Darrin Fresh Water Institute

AT LAKE GEORGE

AN AQUATIC PLANT SURVEY OF EFNER LAKE SARATOGA COUNTY, NEW YORK

Prepared for

Efner Lake Association

Prepared By

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INTRODUCTION

An aquatic plant survey of Efner Lake, Saratoga County, New York was conducted by the staff of the Darrin Fresh Water Institute and the NYS Department of Environmental Conservation in July of 1999. The impetus for this survey was the discovery in 1994 (Kishbaugh, 1996), of an exotic aquatic plant, Fanwort (*Cabomba caroliniana*), in Hunt and Jenny Lakes. As a non-native species, the potential exists for explosive growth of this species. Fanwort has been found to reach nuisance proportions in several lakes in Massachusetts and southern New York State.

As part of the process for determining the need for managing Fanwort in Efner Lake, a survey to evaluate the current populations of Fanwort and native plants was required. On July 13, 1999 the survey was conducted, and designed to provide baseline data necessary to develop an aquatic plant management plan.

VEGETATION METHODS

The location of scattered and dense Fanwort (*Cabomba caroliniana* L.) populations for the entire lake were recorded by divers trained in aquatic plant identification. To quantify the aquatic plant populations present in the lake, six transects were located evenly around the lake. At each transect, all aquatic plant species and their relative abundance were recorded at one meter depth intervals using the following abundance classes: abundant (greater than 50% cover), common (25 to 50% cover), present (15 to 25% cover), occassional (5 to 15% cover) and rare (less than 5% cover). This data both provides average depth distributions of plants, and an estimate of the relative abundance of all species in the lake.

Site Selections

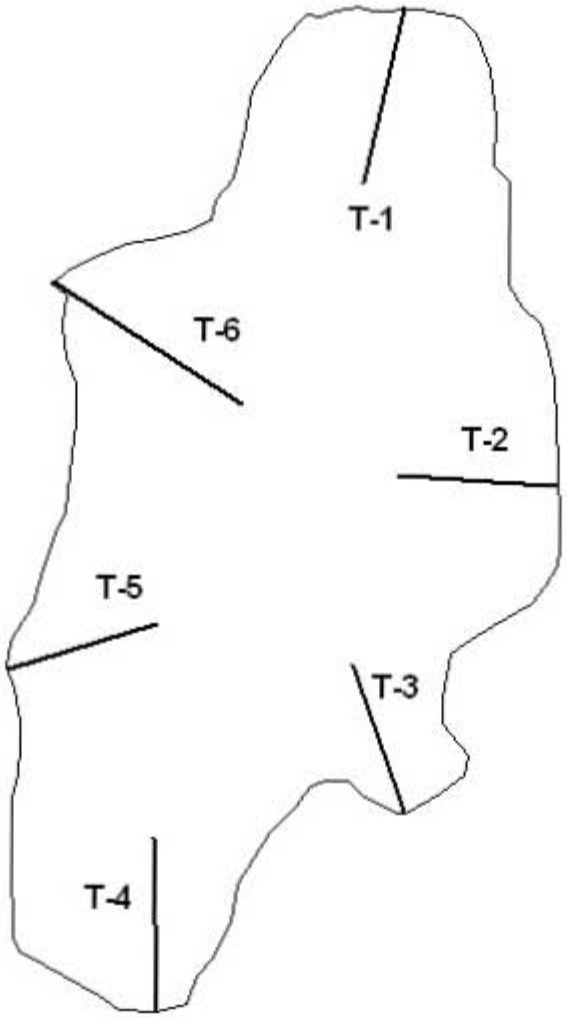
In order to characterize the aquatic plant community of Efner Lake, six sites were selected for transects (Figure 1 and Table 1). Sites were chosen to provide samples representative of the lake as a whole. Selection criteria included: water depth, degree of shoreline development, density of aquatic weed growth, and proximity to inlets or outlets.

Plant Survey Transect Descriptions

Transect Number	Site Name	Description
1	East Side	The transect was located at the Schelmbauer property adjacent to the mouth of a tributary entering the lake. Sediments in the nearshore area (less than 1 meter deep) were sandy. Further from shore was found soft silt and bottom slope was moderate. Maximum depth 21.5 ft.

Transect Number	Site Name	Description
2	South Cove	The transect was located in a small cove on the SE shore of the lake adjacent to the old Hunter yellow camp. Sediments along the transect ranged from sand and silt in water depth less than 1 meter (3 feet), to soft silt in water depths greater than 1 meter. Maximum depth 21 ft.
3	South Shore Chisholm Property	The transect was located off a small point on the south shore of the lake. Slope at this site was moderate. Sediments along the transect ranged from fine sand in water depth less than 1 meter to soft silt beyond this depth. Maximum depth 21 ft.
4	Outlet Area	The transect was located at the mouth of the outlet channel, connecting Jenny and Efner Lakes. Sediments were rocks and sand and the bottom slope was very gradual. Maximum depth 15 ft.
5	NW Shore Mack Property	The transect was located in a rocky cove on the north shore of the lake. Sediments were rocks, sand and silt and bottom slope was gradual. Maximum depth 22 ft.
6	Mack Beach	The transect was located in front of a large sand beach on the NW shore of the lake. Sediments were sand and gravel near shore to sand and silt beyond a depth of 1 meter. Bottom slope was gradual. Maximum depth 15 ft

Figure 1. Map of Efner Lake showing vegetation transects.



VEGETATION IN EFNER LAKE

The submersed vegetation of Efner Lake in July of 1999, including that of Fanwort, will be discussed in this section. First, the plant species observed will be reviewed. Second, the results of the quantitative vegetation transects will be examined, followed by a summarization of this data in terms of plant relative abundance and depth distribution. Third, the distribution patterns of Fanwort will be discussed, noting how this distribution may be related to its introduction, and indicating some future areas of concern. Finally, aquatic plant management options will be reviewed in light of the distribution and density of Fanwort in Efner Lake.

Submersed Plant Species

A list of all submersed and floating-leaved aquatic plant species observed in Efner Lake is given in Table 1. A total of 29 species were observed in 1999. Of these species, one is a

Table 1. Aquatic plant species list for Efner Lake.

SCIENTIFIC NAME	COMMON NAME
Brasenia schreberi	Water Shield
Cabomba caroliniana	Fanwort
Chara/Nitella	Stonewort
Elatine minima	Waterwort
Eleocharis acicularis	Slender Spikerush
Elodea canadensis	Waterweed
Eriocaulon septangulare	Pipewort
Isoetes echinospora	Quillwort
Isoetes macrospora	Quillwort
Juncus pelocarpus	Bog Rush
Callitriche verna	
Lobelia dortmanna	Water Lobelia
Myriophyllum tenellum	Leafless watermilfoil
Najas flexilis	Water Naiad
Nuphar luteum	Yellow Water Lily
Nymphaea odorata	White Water Lily
Pontederia cordata	Pickerelweed
Potamogeton epihydrus	Ribbon Leaf Pondweed
Potamogeton gramineus	Variable Pondweed
Potamogeton natans	Pondweed
Potamogeton pusillus	Pondweed
Potamogeton spirillus	Pondweed
Potamogeton vaseyii	Vasey's Pondweed
Sagittaria graminea	Slender Arrowhead
Sparganium sp.	Burreed
Utricularia intermedia	Bladderwort
Utricularia purpurea	Purple Bladderwort
Utricularia resupinata	Lavender Bladderwort
Vallisneria americana	Duck Celery

macroscopic alga, or charophyte (*Chara/Nitella*), three are floating-leaved species (*Brasenia, Nuphar* and *Nymphaea*), and the remaining 25 are submersed. The large number of species observed indicates excellent diversity, typical of low-elevation Northeastern lakes (Madsen et al. 1989). For instance, Lake George has 47 submersed species (RFWI et al., 1988) and 28 were observed in Lake Luzerne (Eichler and Madsen, 1990). In these two lakes, this high diversity is threatened by further growth and expansion of Eurasian watermilfoil, another exotic plant, which will have negative implications for the health of the lakes as a whole (Madsen et al., 1989, 1990).

One important factor to account for during the permitting process for an aquatic plant management program is the occurrence and abundance of rare plant species that might be affected by a given management technique. One of the plant species observed (*Isoetes macrospora*) is on the New York State Rare Plant list (Mitchell, 1986; Clemants, 1989). This species is generally found in deeper waters, to 5 meters in Efner Lake, and thus is easily missed by surveys. It's presence on the rare plant list may be a result of lack of survey data rather than its scarcity.

The composition of the species list for Efner Lake was similar to that of other nearby lakes. For instance, all of the species observed in Efner Lake have been noted for other regional lakes (Madsen et al., 1989), with the exception of Fanwort (*Cabomba caroliniana*).

Vegetation Transects

The locations of the six transects examined are indicated in Figure 1. Sites were selected that had both shallow and moderately steep slopes, and sediment conditions ranging from sand and gravel to soft silt.

Observations for Transect 1 are indicated in Table 2. This transect was located at the west end of the lake (see Figure 1). In the shallow zone (0-2 m), grass-like species (*Sagittaria graminea* and *Myriophyllum tenellum*) were the most abundant. From 2 to 3 meters, bladderwort, *Utricularia purpurea,* was dominant, forming a low growing carpet on the lake bottom. Beyond 3 meters depth, Fanwort clearly dominated to a depth of 6 meters. Beyond 6 meters depth, charophytes (*Nitella sp.*) were the only species present to a depth of 7 meters.

Table 2. Average percent cover for all quadrats surveyed on transect 1.

SPECIES	DEPTH IN METERS						
	0-1	1-2	2-3	3-4	4-5	5-6	6-7
Cabomba caroliniana	2.5	2.5	2.5	75	75	37.5	
Chara/Nitella	2.5	20	10	2.5	2.5	10	75
Elatine minima	2.5						
Elodea canadensis	2.5	2.5	10				
Eriocaulon septangulare	2.5						
Juncus sp.	20						
Lindernia		2.5					
Lobelia dortmanna	2.5						
Myriophyllum tenellum	37.5						
Potamogeton epihydrus	2.5	2.5					
Potamogeton gramineus	2.5	2.5					
Potamogeton pusillus	2.5	2.5	2.5	2.5			
Potamogeton spirillus	2.5						
Potamogeton vaseyii	2.5						
Sagittaria graminea	20	75					
Sparganium sp.	2.5	2.5					
Utricularia intermedia	2.5	2.5	2.5				
Utricularia purpurea		2.5	75	10	2.5	2.5	2.5
Utricularia resupinata	10						
Vallisneria americana	2.5	10	10	2.5			

Observations for Transect 2 are shown in Table 3. This sandy shoreline sloped rapidly to the edge of the lake. In shallower zones (0-2 meters), *Eriocaulon septangulare* shared dominance with *Nymphaea odorata* and *Pontederia cordata*. Beyond a depth of 4 meters, Fanwort was clearly dominant.

Table 3. Average percent cover for all species at transect 2.

SPECIES	DEPTH IN METERS						
	0-1	1-2	2-3	3-4	4-5	5-6	6-7
Brasenia schreberi	20	10					
Cabomba caroliniana			2.5	2.5	75	75	
Chara/Nitella	10	10	20	10			
Eleocharis sp.		10	20				
Elodea canadensis				10			
Eriocaulon septangulare	37.5	10					
Isoetes macrospora					20		
Myriophyllum tenellum		2.5	10				
Nymphaea odorata	20	20					
Pontederia cordata	20						
Potamogeton natans		10	10				
Potamogeton pusillus			2.5	2.5	2.5		
Utricularia purpurea	10	10	20	37.5	20	2.5	
Vallisneria americana	2.5	2.5	2.5				

A moderately sloped site with sand near shore (0 - 1 meters depth) changing to sand and silt in deeper water was examined at Transect 3 (Table 4). Dominant species in shallow waters included pipeworts, water lilies, and leafless milfoil. Fanwort reached its peak abundance in 3 to 6 meters depth.

Table 4. Average percent cover for all species at transect 3

SPECIES	DEPTH IN METERS				
	0-1	1-2	2-3	3-4	4-5
Brasenia schreberi	2.5				
Cabomba caroliniana			2.5	75	75
Eleocharis sp.		2.5			
Elodea canadensis				2.5	
Eriocaulon septangulare	75	10			
Isoetes echinospora	10	10			
Isoetes macrospora			75	20	
Lobelia dortmanna	10				
Nymphaea odorata	20	2.5			
Potamogeton pusillus	2.5	10	2.5	2.5	
Sagittaria graminea	2.5				
Scirpus sp.	20				
Utricularia purpurea			2.5	2.5	
Vallisneria americana	2.5	10			

Observations along Transect 4 are recorded in Table 5. At this location, the bottom sloped gradually and was primarily cobblestone and sand near shore to a sand and silt mixture in deeper waters. The dominant species from 0 to 2 meters was pipewort. Fanwort dominated from 3 to 5 meters depth.

Table 5. Average percent cover for all species on transect 4

SPECIES	DEPTH IN METERS						
	0-1	1-2	2-3	3-4	4-5	5-6	6-7
Brasenia schreberi	37.5	10					
Cabomba caroliniana	2.5	2.5	10	75	75	75	2.5
Chara/Nitella	10	20	20	20	2.5	2.5	10
Eleocharis sp.	10	2.5					
Eriocaulon septangulare	75	2.5					
Isoetes macrospora				2.5			
Juncus sp.	37.5	2.5					
Myriophyllum tenellum	2.5	75	10	2.5			
Najas flexilis	2.5	2.5	2.5				
Nuphar luteum	37.5	2.5					
Pontederia cordata	10						
Potamogeton epihydrus			10				
Potamogeton pusillus		2.5	2.5	2.5			
Potamogeton spirillus	2.5	2.5					
Sparganium sp.	2.5	2.5					
Utricularia purpurea		2.5	10	2.5	10	2.5	2.5
Utricularia resupinata	10	2.5					
Vallisneria americana		2.5	2.5	10	2.5		

Transect 5 was a moderately sloped site, with sandy sediments interspersed between boulders in shallow water. In the shallow zone, less than 1 meter, the dominant species were emergents including pickerelweed and pipewort (Table 6). Beyond a depth of 1 meter the plant community was very limited with fanwort dominant from 4 to 6 meters.

Table 6. Average percent cover for all species on transect 5

SPECIES	DEPTH IN METERS						
	0-1	1-2	2-3	3-4	4-5	5-6	6-7
Brasenia schreberi	10	20					
Cabomba caroliniana		2.5	2.5	10	75	75	
Chara/Nitella	2.5	20	10	10	2.5	2.5	10
Eleocharis sp.	37.5	2.5					
Elodea canadensis	2.5	2.5	10				
Eriocaulon septangulare	37.5	10					
Isoetes macrospora		10	10	10			
Juncus sp.	37.5	2.5					
Lobelia dortmanna	10	10					
Najas flexilis		2.5	10				
Nymphaea odorata	10	2.5					
Pontederia cordata	20						
Potamogeton pusillus	2.5	2.5	2.5	2.5			
Potamogeton spirillus	2.5	2.5	2.5				
Sparganium sp.	2.5	2.5					
Utricularia purpurea		2.5	10	20	2.5		
Utricularia resupinata	2.5	2.5					
Vallisneria americana		2.5	2.5	2.5	2.5		

Observations for Transect 6 are included in Table 7. Bottom slope at this site was gradual. In the shallow waters (0-1 m), *Utricularia resupinata* and emergent species dominated. Fanwort dominated from 3 to 5 meters depth.

Table 7. Average Percent Cover for All Species on transect 6

SPECIES	DEPTH IN METERS				
	0-1	1-2	2-3	3-4	4-5
Cabomba caroliniana			2.5	75	75
Chara/Nitella		37.5	20	37.5	
Eleocharis acicularis	37.5				
Eriocaulon septangulare	10	37.5			
Isoetes macrospora			20		
Juncus sp.	20	37.5			
M. tenellum		37.5	20		
Pontederia cordata	37.5				
Potamogeton gramineus		37.5			
Potamogeton natans		2.5			
Potamogeton pusillus			20	10	
Utricularia purpurea			20	37.5	
Utricularia resupinata	75				
Vallisneria americana	2.5			2.5	

The depth distribution and cumulative percent cover, listed in alphabetical order, for all aquatic plants in Efner Lake is shown in Table 8. These species are ranked in order of abundance in Table 9. The majority of species occur between the waters edge and 3 meters. The littoral zone or area where rooted plants can grow has a maximum depth of about 6 meters, with fanwort (*Cabomba caroliniana*) clearly dominant from 3 to 6 meters depth. A limited number of specimens of bladderwort (*Utricularia purpurea)* were found beyond 6 meters depth, however only macroalgae (*Nitella* sp.) were common at this depth. Bladderworts are capable of growth without being rooted to the bottom and also under very limited light conditions, however, the plants observed probably drifted into deep water from shallower areas. While able to survive, they are unlikely to grow in this location.

Table 8. Cumulative Percent Cover for All Species and All Depth Intervals listed in alphabetical order.

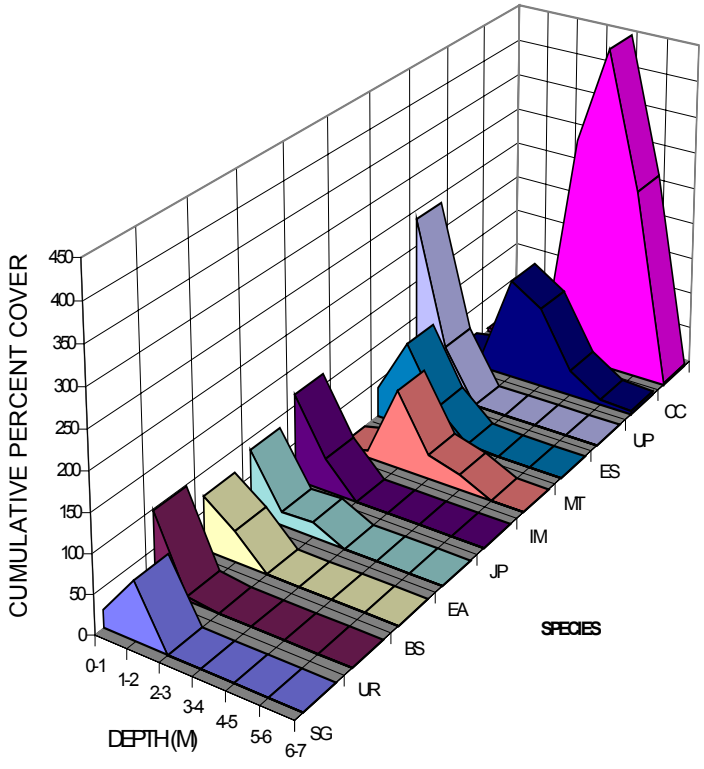
SPECIES	DEPTH IN METERS							
	0-1	1-2	2-3	3-4	4-5	5-6	6-7	Total
Brasenia schreberi	70	40						110
Cabomba caroliniana	5	7.5	22.5	312.5	450	262.5	2.5	1062.5
Chara/Nitella	25	108	80	80	7.5	15	95	410
Elatine minima	2.5							2.5
Eleocharis sp.	85	17.5	20					122.5
Elodea canadensis	5	5	20	12.5				42.5
Eriocaulon septangulare	237.5	70						307.5
Isoetes echinospora	10	10						20
Isoetes macrospora		10	105	32.5	20			167.5
Juncus sp.	115	42.5						157.5
Lindernia		2.5						2.5
Lobelia dortmanna	22.5	10						32.5
Myriophyllum tenellum	40	115	40	2.5				197.5
Najas flexilis	2.5	5	12.5					20
Nuphar luteum	37.5	2.5						40
Nymphaea odorata	50	25						75
Pontederia cordata	87.5							87.5
Potamogeton epihydrus	2.5	2.5	10					15
Potamogeton gramineus	2.5	40						42.5
Potamogeton natans		12.5	10					22.5
Potamogeton pusillus	7.5	17.5	32.5	22.5	2.5			82.5
Potamogeton spirillus	7.5	5	2.5					15
Potamogeton vaseyii	2.5							2.5
Sagittaria graminea	22.5	75						97.5
Scirpus sp.	20							20
Sparganium sp.	7.5	7.5						15
Utricularia intermedia	2.5	2.5	2.5					7.5
Utricularia purpurea	10	17.5	137.5	110	35	7.5	5	322.5
Utricularia resupinata	97.5	5						102.5
Vallisneria americana	10	27.5	17.5	17.5	5			77.5

The depth distribution of the ten most common species is displayed in Figure 3. From this graph, the most typical dominants for each depth interval can be summarized. From 0-1, the dominant species were emergents (*Brasenia schreberi*) and low growing grass-like species including *Utricularia resupinata, Eleocharis* sp. and *Juncus* sp.. Other typical species in shallow waters (1 - 2 m) included *Myriophyllum tenellum, Sagittaria graminea, Eriocaulon septangulare*, and *Nymphaea odorata*. In water depths of 2-3 meters, *Isoetes macrospora* and *Utricularia purpurea*, were also common. Beyond 3 meters depth, only 8 species were found, with *Cabomba caroliniana* the most common. No plants were found in depths greater than 7 meters.

Table 9. Cumulative Percent Cover for All Species and All Depth Intervals Listed in Order of Relative Abundance.

SPECIES	DEPTH IN METERS							
	0-1	1-2	2-3	3-4	4-5	5-6	6-7	Total
Cabomba caroliniana	5	7.5	22.5	312.5	450	262.5	2.5	1062.5
Chara/Nitella	25	107.5	80	80	7.5	15	95	410
Utricularia purpurea	10	17.5	137.5	110	35	7.5	5	322.5
Eriocaulon septangulare	237.5	70						307.5
Myriophyllum tenellum	40	115	40	2.5				197.5
Isoetes macrospora		10	105	32.5	20			167.5
Juncus sp.	115	42.5						157.5
Eleocharis sp.	85	17.5	20					122.5
Brasenia schreberi	70	40						110
Utricularia resupinata	97.5	5						102.5
Sagittaria graminea	22.5	75						97.5
Pontederia cordata	87.5							87.5
Potamogeton pusillus	7.5	17.5	32.5	22.5	2.5			82.5
Vallisneria americana	10	27.5	17.5	17.5	5			77.5
Nymphaea odorata	50	25						75
Elodea canadensis	5	5	20	12.5				42.5
Potamogeton gramineus	2.5	40						42.5
Nuphar luteum	37.5	2.5						40
Lobelia dortmanna	22.5	10						32.5
Potamogeton natans		12.5	10					22.5
Isoetes echinospora	10	10						20
Najas flexilis	2.5	5	12.5					20
Scirpus sp.	20							20
Potamogeton epihydrus	2.5	2.5	10					15
Potamogeton spirillus	7.5	5	2.5					15
Sparganium sp.	7.5	7.5						15
Utricularia intermedia	2.5	2.5	2.5					7.5
Elatine minima	2.5							2.5
Lindernia		2.5						2.5
Potamogeton vaseyii	2.5							2.5

Figure 2. Depth distribution of the ten most common aquatic plant species in Efner Lake: CC, Cabomba caroliniana; UP, Utricularia purpurea ; ES, Eriocaulon septangulare, MT, Myriophyllum tenellum; IM, Isoetes macrospora, JP, Juncus sp.; EA Eleocharis sp., BS, Brasenia schreberi; UR, Utricularia resupinata, SG, Sagittaria graminea.



Fanwort in Efner Lake

Fanwort plants were found throughout the littoral (area of rooted aquatic plants) zone of Efner Lake (Figure 3). The depth distribution of Fanwort (see Table 9) indicates that this species is present from the waters edge to a depth of 6 meters. Fanwort reached its maximum abundance in waters of 3 to 6 meters (3 to 20 feet) depth. At the current time, Fanwort is the most abundant species in Efner Lake, with a nearly monospecific stand forming a donut shaped bed. The innner margin of the dense stand of *Cabomba* is found at approximately 12 feet and the outer margin at 19 feet deep.

Certain areas within the littoral zone of the lake only support scattered populations of Fanwort. These areas have sand or rocky bottom sediments which do not support dense growth of any of the aquatic plants species observed in Efner Lake. Most areas with sediment types and depth ranges acceptable for growth of Fanwort support some growth of this plant. It was observed as a dominant species at all transects surveyed.

Fanwort does not appear to pose either an environmental or aesthetic risk to Efner Lake at the current time. Its presence in deep waters and relatively short stature, 3 feet or less in height, keeps it from invading the portion of the lake used for the majority or

recreational activities. This plant, in fact, may be a benefit to the lake by providing 1) a food source to herbivorous invertebrates and fish, 2) hiding places for young fish to avoid predation, 3) oxygen to the deeper parts of the lake, 4) places for attachment for filamentous algae and invertebrates, and 5) bottom coverage to prevent other, less desirable plants species from invading the lake (e.g. Eurasian watermilfoil).

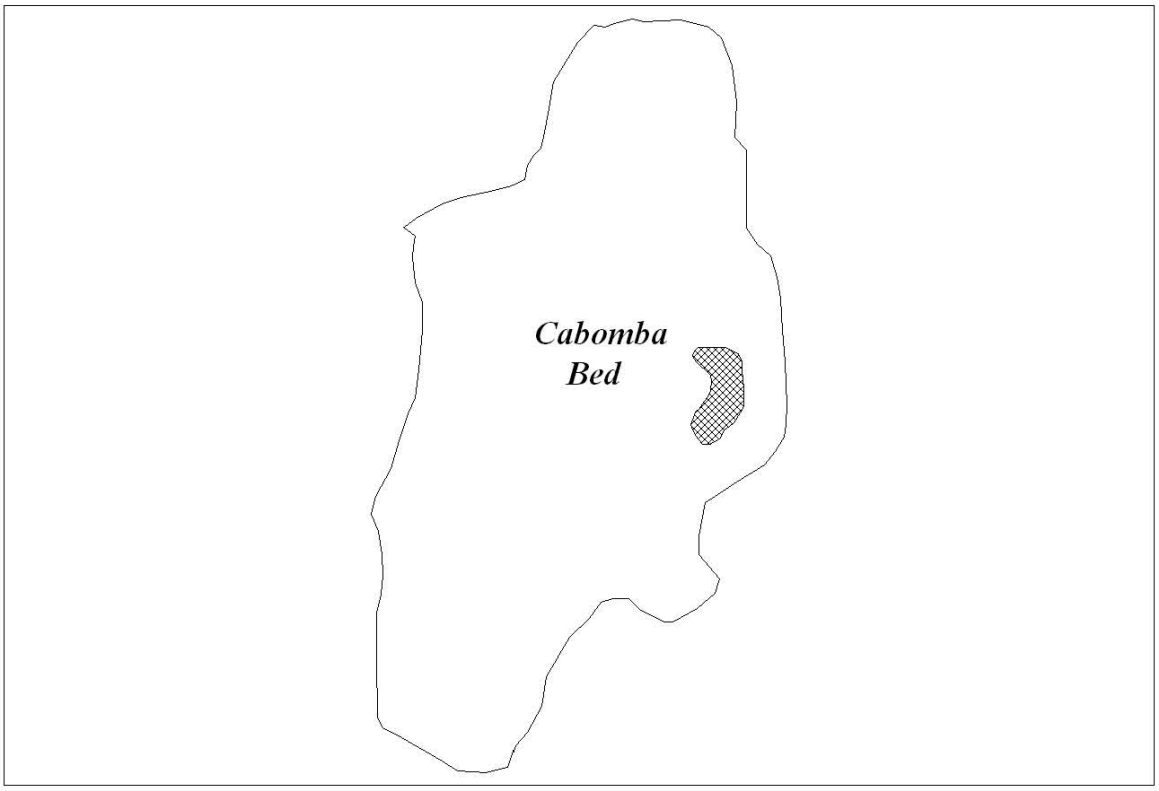
Physical Characteristics of Efner Lake

The following table lists a number of the physical characteristics of Efner Lake. This information is useful in planning any aquatic plant management program.

Table 10. Physical Characteristics of Efner Lake.
From Mikol and Polsinelli, 1985.

Latitude	43°15'33"
Longitude	73°54'50"
Surface Area	134 acres (54.4 ha)
Elevation	1239 feet amsl
Shoreline Length	2.2 mi (3.54 km)
Maximum Depth	7.9 meters (25 feet)
NYS DEC Use Classification	B (Primary Contact Recreation)

Figure 3. Distribution of Fanwort in Efner Lake.
Fanwort placement is for relative location and is not drawn to scale.



Management of Fanwort in Efner Lake

While Fanwort populations are not currently a nuisance to the residents of Efner Lake, the potential exists for this species to reach nuisance proportions. Should management prove necessary, the first step in addressing Fanwort problems in Efner Lake would be to develop a long-term aquatic plant management plan as a component of an overall lake management plan. A long-term plan is needed, since it is unlikely (if not impossible) that Fanwort can be eradicated from the lake. Even if eradication were to be accomplished, continued vigilance would be necessary to prevent any future reintroductions. Some specific components to address in any aquatic plant management plan are:

Education
Prevention
Implementation of Controls
Evaluation and Monitoring

Education. To develop support for management efforts, and to gather volunteers to assist with the program, education of lake-users and homeowners is imperative. Homeowners and lake users must have a basic understanding of nuisance aquatic plants such as Fanwort and how to prevent further introductions and spread. There are also a number of other nuisance species in our region, whose introduction should be avoided. These include Eurasian watermilfoil and Zebra mussels. One fact is becoming plain - in these times of tight money, the only way to protect your lake is to band together and do it as a lake association.

Prevention. Once control has been successful, efforts must be made to prevent reintroduction, and slow the spread of Fanwort. Also, preventive efforts will help to curtail the spread of this plant to other lakes; both as an altruistic measure to keep other lakes from experiencing these problems, and to minimize sources of plants for potential reintroduction of exotic species. Prevention efforts might include education, nonpoint pollution control, erosion management and encouraging the reintroduction and growth of native plants.

Implementation of Controls. A wide variety of control techniques are available, none of which provides a perfect solution. All techniques have advantages and drawbacks. Each location with Fanwort must be assessed individually, and a control technique selected that will work under those conditions.

The vegetation management committee must study the control options and decide on a suitable group of control techniques. Do not rely solely on consultants to decide for you. One important consideration generally neglected is that these techniques will have to be approved through a permitting process, so select techniques that will be acceptable to the permit administrator. The permits for aquatic plant control inside the Adirondack Park are administered by the Adirondack Park Agency.

Aquatic plant management options fall into 4 major groups:

Physical - lake level drawdown or benthic barrier

Mechanical - harvesters, dredges and rakes

Chemical - herbicides

Biological - pathogens, herbivores and parasites

Of these four categories, only physical and chemical means offer the possibility of long-term reductions in Fanwort growth for Efner Lake. There are currently no viable biological control options, since only grass carp, a plant eating fish, is approved in New York State. Grass carp are not suitable since they are completely non-selective in their feeding habits, and tend to prefer native vegetation. All other biological control agents are experimental at the current time.

Mechanical controls, while they may be useful in a long-term maintenance program, do not generally eliminate the target plant species from a given area, but simply reduce its abundance to allow recreational use. While raking and harvesting (cutting) can provide some relief for lakeside residents, longer term control is desired.

Lake level drawdown, a physical control technique, lowers lake water levels in the winter in order to freeze out the plants. This technique has had some success on Eurasian watermilfoil in area lakes, for example, Galway Lake in Saratoga County, NY. The current lake outlet structure on Efner Lake, however, will not allow for a sufficient lake level reduction to reach most the the fanwort growth in the lake.

Benthic barriers, fabric stretched over the lake bottom to smother plants, have also been successful for nuisance aquatic plant control. The extensive areas of Efner Lake dominated by Fanwort, make this technique cost prohibitive. Benthic barriers typically cost from $10,000 to $15,000 per acre. Significant cost savings can be achieved by the use of non-typical barrier materials such as belt press cloths, sand and others in place of commercially available benthic barrier materials.

The availability of a suction harvester from East Caroga Lake makes this a viable plant management option. With the extensive areas of dense growth of Fanwort in Efner Lake however, suction harvesting may also prove cost prohibitive. Suction harvesting in essence is an automated hand harvesting procedure. Divers scoop up the roots and plants of Fanwort and feed them into a suction hose. The hose transports the plants and their associated sediments to a mesh basket at the surface, where the sediments are allowed to wash out and settle to the lake bottom. This form of management is labor intensive, but has the advantage of being very selective for the removal of Fanwort with little impact to native plant species present.

Chemical or herbicide application offers a possible alternative for Fanwort control in Efner Lake. The extent of Fanwort growth in Efner Lake suggests herbicides as a viable option. While herbicide application is often inexpensive, on a per acre basis when compared to physical plant controls, the time and costs associated with acquiring a permit for herbicide application may make this technique more costly. There are a number of herbicides on the market which can be used for Fanwort management. The most commonly used and/or recommended include Aqua-Kleen (2,4-D) and Sonar (fluridone). New York State requires that these chemical herbicides be applied by a licensed applicator. The lake association may wish to contact an applicator and get cost estimates on various applications. The information contained in this survey should allow for fairly specific price quotations. All herbicides contain label restrictions for applications rates,

proximity to drinking water intakes, contact restrictions for swimming, and toxicity for species other than those targeted. The applicator should be able to provide this type of information. Contacting several applicators in order to get the best price and possibly differing points of view is recommended.

Monitoring and Evaluation. These two activities are similar in execution, but somewhat distinct in purpose. The vegetation committee should coordinate a lay monitoring program of lake-users to observe lake areas for the presence and spread of Fanwort in the lake. In addition, these individuals might help in posting boat launches and even inspecting boats and interviewing owners about the Fanwort problem.

Monitoring the lake would include consistent visual inspections of areas of the lake, using snorkeling or SCUBA, for the presence and spread of Fanwort. One technique for quantifying areas with dense Fanwort is to use an echolocation unit ("fish/depth locator") to map the height and area of dense beds during the summer. Currently the Citizens Statewide Lake Assessment Program (CSLAP) collects information on the aquatic plants in a number of New York State lakes, including Efner Lake. Coordination with the efforts of this program should be encouraged. These monitoring activities should be part of an overall lake monitoring program.

Evaluation activities are designed to examine specific control programs and techniques, as well as assessing the rate of Fanwort regrowth or recolonization and the need for repeated control at a given location. This may be done by lay monitors, or contracted with consultants.

An ongoing effort in prevention, education, evaluation and monitoring will greatly facilitate gathering information and making decisions on future management directions.

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