuating water levels or beaver channels, both natural disturbances. Human disturbance to moat habitat in Clearwater County consisted of the single lane logging road that cut off small portions of wetland. Interestingly, *S. glomeratum* was not found in these fragments.

6) Streams
Fluctuating water levels and periods of rapid flow are a major disturbance. Beavers can dramatically alter the flow of water in small streams and rivers. Their dam building activities and the resulting floods create new habitat for *Sparganium* species.

7) Beaver ponds/channels/meadows
Beaver ponds are disturbance communities that may remain stable for long periods of time. Many beaver ponds have a variety of microhabitats where various *Sparganium* species may grow. Muskrats may also be active in these habitats. Disturbance consists of channel maintenance and predation on rhizomes by these aquatic rodents.

8) Ditches
Ditches are similar to moats and beaver channels. One "ditch" is actually an artificial pool constructed when a shallow sedge marsh was excavated. Other ditches include ditched streams that run parallel to roads. The ditch itself is a disturbance but other disturbances occur in the ditch such as fluctuating water levels, predation by herbivores (muskrats and deer), and periodic clearing. Other species of *Sparganium* have been reported from ditches (Cook and Nicholls 1986) and I observed *S. chlorocarpum, S. angustifolium*, and *S. americanum* in ditches in northern St. Louis County.

List of *Sparganium glomeratum* collections for 1995

127. Eight new Minnesota sites for *Sparganium glomeratum* were found this year adding to the previous known number of 8 for a total of 16. In several cases at some sites two or more small groups of plants were found. Such groups of plants were usually separated by slight changes in the microtopography. Five new sites were discovered in Wisconsin as a result of other rare plant survey work, bringing the total to 6 sites in the state of Wisconsin. Additional colonies were found in Superior near previously known populations (Monson and Walton 1995, E. Judziewicz and D. Spuhler, WDNR, pens. comm.)

1995 Minnesota Collections of *Sparganium glomeratum* Laest., Collector G. B. Walton

1675 June 24, 1995
Location: T47N, R18W, ne/nw Sec. 30 , Barnum, Carlton County, MN.
Habitat: Shallow water at edge of beaver dam.
Associated species: *Calamagrostis canadensis* and other grasses with sedges, willows.

1676 June 24, 1995
Location: T47N, R18W, nw/nw Sec.30, Barnum, Carlton County, MN.
Habitat: In ditch leading from beaver pond.
Associated species: *Phalaris arundinacea, Calamagrostis canadensis, Salix* spp.

1712 July 1, 1995
Location: T51N, R14W, se/ne Sec. 28, Stockholm Road, Rice Lake Township, St. Louis County, MN.
Habitat: Shallow water track in black ash swamp.
Associated species: *Sphagnum* spp., *Sparganium chlorocarpum, Carex stipata, C. diandra, C. tenera, C. tuckermani*.

1721 July 1, 1995
Location: T50N, R14W, ne/ne Sec. 20, Maple Grove Road, Duluth, St. Louis County, MN.
Habitat: In shallow water of a flooded black ash swamp replaced by *Calamagrostis canadensis*. Over 30 flowering and fruiting stems with about 300 vegetative shoots. Associated species: *Calamagrostis canadensis, Eleocharis palustris, Calla palustris, Bidens* spp., *Aster* spp., *Salix* spp.

1741 July 21, 1995
Location: T57N, R14W, sw/se Sec. 33, along HWY 16, St. Louis County, MN about 2/10 mile east from entry to Whiteface Campground, Lat 47° 22.285' N, Long. 92° 07.104' W.
Habitat: A large ditch, almost like a pool, along the roadside, partly filled by gravel from recently constructed log landing. 20 flowering and fruiting plants in an area measuring 50 ft^2.
Associated species*: Scirpus cyperinus, Glyceria canadensis*.

1754 July 23, 1995
Location: T50N, R14W, sw/sw Sec. 11, Hartley Park, Duluth, St. Louis County, MN, Lat. 46° 49.564' N, Long. 92° 05.429 W.
Habitat: Shallow water-filled depressions in black ash/white cedar swamp.
Associated species: *Carex intumescens, C. psuedocyperus, Calla palustris, Sium suave*.

1778 July 29, 1995
Location: T50N, R14W, nw/nw Sec. 8, Rice Lake Road, Duluth, St. Louis County, MN, Lat. 46° 50.488' N, Long. 92° 09.374' W.
Habitat: Among cattails between black ash swamp and edge of encroaching landfill. About 12 ft^2 of area occupied.
Associated species: *Typha latifolia, Scirpus cyperinus*.

1779 July 29,1995
Location: T50N, R14W, sw/sw Sec. 11, Hartley Park, Duluth, St. Louis County, MN, Lat. 46° 49.564' N, Long. 92° 05.429' W.
Habitat: Shallow pools in black ash swamp, very shaded.
Associated species: *Lemma minor* common in the water.

1780 July 30, 1995
Location: T50N, R14W, ne/ne Sec. 19, Trinity Road, Duluth, St. Louis County, MN, Lat. 46° 48.238 N', Long. 92° 09.299' W.
Habitat: Ditch along side of road, but apparently receives water from some other source, possibly once connected with pool at the base of a nearby rock outcrop. About 75 flowering and fruiting stems with numerous sterile shoots along a 120 foot stretch.
Associated species: *Typha latifolia, Potamogeton, Polygonum, Impatiens capensis, Onoclea sensibilis, Equisetum Fluviatile, Carex* spp., *Juncus* sp., *Eleocharis palustris, Lemna minor*.

1781 July 30, 1995
Location: T50N, R14W, sw/sw Sec. 20, Trinity Road, Duluth, St. Louis County, MN, Lat. 46° 47.012' N, Long. 92° 09.081' W.
Habitat: In shallow water of trail recently bulldozed through a black ash swamp. Other colonies present in undisturbed areas of same swamp.
Associated species: *Alisma plantago-aquatica, Iris versicolor, Potamogeton* sp., *Juncus* sp., *Eleocharis* sp.

1783 July 30, 1995
Location: T50N, R14W, sw/sw Sec. 20, Trinity Road, Duluth, St. Louis County, MN, Lat. 46° 47.987 N, Long. 92° 09.138' W.
Habitat: Shallow pool between maple/basswood uplands and black ash swamp.
Associated species: *Sparganium chlorocarpum, Utricularia vulgaris, Potamogeton obtusifolius, Salix lucida.*

1786 Aug. 2, 1995
Location: T5 IN, R15W, ne/ne Sec. 36, St. Louis County, MN, in an alder/willow swamp on the east side of the Northern Natural Gas right-of-way about 300 feet south from the west side of Martin Road.
Habitat: Shallow water in alder/willow swamp succeeding to black ash.
Associated species: *Sphagnum* spp., Typha latifolia, *Alnus rugosa, Calamagrostis canadensis, Carex lacustris, C. comosa, C. diandra, C. leptalea, Calla palusiris, Fraxinus nigra, Acer rubrum, Salix discolor, S. lucida, Lemna minor, Onoclea sensibilis, Dryopteris intermedia, Viola cucullata, V. macloskeyi, Bidens* sp., *Aster puniceus, Sium suave, Smilicina trifolia.*

1787 Aug. 3, 1995
Location: T5 IN, R14W, se/sw Sec. 30, St. Louis County, MN, in the Northern Natural Gas right-of-way.
Habitat: Small shallow marsh, isolated from other wetlands.
Associated species*: Typha latifolia, Glyceria grandis, Scirpus cyperinus, S. airovirens, Carex lacustris, Calamagrostis canadensis.*

1788 Aug. 3, 1995
Location: T51N, R14W, se/sw Sec. 30, St. Louis County, MN, in the Northern Natural Gas right-of-way.
Habitat: Small shallow marsh, isolated from other wetlands.
Associated species: *Typha latifolia, Glyceria grandis, Scirpus cyperinus, S. atrovirens, Carex lacustris, Calamagrostis canadensis.*

1796 and 1798 Aug. 5, 1995
Location: T60N, R19W, Sec. 10, St. Louis County, MN.
Habitat: Among sedges on mudflats of old beaver pond.
Associated species: *Carex* spp., *Epilobium leptophyllum, Eleocharis p*alustris, *Campanula uliginosa, Scutellaria* sp., *Callitriche verna, Eupatorium maculatum*.

1810 Aug. 7, 1995
Location: Wetland # 1, T143N, R37W, Sec. 28, Anchor Hill Road, Clearwater County, MN.
Habitat: Shallow pool with floating island of Salix spp.
Associated species: *Salix gracilis, Salix* spp., *Glyceria striata, G. grandis, Sium suave, Typha lahfolia, Potentilla palustris, Carex lacustris, Carex* spp., *Bidens* spp., *Sparganium* sp. (sterile shoots), *Potamogeton* sp., some *Lemna minor, Utricularia sp., Lemna minor, Glyceria grandis, Bidens* sp*., Scirpus cyperinus, Carex lacustris, Iris versicolor, Lysimachia thyrsiflora, Lycopus* sp., *Scutellaria sp., Impatiens capensis*, Potentilla palustris, Ranunculus pensylvanicus.

1813 Aug. 7, 1995
Location: Wetland # 8, T143N, R37W, Sec. 22, Anchor Hill Road, Clearwater County, MN.
Habitat: A Typha/Carex marsh in mixed white-red pine/spruce-fir/aspen-birch forest.
Associated species: *Typha latifolia, Carex lacustris, Calla palustris, Lemna trisulca, Utricularia minor*, and at the edges, *Alnus ragosa.* Some *Larix laricina* and *Fraxinus n*igra.

1816 Aug. 7, 1995
Location: Wetland # 13, T 143N, R37W, se/nw Sec. 23,, Anchor Hill Road, Clearwater County, MN.
Habitat: Moat pond surrounding a floating vegetation mat of Alnus rugosa, Carex spp., Salix sp.
Associated species: *Alnus rugosa, Carex lasiocarpa, C. lacustris, .Salix* sp., *Sium suave,* and *Epilobium leptophyllum,* Potentilla palustrts, *Bidens s*pp., and *Utricularia vulgaris*.

1817 Aug. 7, 1995
Location: Wetland # 36, T143N, R37W, se/nw Sec. 14, Anchor Hill Road, Clearwater County, MN.
Habitat: 2-3 acre floating mat of *Carex lacustris, C. lasiocarpa*, and *Typha latifolia* ringed by a narrow, shallow moat. Associated species: *Carex lacustris, C. lasiocarpa, Typha latifolia, Lemna minor, Cicuta bulbafera, Sium suave, Bidens frondosa,* and *Utricularia minor*.

1837 Aug. 19, 1995
Location: T56N, R13W, nw/ne Sec. 1, intersection of DM & IR railroad tracks and HWY 16, Fairbanks, MN.
Habitat: Ditch between black spruce swamp forest and road.
Associated species: *Typha latifolia, Cicuta maculata*.

1843 Aug. 20, 1995
Location: T50N, R14W, sw/sw Sec. 11, Hartley Park, Duluth, St. Louis County, MN. Lat. 46° 49.564' N, Long. 92° 05.429' W.
Habitat: Shallow pool with island of *Salix* spp.
Associated species*: Salix lucida* and other *Salix* spp., *Sium suave, Glyceria grandis, G. borealis, Iris versicolor, Calla palustris, Scirpus cyperinus,* and *Carex intumescens.*

1854 Aug. 26, 1995
Location: Forest Road 418, T57N, R12W, se/sw Sec. 15, St. Louis County, MN, Lat. 47° 25.245' N, Long. 91° 51.998' W.
Habitat: Emergent wetland.
Associated species: *Equtsetum,/luviatile, Typha latifolia* (only occasional), *Scirpus cyperinus, Carex psuedocyperus,* and *C. rostrata, Salix serissima, S. discolor, S. planifolia*, and *Alnus rugosa.*

#1870 Aug.26, 1995
Location: T56N, R13W, nw/ne Sec. 1, intersection of DM & IR railroad tracks and HWY 16, Fairbanks, St. Louis County, MN.
Habitat: Ditch between black spruce swamp forest and road.
Associated species: *Typha latifolia, Cicuta maculata.*

1871 Aug. 26, 1995
Location: T57N, R14W, sw/se Sec. 33, along HWY 16, St. Louis County, MN about 2/10 mile east from entry to Whiteface Campground, Lat. 47° 22.285' N, Long. 92° 07.104' W.
Habitat: A large ditch, almost like a pool, along the roadside, partly filled by gravel from recently constructed log landing.
Associated species: *Scirpus cyperinus, Glyceria canadensis.*

1882 Sept. 2, 1995
Location: T57N, R12W, ne/ne Sec. 21, FR 418, St. Louis County, MN, Lat. 46° 41.288' N, Long. 92° 04.797 W.
Habitat: Old beaver pond.
Associated species: *Sparganium minimum, S. angustifolium, S. chlorocarpum, Callitriche verna, Carex* spp., *Scirpus cyperinus.*

1890 Sept. 2, 1995
Location: T56N, R14W, sw/se Sec. 33, along HWY 16, St. Louis County, MN about 2/10 mile east from entry to Whiteface Campground, Lat. 47° 22.285' N, Long. 92° 07.104' W.
Habitat: A large ditch, almost like a pool, along the roadside, partly filled by gravel from recently constructed log landing. Associated species: *Scirpus cyperirnus, Glyceria canadensis.*

1910 Sept. 16, 1995
Location: T47N, R19W, ne/ne Sec. 16, W. F. of the Moose Horn River, Skelton, Carlton County, MN, Lat. 46° 33.515' N
Long. 92° 44.464' W.
Habitat: Beaver channel in willow swamp.
Associated species: *Ranunculus gmelinii, Calamagrostis candensis, Salix gracilis, S. discolor, Glyceria grandis.*

#1915 Sept. 20, 1995
Location: T50N, R13W, se/ne Sec. 13, Hermantown, St. Louis County, MN.
Habitat: Shallow emergent marsh.
Associated species: *Calamagrostis canadettsis, Carex lacustris, C. psuedocyperus, C. comosa, Typha latifolia, Calla palustris.*

1918 Sept. 22, 1995
Location: T48N, R17W, Sec. 1, County HWY 3, Carlton, Carlton County, MN, Lat. 46° 40.359' N, Long. 92° 25.782' W. Habitat: Shallow marsh with areas of open water, organic substrate of partly decomposed herbaceous plant matter deposited in trough of slate and graywacke bedrock. Muskrat use marsh and are feeding on *Sparganium* plants.
Associated species: *Sparganium chlorocarpum, Typha latifolia, Calamagrostis canadensis, Carex psuedocyperus, Glyceria grandis, G. candensis, Bidens cernua, B. frondosa, Ranunculus gmelinii, Cicuta bulbifera, Utricularia vulgaris, Spiraea alba, Epilobium leptophyllum. Viola novae-angliae* growing on slate ridge.
1924 Sept. 23, 1995
Location: T47N, R17W; sw/se Sec. 30, Blackhoof, Carlton County, MN, Lat. 460 31.163' N, Long. 920 32.171' W.

Habitat: Formerly a shallow ditch along a black ash swamp. Now the ditch is nearly filled in after road construction.
Associated species: *Bidens cernua, B. frondosa, Gnaphalium uliginosum, Spergularia rubra, Typha latifolia.*

1964 Oct. 15, 1995.
Location: T48N, R17W, Sec. 1, County HWY 3, Carlton, Carlton County, MN, Lat. 46° 40.465' N, Long. 92° 25.598' W. Habitat: *Typha/Carex* marsh with areas of shallow open water, organic substrate of partly decomposed herbaceous plant matter deposited in trough of slate and graywacke bedrock. Muskrat seem to prefer *Sparganium glomeratum* and *Carex lacustris* rhizomes over *Typha* rhizomes in this marsh.
Associated species: *Carex lacustris, Typha latifolia, Salix spp., Potentilla palustris, Utricularia vulgaris, Eleocharis palustris, Ranunculus gmelinii. Botrychium multifidum* and *Viola novae-angliae* growing on slate ridge.

1995 Wisconsin Collections of *Sparganium glomeratum* Laest., Collector G. B. Walton

1752 July 23, 1995
Location: T49N, R14W, se/nw Sec 26., Superior, Douglas County, WI.
Habitat: Sedge marsh of *Carex lacustris* and *C. buxbaumii* and shrub swamp of *Salix* spp. and *Alnus rugosa* near forested wetland of quaking aspen and paper birch. Fine textured organic soil over red clay, full sun, standing water about 1 foot deep.
Associated species: *Carex lacustris, C. huxbaumii, C. paupercula, C. aurea, Eriophorum angustifolium, Scirpus validus, S. atrovirens, Eleocharis obtusa, E. acicularis, E. nitida, Calamagrostis canadensis, Beckmannia syzigachne, Glyceria grandis, Juncus vaseyi, J. effusus, J. dudleyi, J. brevicaudatus, Potamogeton obtusifolius, Salix gracilis, S. discolor, S. serissima, S. lucida, Alnus rugosa.*

1756 July 25, 1995
Location: T42N, R12W, ne/ne/se Sec. 11, on west side of HWY 53, Washburn County, WI.
Habitat: Flooded conifer/hardwood swamp, now a floating cattail marsh. Grades back into conifer/hardwood swamp. Associated species: *Equisetum fluviatile, Thelypteris palustris, Osmunda regalis, Typha latifolia, Calla palustris, Potentilla palustrts, Alnus rugosa, Salix gracilis, Iris versicolor, Carex lacustris, Utricularia minor, Lysimachia thyrsiflora, Polygonum sagittatum.*

1758 July 25, 1995
Location: T42N, R12W, se/ne/se Sec. 11, on west side of HWY 53, Washburn County, WI.
Habitat: Flooded conifer/hardwood swamp, now a floating cattail marsh. Grades back into conifer/hardwood swamp.
Associated species: *Equisetum fluviatile, Thelypteris palustris, Osmunda regalis, Typha lahfolia, Calla palustris, Potentilla palustris, Alnus rugosa, Salix gracilis, Iris versicolor, Carex lacustris, Utricularia minor, Lysimachia thyrsiflora, Polygonum sagittatum.*

1759 July 25, 1995
Location: T42N, R12W, sw/nw/sw Sec. 12, on west side of HWY 53, Washburn County, WI
Habitat: *Carex lacustris* marsh adjacent to where # 1756 collected.
Associated species: *Carex lacustris, Salix* spp.

1761 July 25, 1995
Location: T43N, R12W, sw/ne/se Sec. 25, Bergen Creek, on west side of HWY 53, Wascott, Douglas County, WI
Habitat: Muddy soil and shallow water at base of a beaver dam on Bergen Creek.
Associated species: *Sparganium chlorocarpum*.

1764 July 26, 1995
Location: T44N, R12W, ne/ne Sec. 36, about 1 mile north of Gordon, Douglas County, WI where railroad tressel crosses HWY 53, then about 1/4 mile due west.
Habitat: Shallow, marshy pool in aspen/birch/fir/white pine forest.
Associated species: *Carex lacustris, Potentilla palustris, Salix gracilis, S. discolor, Sium suave*.

1902 Sept. 12, 1995
Location: T49N, R14W, nw/ne sec. 26, Superior, Douglas County, WI.

Habitat: Floating cattail marsh with alders and willows encroaching from the edges.
Associated species: *Alnus rugosa, Aster puniceus, A. umbellatus, Bidens cernua, Calamagrostis canadensis, Carex lasiocarpa, Cicuta bulbifera, Dryopteris cristata, D. spinulosa, Eleocharis palustris, Iris versicolor, Lysimachia thyrsiflora, Ranunculus gmelinii vas. hookeri, Ribes hirtellum, Rubus pubescens, Salix eriocephala (?), S. gracilis, S. lucida, Solidago canadensis, S. uliginosa, Typha latifolia.*

1903 Sept. 12, 1995
Location: T49N, R14W, nw/ne sec. 26, Superior, Douglas County, WI.
Habitat: Cattail marsh with emergent, not floating, vegetation, and with a large area of open water towards center.
Associated species: *Acorns calamus, Lemna minor, L. trisulca, Myriophyllum sp., Ranunculus gmelinii vas. hookeri, Salix eriocephala (?), S. gracilis, S. lucida, Spirodela polyrhiza, Typha latifolia.*

1925 Sept. 27, 1995
Location: T48N, R13W, ne/nw Sec. 24, Parkland, Douglas County, WI. Lat. 46° 38.034 N, Long. 92° 00.576' W
Habitat: Shallow water at the edge of a beaver pond in aspen forest with some conifers.
Associated species: *Bidens cernua, Sparganium americanum, Potamogeton natans, Eleocharis palustris, Lemna minor, Spirodela polyrhiza, Glyceria grandis, Calamagrostis canadensis, Galium tinctorium.*

1949 Oct. 2, 1995
Location: T48N, R13W, se/ne Sec. 24, Parkland, Douglas County, WI. Lat. 46° 37.706 N, Long. 92° 00.594' W.
Habitat: Shallow water of a small stream connecting two beaver ponds in aspen forest with some conifers.
Associated species: *Calamagrostis canadensis, Scirpus cyperinus.*

1969 Oct. 24, 1995
Location: T49N, R14W, nw/se Sec. 34, Superior, Wisconsin. Habitat: Shallow water in floating cattail marsh.
Associated species: *Typha latifolia, Calamagrostis canadensis, Glyceria grandis, G. canadensis, Carex comosa, C. psuedocyperus, C. retrorsa, C. lacustris, Ranunculus gmelinii var. hookeri.*

Taxonomic Considerations

128. Since 1936 a number of *Sparganium* specimens collected in Minnesota and Wisconsin have been assigned to *Sparganium glomeratum*. Generally, the specimens called "*Sparganium glomeratum*" tend to be robust, erect plants with densely crowded, mostly sessile, extra- or supra-axillary, pistillate heads subtending 1 or 2 crowded staminate heads on a very short internode at the shoot apex. These specimens fit very well the "classic" description of *S. glomeratum.*

129. In the last few years the number of collections of *S. glomeratum* and other *Sparganium* species from northern Minnesota and northwest Wisconsin has increased representing a wider geographic range and assortment of habitats. While most collections have presented little problem concerning their species status some have proven to be impossible to assign to any species. These difficult specimens have usually been collected from within or near colonies of *S. glomeratum*.

130. Several of these problematic specimens are from small, isolated colonies in fragmented wetlands, usually black ash swamps, in Duluth. The original distribution of *Sparganium* species in Duluth is not known. In fact, it wasn't until recently that black ash swamps with a more or less closed canopy were considered habitat for *S. glomeratum* or any other *Sparganium* species. The *Sparganium* species *S. minimum* and *S. chlorocarpum* have been found with *S. glomeratum* in these swamps and their associated wetlands. Hybridization is a possibility, but attempted hybrids between different *Sparganium* species have never generated plants (Cook and Nicholls 1986). Collections from the 1995 Status Survey that have a mixture of characteristics are listed and described below.

131. Certain collections (Walton # 1785, # 1841, # 1842) from Duluth exhibit traits of a poorly known taxon, *Sparganium glehnii* Meinsh., reported from Sakhalin in eastern Asia (Komarov 1968). Komarov classes *S. glehnii* with *S. glomeratum* in the Cycle Glomerata Juz. on the basis of sharply keeled leaves, and sessile, crowded pistillate heads that are often strongly extra-axillary. He separates *S. glehnii* from *S. glomeratum* on the basis of less crowded pistillate heads, up to 3 staminate heads on a more developed staminate portion of the inflorescence up to 1.5 cm long. *S. glomeratum* is known for its densely crowded, sessile pistillate heads and the staminate portion which is

reduced to 1, sometimes 2, heads separated from the pistillate portion by almost no internode. Cook and Nicholls (1986) do not discuss S. glehnii, relegating it to status of synonym for S. glomeratum although they have never seen the type specimen or any other specimen labeled "*S. glehnii*".

List of anomalous specimens of uncertain taxonomic status

132. G. B. Walton 1723. Collected from a shallow pool in a black ash swamp, Duluth, MN. Pistillate heads loosely to not at all glomerate, staminate heads 1-2 and up to 8 mm from the pistillate portion. Found growing approximately 200 feet from S. *glomeratum.*

133. G. B. Walton 1785. Collected from a channelized stream that crosses the Northern Natural Gas right-of-way in Duluth, MN. Glomerate pistillate heads and 1-4 staminate heads on an elongate axis, achenes within range for shape, color, and size for *S. glomeratum,* leaves of inflorescence inflated at base and keeled.

134. G. B. Walton 1797. Collected from a shallow ditch at T60N, R19W, Sec. 10 in northern St. Louis County, MN. Elongate staminate inflorescence, 2 staminate flower clusters, pistillate flower clusters not crowded, all sessile, plants erect, leaves nearly flat.

135. G. B. Walton 1799. Collected from a shallow ditch at T60N, R19W, Sec. 10 in northern St. Louis County, MN. Elongate staminate inflorescence, 3 staminate flower clusters, pistillate heads not crowded, all sessile, plants erect, leaves nearly flat.

136. G. B. Walton 1841 & 1842. Collected from a pool with a floating *willow/Carex* mat in Hartley Park, Duluth, MN. Pistillate heads loosely glomerate, usually arranged in a linear rather than angular pattern, staminate heads 1-2, 0.5 mm to 2.2 cm above pistillate portion of the axis. Stems more or less erect, leaves of inflorescence inflated at base and with a keel.

137. G. B. Walton 1883, 1884, 1887, 1888. Collected from a beaver pond near Forest Road 418. Crowded pistillate heads arranged in an angular pattern, the lowest usually pedunculate, 2-4 staminate flower clusters on an elongate axis.

138. G. B. Walton 1922. Collected from a shallow marsh in Canton County. Crowded pistillate heads arranged in an angular pattern, the lowest usually pedunculate, 2-3 staminate flower clusters on an elongate axis, otherwise like G. B. Walton 1918 which is *S. glomeratum.*

Key to Minnesota *Sparganium* species

la.	Perianth segments not translucent and with dark pad at apex; inflorescence inflorescence branched or rarely simple.	2 subgenus *Sparganium*
1b.	Perianth segments translucent; simple or rarely branched.	4 subgenus *Xanthosparganium*
2a	Stigmas usually 2, fruit broader at top than at bottom; inflorescence branched extensive; leaves stiff.	*Sparganium eurycarpum*
2b.	Stigmas 1, fruit spindle-shaped; inflorescence may be branched extensively; pistillate clusters usually axillary; leaves soft.	3
3a.	Fruit with constriction in middle, upper half shiny brown, lower dull brown, beak strongly curved to hooked.	*Sparganium androcladum*

3b.	Fruit with or without constriction in middle, dull brown, beak slightly curved, never hooked.	*Sparganium americanum*
4a.	Leaves of inflorescence not inflated at base, without a distinct keel.	5
4b.	Leaves of inflorescence inflated at base, with or without a distinct keel.	6
5a.	Inflorescence simple; delicate floating plants; 1-2 staminate clusters on elongate axis, remote from pistillate clusters (1-4); leaves thin; fruit roundish, dull green or brown, beak short, straight.	*Sparganium minimum*
5b.	Inflorescence branched; robust floating plants; fruits obovoid, constricted, dull brown, beak long, curved.	*Sparganium fluctuans*
6a.	Plants lax; leaves not distinctly keeled; inflorescence simple; 1-4 staminate clusters crowded on elongate axis, remote from pistillate clusters 1-4, sessile or some pedunculate, sometimes crowded; leaves thin; fruit ellipsoid, greenish, beak long, straight.	*Sparganium angustifolium*
6b.	Plants erect; leaves distinctly keeled; inflorescence simple; pistillate clusters 1-7, sessile, some pedunculate, usually extra axillary.	7
7a.	Pistillate clusters 1-6, extremely to slightly crowded; staminate clusters 3-6 on elongate axis, remote; fruit brown or green, shiny, spindle-shaped to ellipsoid, constricted, long straight beak.	*Sparganium chlorocarpum*

i. Plants with extremely crowded pistillate inflorescence are *S. c. var. acaule*.
ii. Plants with less crowded pistillate inflorescence are *S. c. var. chlorocarpum*.

7b.	Pistillate clusters 2-7, extremely crowded; 1-2 staminate clusters crowded on short axis; fruit shiny, olive-green to brown spindle-shaped, constricted, short straight beak.	*Sparganium glomeratum*

Conservation Considerations

139. When considered in the context of Rabinowitz. et al.'s matrix (1986) *S. glomeratum* is a rare plant in North America, including Minnesota. Until 1990 it was know from only 8 different sites on the continent, 6 of which were in Minnesota. Since then 27 more sites have been reported from Minnesota and Wisconsin. Some of these sites support 2 or more small patches of *S. glomeratum*. In most cases these patches consist of leafy shoots and fertile stems sparsely distributed within 20-50 square feet. In Minnesota and Wisconsin there exist situations where there are areas of concentration separated by areas of near to total absence even though apparently suitable habitat is present. For example, there are 7 known colonies in a 1 square mile area in Clearwater County, Minnesota, but it is presently unknown elsewhere in the county. It then occurs sporadically eastward to St. Louis County. Half (9) of the known Duluth, Minnesota colonies are found in an approximately 2.5 square mile area. In Superior, Wisconsin the situation is also extreme with 6 colonies in a 5.5 square mile area. The next nearest colony of S. glomeratum is about 1.5 miles to the west in the Superior Municipal Forest. A few others are found about 5 to 10 miles south in Parkland and Carnegie and nearly 30 miles south near the Douglas and Washburn County lines. Table 1 summarizes the known sites in Canada, Minnesota, and Wisconsin.

140. *S. glomeratum* is a species confined to shallow, emergent wetlands and certain wetlands with woody vegetation growing for at least part of the year in some standing water. Few of the known colonies of *S. glomeratum* are actually on protected land. Most are on private land or unregulated municipal land. Draining, filling, and other abuses to habitat pose severe problems to the survival of S. glomeratum in these places. It is not sufficient to have one or a few colonies of *S. glomeratum*, or any other rare species for that matter, located in some remote wilderness area and be able to say the species is secure. The species is in that case extirpated from most of its previous range and survives only as a remnant population. Remnant populations are in a precarious situation and can easily go extinct from ordinary natural causes (Gilpin and Soule 1986). Counties in northern Minnesota have refused to comply with the state of Minnesota's wetlands regulations, and the St. Louis County Board is considering to refuse compliance and allow up to 2 acres of wetland per project to be filled without a permit (Kuchera 1995). This noncompliance does not make S. glomeratum safe no matter how many more sites or colonies are found if natural habitat is lost at the same time. Not one of the colonies found in the Duluth area between 1993 and 1995 is absolutely safe from harm because many are on private land in wetlands or parts of wetlands that are well under the 2 acre maximum for non-permitted filling. Also, because one is found in a ditch that could arguably be called an agricultural ditch (although probably not originally a ditch) the state's endangered species law offers absolutely no protection (Minnesota Statute 84.0895, Subd. 1, Paragraph 1). In one summer of construction all the 1994-1995 Status Survey for Sparganium glomeratum in Minnesota Duluth colonies could be legally eliminated. In fact, the Duluth City Council has already voted in favor of a shopping center project (Lincoln 1995) that will destroy the colony in the ditch and at the base of the cliff and also remove most of the uplands watershed adjacent to another colony in a black ash swamp. The alteration of upland watersheds adjacent to wetlands, especially isolated wetlands, can change vegetational components (Committee on Characterization of Wetlands 1995). The situation in Wisconsin is even worse where the species is only "proposed endangered" and thus has no official protection. It is secure at only one site simply because it is on public land which it shares with a state listed endangered species (*Ranunculus gmelinii*) and 2 state listed threatened species (*Petasites sagittatus* and *Viola novae-angliae*). Wisconsin state law currently forbids the removal or destruction of endangered and threatened plant species from publicly owned land. (Wisconsin Statute 29.415 (4c)). But that law may soon be changed to permit destruction of rare plant species if economic need is declared to be overwhelming (Flaherty 1995). Furthermore, the WDNR Board has decided to postpone considering any new recommendations for listed species (e-mail message from Don Waller, University of Wisconsin-Madison, Oct. 27, 1995) which means that *S. glomeratum* will remain unprotected in that state.

Recommendations

141. Useful management or recovery plans for endangered plant species must contain basic biological facts on life history attributes and habitat requirements. This is attested to repeatedly in the scientific literature on conservation biology (Soule 1986, De Steven and Franke 1990, Falk and Holsinger 1991). Yet, for the majority of plant species such information is not available. What is needed on the life history of S. glomeratum is information about pollination, seed dispersal, germination requirements, and the stages of development from seeds or rhizome fragments to reproductively mature plants. There are no demographic studies on populations of *S. glomeratum* and so we cannot say which colonies are vigorous and which are declining. We also lack information on the habitat requirements of *S. glomeratum*. What factor or factors unite the different habitats in which it has been found? Information on habitat requirements would be especially useful and potentially applicable to several other rare or uncommon wetland plant species often found in close association with *S. glomeratum*.

142. It is recommended that life history characteristics and habitat requirements of *S. glomeratum* be studied. It is further recommended that wetlands where *S. glomeratum* has been found be protected from degradation and that such protection extend beyond the wetland boundaries to include the adjacent upland watersheds. Also, laws and regulations intended to protect wetlands should be enforced. It is further recommended that *S. glomeratum* remain on the endangered list given its sparse numbers at nearly all colonies, threats to populations in the Duluth-Superior area, lack of knowledge about its actual distribution in Canada, and because this species is, in our area, disjunct from the main populations in Eurasia and also at its southern limits in North America.

143. The discovery of anomalous *Sparganium* plants with characters of S. *glomeratum* and other species strongly indicates the need to determine the taxonomic status of S. *glomeratum* in Minnesota. That some S. *glomeratum* in North America represent a variety or subspecies is a distinct possibility. Other circumboreal species have been accorded varietal and subspecies status including *Ranunculus gmelinii* (var. *gmelinii* in Canada and Asia and var.

hookeri in parts of Canada and the continental U. S) and *Vaccinium vitis-idaea* (subspecies *minus* in North America and parts of Asia and ssp. *vitis-idaea* in western Asia and in Europe). A variety of S. glomeratum is reported from Japan, *S. glomeratum* var. a*ngustifolium* Graebn. (Ohwi 1965). Reproductive isolation caused by geography or biology can lead to new species and varieties. New species and varieties of plants can originate through hybridization and later hybrid stabilization. Rieseberg (1991) has shown how a new species of (rare) Helianthus has arisen in just such a fashion. It is possible that *S. glomeratum* in Minnesota is crossing with other Sparganium species. Hybridizing has been observed in populations of other rare plants in disturbed habitats where syngameons or hybrid swamis are produced that may reduce genetic diversity with eventual assimilation of the rare species into the more common one (Rieseberg 1991, Templeton 1991). The amount of gene flow between *S. glomeratum* and other Sparganium species should be investigated.

Summary

144. *S. glomeratum* was first found in Minnesota in 1893 by Aiton. Since then it has been reported in North America from 38 sites. This record of infrequent observation would be extremely unusual if *S. glomeratum* were common. Small, obscure plants such as *Botrychium simplex* or *B. lunaria* have a greater report and collection record. Herbarium searches at MIN and WIS have found no *S. glomeratum* specimens collected in North America prior to 1929. Between 1994 and 1995 as part of the Status Survey in Minnesota and related rare plant surveys in Wisconsin 136 wetlands with an estimated total acreage of 2,700 acres were investigated. This breaks down to 112 wetlands at 1,380 acres in Minnesota and 24 wetlands at 1,320 acres in Wisconsin. Wetlands searched during these projects ranged in size from 0.25 acre to larger than 400 acres. *S. glomeratum* was found in 32 of the wetlands investigated and is estimated to cover about 4,100 ft^2 (or a square 64 feet on a side) in the states of Minnesota and Wisconsin, approximately 0.0034% of the wetlands acreage searched. That *S. glomeratum* was found so infrequently and in such small numbers is evidence that it is a rare plant. The clamoring for changes to the endangered species laws and environmental regulations in both states as well as at the federal level is reason for concern. Changes proposed could have a drastic effect not only rare plants such as *S. glomeratum*, but upon entire wetland ecosystems and all the organisms that depend upon them.

Acknowledgments

145. I wish to thank the Minnesota Department of Natural Resources-Natural Heritage Program for funding provided in support of this status survey. Thank you also to Roger Lake and Nancy Sather of the MDNR for accompanying me during part of the survey. Thanks to the Wisconsin Department of Natural Resources-Bureau of Endangered Resources, the Wisconsin Department of Transportation, and Barton-Aschman Associates for arranging rare plant surveys in Douglas and Washburn counties. Thanks to the Sierra Club for a grant in 1994 which funded a floristic survey at Wisconsin's first S. glomeratum site in Superior. Thanks to Dr. D. J. Schimpf and Dr. P. H. Monson for their helpful comments on the manuscript and other aspects of this project. Finally, thanks to the Olga Lakela Herbarium at the University of Minnesota-Duluth, the Department of Biology at the University of Minnesota-Duluth, the University of Minnesota-St. Paul Herbarium, and the University of Wisconsin-Madison Herbarium for use of their facilities.

1994-1995 Status Survey for *Sparganium glomeratum* in Minnesota

Table 1

Minnesota Sites	Discovered by	Year	Extant?
Lake Itasca, MN	Aiton	1893	Unknown
Minnesota Point (Duluth, MN	Lakela	1936	No
Twig, MN	Lakela	1954	Yes (as of 1995)
Basswood Lake, MN	Lakela	1955	Yes (as of 1984)
Knife River, MN	Lakela	1959	No
Itasca County, MN	Wheeler and Glaser	1977	Yes (as of 1988)
Itasca County, MN	Suddendorf	1995	Yes
Clearwater County, MN	Townsend	1990, 1992	Yes (as of 1995)
Cass County, MN	Myhre	1992	Unknown
Cass County, MN	Townsend	1992	Unknown
Biwabik, MN	Walton, Townsend	1993	Unknown
Duluth, MN	Walton	1993, 1994, 1995	Yes
Peyla, MN	Walton	1994	Unknown
Blackhoof, MN	Walton	1994	Mostly destroyed.
Skelton, MN	Walton	1993, 1994	One colony destroyed.
Carlton, MN	Walton	1995	Yes
Scott's Corner, MN	Coyer	1995	Probably
Paavola, MN	Walton	1995	Yes
Shannon Creek, MN	Walton	1995	Yes
Stockholm Rd. (Rice Lake), MN	Walton	1994	Yes
Hermantown, MN	Walton	1995	Yes
Rice Lk. Rd. (Rice Lake), MN	Walton	1995	Yes
Fairbanks, MN	Walton	1995	Yes
Whiteface, MN	Walton	1995	Yes
Toimi area, MN	Walton	1995	Yes
Becker County, MN	Myrhe	1995	Yes
Wisconsin Sites	**Discovered by**	**Year**	**Extant?**
Superior, WI	Monson, Walton, & WDNR	1993, 1994, 1995	Yes
Parkland, WI	Walton	1995	Yes
Wascott, WI	Walton	1995	Yes
Gordon, WI	Walton	1995	Yes
Washburn, WI	Walton	1995	Yes
Carnegie, WI	WDNR	1995	Yes
Canadian Sites	**Discovered by or cited in**	**Year**	**Extant?**
Quebec	Lewis	1931	Unknown
Newfoundland	Cook and Nicholls 1986	Unknown	Unknown
Saskatchewan	Scoggan 1978	Unknown	Unknown
Yukon	Scoggan 1978	Unknown	Unknown
Alberta	Scoggan 1978	Unknown	Unknown
British Columbia	Brayshaw 1985	Unknown	Unknown

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