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Minnesota Dept. of Natural Resources
Division of Fish and Wildlife
Section of Fisheries

Aquatic vegetation point intercept surveys of South Center Lake (13-0027), Chisago County, Minnesota

May and August 2009

Area Fisheries Supervisor Date

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Report by: Deb Sewell
Fisheries Management Specialist
Hinckley Area Fisheries Office

Introduction

South Center is a deep eutrophic lake that is part of a chain of medium to large lakes in southern Chisago County. The lake has several deep holes, with very sharp breaks but is also characterized by an extensive littoral area (67%). Much of the shoreline is developed with lake homes. South Center Lake receives heavy recreational pressure in the summer, and heavy angling pressure year round.

In 2007, South Center Lake was chosen as a sentinel lake for a multi-partner long term monitoring project: Sustaining Lakes in a Changing Environment (SLICE). During the first four years of the project, which began in 2008, South Center and 23 other lakes throughout the state, representing a range of ecological conditions, will undergo intensive monitoring. Factors monitored will include water chemistry, water clarity, aquatic plant communities, fish populations, and invertebrates. From this four year pilot study, indicators will be identified that can be used to assess lakes' responses to environmental stressors.

Information about habitat and vegetation on South Center Lake can be found in Fisheries lake surveys dating back to 1942 (Table 1). However, it is difficult to draw conclusions about species diversity in surveys prior to 1995 since only the most prevalent species were listed, and species such as pondweeds were lumped together as one classification. The 1956 lake survey indicated that vegetation was abundant over 40% of the lake, growing to a depth of 10 feet. Aquatic plant control was practiced as early as 1955.

The non- native plant curlyleaf pondweed (*Potamogeton crispus*) has been in South Center Lake since at least 1969 (Table 1). Curlyleaf pondweed is a perennial submersed aquatic plant that was first noted in Minnesota around 1910 (Moyle and Hotchkiss 1945). Unlike most native submersed aquatic plants, curlyleaf pondweed plants sprout in the fall and grow slowly throughout the winter, even under thick ice and snow cover (Wehrmeister and Stuckey 1978). This strategy gives curlyleaf pondweed an advantage over native plants; by the time other species start growing in the spring, curlyleaf plants are large enough to block light penetration to the bottom. By late spring, curlyleaf pondweed can form dense mats which interfere with recreation. In mid-summer these dense mats senesce and die back, releasing nutrients that can contribute to undesirable algae blooms. Before curlyleaf pondweed plants die back, they form hardened stem tips called turions, which serve the function of vegetative reproduction. These turions sprout in the fall and begin the plant's life cycle again.

Eurasian watermilfoil (Myriophyllum spicatum), another non-native plant, was found in North Center Lake in the spring of 2008. North Center and South Center Lakes are connected by a navigable channel. No Eurasian watermilfoil was observed during plant surveys on South Center in 2008.

The SLICE work plan calls for South Center and the other sentinel lakes to be sampled for aquatic vegetation annually for four years. The 2009 sampling represents the first year of this study. This sampling will add to the understanding of annual variability in lake vegetation communities.

Methods

Point intercept surveys were conducted on South Center Lake in May and August of 2009. Methodology for the point intercept survey was developed by Madsen (1999) and modified by the Minnesota Department of Natural Resources (2008a). A grid of sample points was generated at a density of 0.7 points/acre. Past Secchi depth readings were used to determine the probable maximum depth of plant growth, and points were created out to the depth contour one meter beyond the maximum depth. Additional points were added to adequately sample shoreline areas. A field crew used a global

positioning system (GPS) unit to navigate to each point. A double headed garden rake was thrown once to sample vegetation in an approximate 1 meter square area. If any species were visually observed but not sampled on the rake they were recorded separately on field forms. Depth was recorded using a depth finder or survey rod.

Results

Plant species and frequencies from surveys in May and August are listed in Table 2. Vegetation was much more widespread in May than in August (93% vs 66% frequency). Curlyleaf pondweed was abundant during the May survey, occurring at 85 percent of sample points (Figure 2). Coontail was the most prevalent species in August, occurring at 38 percent of points. A form of milfoil believed to be a hybrid between northern and Eurasian watermilfoil was found at 14 points during the May survey. Hybrid milfoil and Eurasian watermilfoil were both found in August at widely scattered locations (Figure 3). Eurasian and hybrid watermilfoil were most often found in association with other plant species such as coontail.

Discussion

Two years of vegetation surveys on South Center Lake have shown that curlyleaf pondweed is a major component of the lake's early summer ecosystem, with some persisting throughout the growing season. The relationship between curlyleaf pondweed and water quality has been studied over the last decade but is still not fully understood. While it is known that algal blooms tend to coincide with the senescence of curlyleaf pondweed, the contributions of curlyleaf pondweed to the overall phosphorus budget are affected by an interplay of factors and can vary greatly. In Minnesota lakes it has been observed that reductions in curlyleaf pondweed alone are not likely to result in major impacts on water clarity (Invasive Species Program 2010).

The two main challenges associated with the management of curlyleaf pondweed are to minimize damage to native plants and to produce long term control. The MN DNR protocol for large scale treatment of curlyleaf pondweed calls for low rate applications of endothall herbicides (such as Aquathol K) when water temperatures are between 50-60 F and rising (MN DNR 2008b). Since 2004, pilot projects have been underway in Minnesota in an effort to determine whether long term control of curlyleaf pondweed can be achieved. Studies suggest that in order to provide long term reduction of curlyleaf pondweed, a lake must be treated for several years in a row (Skogerboe et al. 2008). However, there is not enough information yet to determine the long term effects of curlyleaf pondweed treatment (Invasive Species Program 2010). While in most cases native aquatic plant populations have not been negatively affected by lakewide early season endothall treatments, in some situations caution should be exercised in implementing a treatment program. These include eutrophic lakes with few species of native plants, and lakes where multiple herbicides are used to target both curlyleaf pondweed and Eurasian watermilfoil (Invasive Species Program 2010).

References

Invasive Species Program. 2010. Invasive Species of Aquatic Plants and Wild Animals in Minnesota: Annual Report for 2009. Minnesota Department of Natural Resources, St. Paul, MN.

Madsen, J. D. 1999. Point intercept and line intercept methods for aquatic plant management. *APCRP Technical Notes Collection* (TN APCRP-M1-02). U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Minnesota Department of Natural Resources. 2008a. Minnesota's Sensitive Lakeshore Identification Manual: a conservation strategy for Minnesota lakeshores (version 2). Division of Ecological Resources, Minnesota Department of Natural Resources. 62 pp.

Minnesota Department of Natural Resources. 2008b. Pilot projects to control curly-leaf pondweed or Eurasian watermilfoil on a lake-wide or bay-wide basis for ecological benefits during 2009.: Description of Grants available from the Minnesota Department of Natural Resources [2 December 2008].

Moyle, J.B. and N. Hotchkiss. 1945. The aquatic and marsh vegetation of Minnesota and its value to waterfowl. Minnesota Department of Conservation. Technical Bulletin 3.

Skogerboe, John G., A. Poovey, K.D. Getsinger, W. Crowell, and E. Macbeth. 2008. Early-season, low-dose applications of endothall to selectively control curlyleaf pondweed in Minnesota lakes. APCRP Technical Notes Collection. ERDC/TN APCRP-CC-08. Vicksburg, MN: U.S. Army Engineer Research and Development Center. http://el.erdc.usace.army.mil/aqua/

Wehrmeister and Stuckey. 1978. The life history of *Potamogeton crispus* with emphasis on its reproductive biology. Ohio Journal of Science. 78 (April program and abstract) supplement: 16.

Figure 1. Grid of sample points used in the 2009 vegetation point intercept surveys on South Center Lake. Due to low water levels, not all points could be sampled.

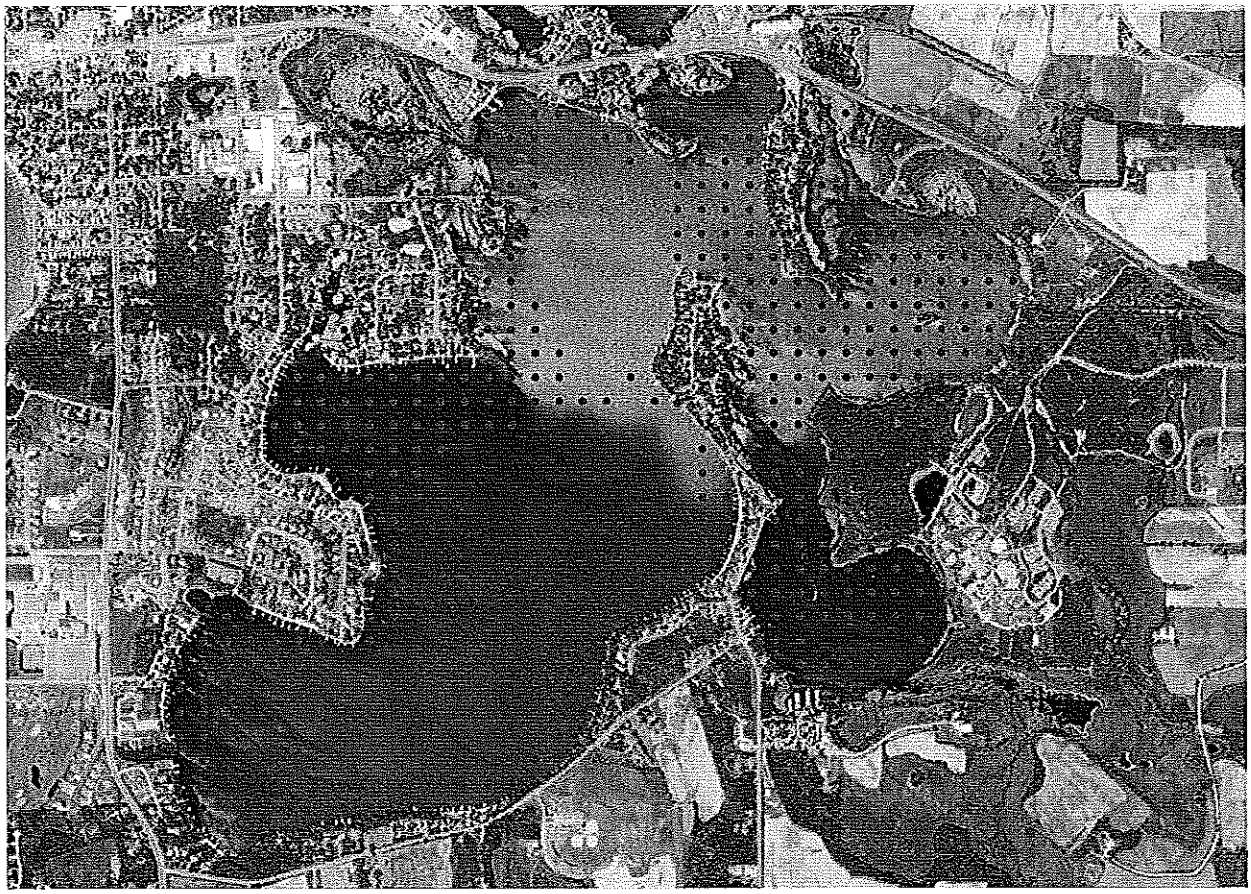

Figure 2. Survey points where curlyleaf pondweed was sampled during the May 2009 vegetation point intercept survey on South Center Lake.

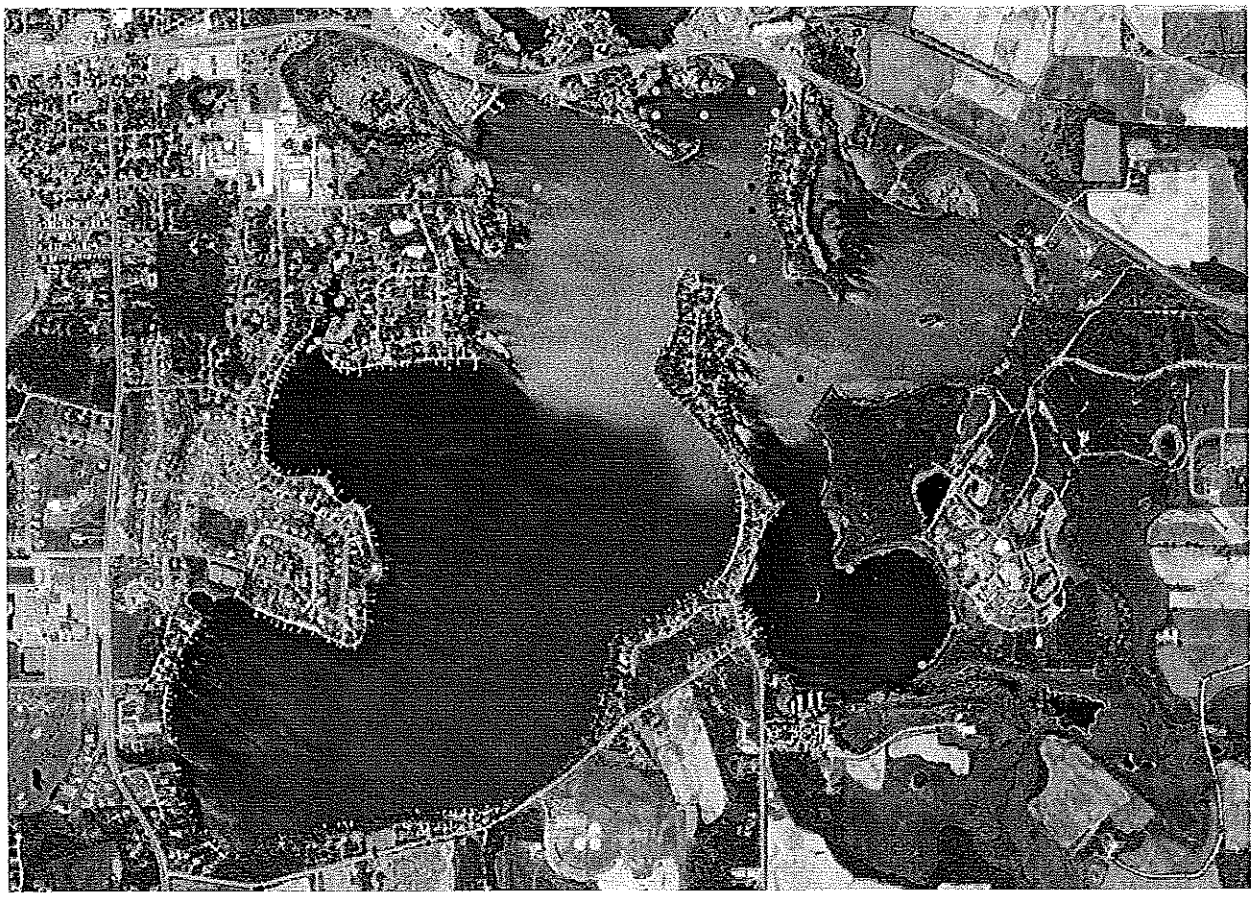

Figure 3. Survey points where Eurasian watermilfoil (red) or hybrid watermilfoil (orange) was found during the August point intercept survey on South Center Lake.

Table 1. List of aquatic plant species that have been recorded in South Center Lake

Common name	Scientific name	Survey years
Emergent species (13 total)		
Blue flag iris	*Iris versicolor*	F, G
Broad leaved arrowhead	*Sagittaria latifolia*	B, C, D, E, F
Cattail	*Typha latifolia*	A, B, C, D, E, F, G, H, I
Giant burreed	*Sparganium eurycarpum*	F
Hardstem bulrush	*Scirpus acutus*	A, B, C, D, E, F
Needlerush	*Eleocharis accicularis*	F
Purple loosestrife	*Lythrum salicaria*	F, G
River bulrush	*Scirpus fluviatilis*	F, G
Rushes	*Juncus sp.*	F
Sedge	*Carex or Cyperaceae*	B, F, G
Softstem bulrush	*Scirpus validus*	F
Water smartweed	*Polygonum amphibium*	D, E, I
Wool grass	*Scirpus cyperinus*	F
Submerged and floating leaf species (30 total)		
Bushy pondweed	*Najas flexilis*	F, G, H, I
Canada waterweed	*Elodea canadensis*	A, B, C, D, E, F, G, H, I
Claspingleaf pondweed	*Potamogeton Richardsonii*	F, G, H, I
Coontail	*Ceratophyllum demersum*	A, D, E, F, G, H, I
Curlyleaf pondweed	*Potamogeton crispus*	C, E, F, G, H, I
Eurasian watermilfoil	*Myriophyllum spicatum*	I
Filamentous algae		F, H, I
Flatstem pondweed	*Potamogeton zosteriformis*	E, F, G, H, I
Floatingleaf pondweed	*Potamogeton natans*	C, E
Greater bladderwort	*Utricularia vulgaris*	F
Greater duckweed	*Spirodela polyrhiza*	F
Hybrid watermilfoil	*Myriophyllum sibiricum x spicatum*	I
Illinois pondweed	*Potamogeton illinoensis*	I
Largeleaf pondweed	*Potamogeton amplifolius*	C, F
Leafy pondweed	*Potamogeton foliosus*	F
Lesser duckweed	*Lemna minor*	D, F, G, H, I
Muskgrass	*Chara sp.*	B, C, H, I
Narrowleaf pondweed	*Potamogeton sp.*	G, H, I
Northern watermilfoil	*Myriophyllum sibiricum (exalbescens)*	D, E, F, G, H, I
Robbins' pondweed	*Potamogeton Robbinsii*	H, I
Sago pondweed	*Stuckenia pectinata*	H, I
Stonewort	*Nitella sp.*	I
Variable pondweed	*Potamogeton gramineus*	F
Water meal	*Wolffia sp.*	F, G, H, I
White water buttercup	*Ranunculus sp.*	H
White waterlily	*Nymphaea tuberosa*	D, E, F, G, H, I
Whitestem pondweed	*Potamogeton praelongus*	A, H, I
Wild celery	*Vallisneria americana*	C, F, H, I
Yellow water starwort	*Zosterella dubia*	A
Yellow waterlily	*Nuphar variegatum*	A, E, F, G, H, I

A) 1942 Fisheries lake survey; B) 1956 Fisheries lake survey; C) 1969 Fisheries lake survey; D) 1975 Fisheries lake survey; E) 1985 Fisheries lake survey; F) 1995 Fisheries lake survey; G) 2005 Fisheries lake survey; H) 2008 SLICE vegetation sampling; I) 2009 SLICE vegetation sampling

Table 2. Percent frequency of occurrence of aquatic plant species sampled during point-intercept surveys in May and August in South Center Lake, Chisago County, MN.

Survey date	Species	Scientific name	Growth form	Frequency (%)
May	***all vegetation***			92.6
	curlyleaf pondweed	*Potamogeton crispus*	submergent	84.5
	filamentous algae			14.0
	coontail	*Ceratophyllum demersum*	submergent	12.7
	northern watermilfoil	*Myriophyllum sibiricum*	submergent	5.1
	hybrid watermilfoil	*Myriophyllum sibiricum x spicatum*	submergent	3.6
	Robbins' pondweed	*Potamogeton Robbinsii*	submergent	2.5
	white waterlily	*Nymphaea sp.*	floating leaf	2.5
	stonewort	*Nitella sp.*	submergent	0.8
	whitestem pondweed	*Potamogeton praelongus*	submergent	0.5
	yellow waterlily	*Nuphar variegatum*	floating leaf	0.3
	mean species diversity = 1.3			
August	***all vegetation***			66.1
	coontail	*Ceratophyllum demersum*	submergent	37.6
	curlyleaf pondweed	*Potamogeton crispus*	submergent	27.6
	northern watermilfoil	*Myriophyllum sibiricum*	submergent	22.9
	Robbins' pondweed	*Potamogeton Robbinsii*	submergent	8.0
	white waterlily	*Nymphaea sp.*	floating leaf	8.0
	Canada waterweed	*Elodea canadensis*	submergent	5.1
	filamentous algae			4.6
	Eurasian watermilfoil	*Myriophyllum spicatum*	submergent	4.4
	bushy pondweed	*Najas flexilis*	submergent	3.4
	hybrid watermilfoil	*Myriophyllum sibiricum x spicatum*	submergent	2.2
	duckweed	*Lemna sp.*	free floating	2.2
	water meal	*Wolffia sp.*	free floating	2.0
	claspingleaf pondweed	*Potamogeton Richardsonii*	submergent	1.0
	narrowleaf pondweed	*Potamogeton sp.*	submergent	0.7
	flatstem pondweed	*Potamogeton zosteriformis*	submergent	0.7
	smartweed	*Persicaria sp.*	emergent	0.5
	Illinois pondweed	*Potamogeton illinoensis*	submergent	0.2
	whitestem pondweed	*Potamogeton praelongus*	submergent	0.2
	sago pondweed	*Stuckenia pectinata*	submergent	0.2
	cattail	*Typha sp.*	emergent	0.2
	wild celery	*Vallisneria americana*	submergent	0.2
	muskgrass	*Chara sp.*	submergent	0.2
	mean species diversity = 1.3			