

Control of Milfoil in Bashan Lake

2001

Revised 12-14-2001

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Collaborators

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Funding

Funding for this research was provided by a \$5,000 grant from the Bashan Lake Association (BLA), East Haddam, CT.

Acknowledgments

Assistance with permitting by Brad Robinson, Judy Singer and Peter Aarastad of CTDEP is gratefully acknowledged.



Introduction

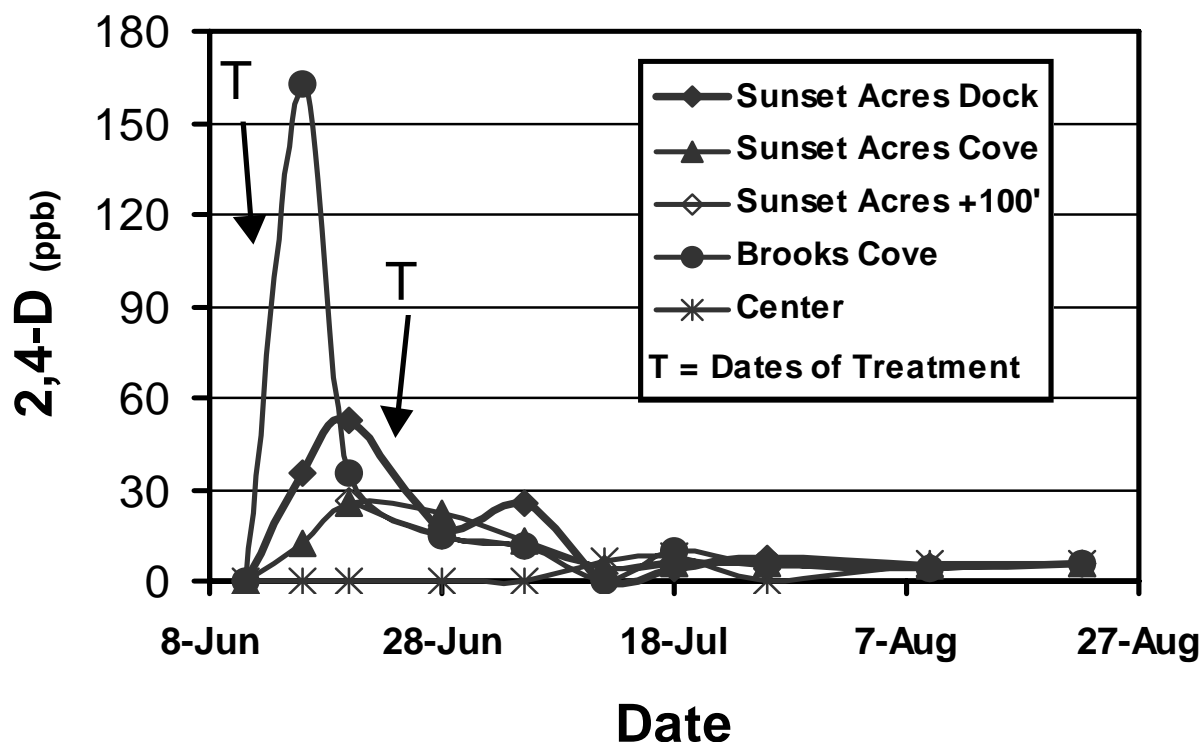
2001 marked the third year of research by the Connecticut Agricultural Experiment Station on controlling variable milfoil (*Myriophyllum heterophyllum*) in Bashan Lake. In 1999, Aquacide (2,4-D sodium salt, 18% active ingredient) was applied, at rate of 100 pounds per acre, to 10 acres of milfoil. Milfoil control was marginal with only about half of the weed being eliminated. Another formulation of 2,4-D, called Navigate (2,4-D butoxyethyl ester, 19% active ingredient), could have been more effective but it was not labeled for use in lakes like Bashan with homes having direct water intakes. CAES obtained a special local need registration for Navigate from the USEPA and CTDEP in 2000. This registration required all lakeside homeowners to be notified that water from Bashan Lake was not suitable for human consumption. The Town of East Haddam did this in the spring of 2000. Lakefront residents must also be notified to not irrigate with lake water until testing shows levels of 2,4-D are below 100 ppb (parts per billion). In 2000 Navigate was applied at a rate of 200 pounds per acre to 10 acres of milfoil. Control was exceptional and by mid-summer nearly all of the treated milfoil was gone. Other aquatic plants such as pondweeds (*Potamogeton sp.*) and bladderwort (*Utricularia sp.*) were not affected and began to populate areas where the milfoil had been eliminated. Unfortunately, milfoil was found in areas outside the treatment sites and this milfoil was targeted for control in 2001.

Pretreatment Weed Surveys

Aquatic vegetation surveys were performed prior to treatments on June 11, June 26 and September 5 (see "Aquatic Plant Survey" maps). The June 11 survey concentrated on milfoil found and mapped on September 8, 2000. The June 26 survey found milfoil in deep-water (3-5m) between the boat launch and the island. This area was over one acre in size and too large to be completely treated on June 26. The September 8 survey mapped the large area of milfoil observed throughout the summer at the mouth of Brooks Cove. Further



Figure 1. Concentrations of 2,4-D in Bashan Lake 2001



Application of Navigate

Navigate was applied on June 13 (500 lbs./ 2.5 A), June 26 (200 lbs./ 1 A) and September 13 (300 lbs./ 1.5 A). A 12-volt Truckster-mount spreader, attached to the back of a motorized boat, was used to distribute the granules. To minimize inconsistencies in coverage treatment areas were crisscrossed in multiple directions. The weather on days of treatment was partly cloudy and mild (75° -85° F) with light winds.

Sampling of Lake Water for 2,4-D

Lake water samples for 2,4-D analysis were obtained in the center of the Brooks cove treatment site, Sunset Acres treatment site, boat launch cove treatment site, 100 feet away from the Sunset Acres treatment sites and a site near the center of the lake. Locations are shown on the “Aquatic Plant Survey” maps. Samples were obtained approximately one meter (three feet) above the bottom where concentrations of 2,4-D are likely the greatest. Samples were



collected before the June 13 treatment and 3, 16, 24, 31, 38, 46, 42, 48 and 59 days after treatment. Testing for 2,4-D by was done by CAES using solid phase extraction and liquid chromatography with a detection limit of 2 ppb. The levels of 2,4-D peaked 3 days after treatment and rapidly dropped to low or non-detectable levels. No levels of 2,4-D approached 1000 ppb, a concentration thought necessary for at least 24 hours to achieve milfoil control. 2,4-D migrated readily to the 100 feet from the Sunset Acres treatment sites. Seven days after treatment samples taken 100 feet from the Sunset Acres sites were similar to those taken from the Sunset Acres treatment sites. All levels were low (<60 ppb). Twenty-nine days after the first treatment (July 12), 2,4-D levels in all sites were <10 ppb. Movement of 2,4-D to the center of the lake was slow. The first detection here occurred 29 days after treatment. From this time until the end of sampling (August 22), 2,4-D levels in the lake center generally ranged from 5 – 10 ppb and were similar to the treated sites. The Navigate application on June 26, did not increase 2,4-D in the lake samples. This was probably because of the small amount of Navigate used and the distance of the sampling sites from the treated areas.

Resumption of Irrigation with Lake Water

Use of water from Bashan Lake for irrigating plants could not occur until 2,4-D levels fell below 100 ppb in all samples. Levels were above 100 ppb only on June 16, in Brooks Cove. Because of the time needed for CAES to test the samples, the irrigation restriction was lifted via written letter to the Town of East Haddam and the BLA on July 7.

Sampling Groundwater Wells for 2,4-D

Four groundwater wells were sampled for 2,4-D. The names and locations of these wells are shown on the “Aquatic Plant Survey” maps. Samples were obtained from the homeowners’ kitchen faucets or outdoor hose outlets 21 days after the June 13th treatment. Levels of 2,4-D were quantified by CAES using solid phase extraction liquid chromatography with a detection level of 2 ppb. No detectable levels of 2,4-D appeared in any well. Copies of all water tests were sent to CTDEP Pesticide Unit as soon as received.

Milfoil Control



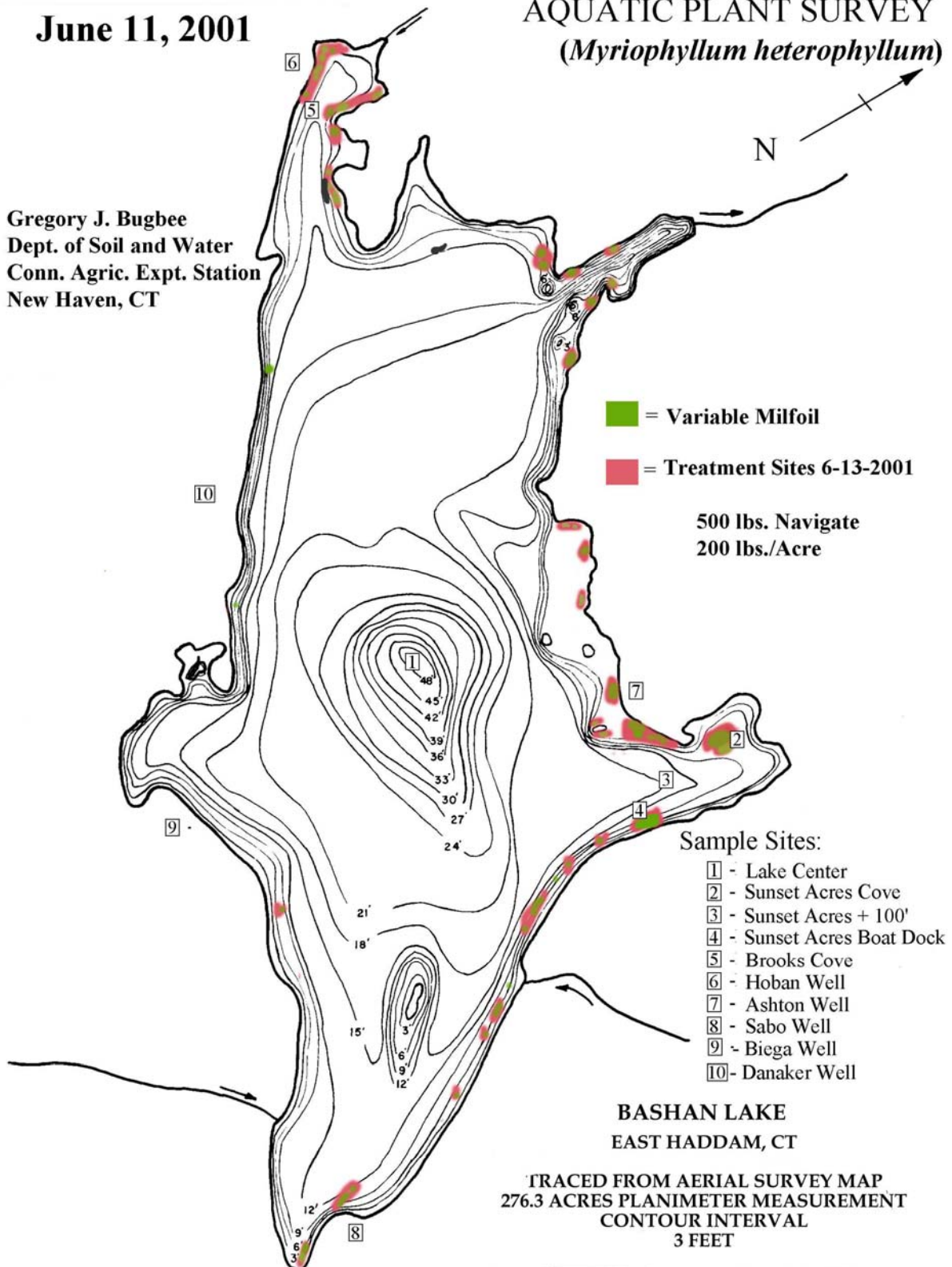
Milfoil control was monitored by weed surveys on June 26, September 5 and September 23 and visual inspections during other visits. On June 26, the milfoil treated on June 13 was either no longer visible or seriously damaged (see Aquatic Survey Map). Visual inspection on August 8 (no map) found the milfoil treated on June 26 had disappeared but 1-2 untreated acre patch in Brooks Cove had become dense with plants reaching the surface. Occasional pieces of healthy looking milfoil were floating in the lake and these could help disperse the weed to other areas. The weed survey performed on September 5 (see Aquatic Survey Map) confirmed all areas treated in June were controlled. Large patches were found, however, on the north side of the Boat launch cove, between the boat launch and the island, in the Brooks Cove area and along the east shore of Sunset Acers cove. Other isolated patches were found with the most notable in Laurel Cove. The Brooks and Laurel Cove patches were treated in 2000. This indicates either a lack of complete control or regeneration of milfoil from seeds or plant parts that drift in and take root. The milfoil on the east shore of Sunset Acres Cove was in 1-2 feet of water and probably had been exposed by a draw down the preceding winter.



June 11, 2001

AQUATIC PLANT SURVEY (*Myriophyllum heterophyllum*)

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Conn. Agric. Expt. Station
New Haven, CT

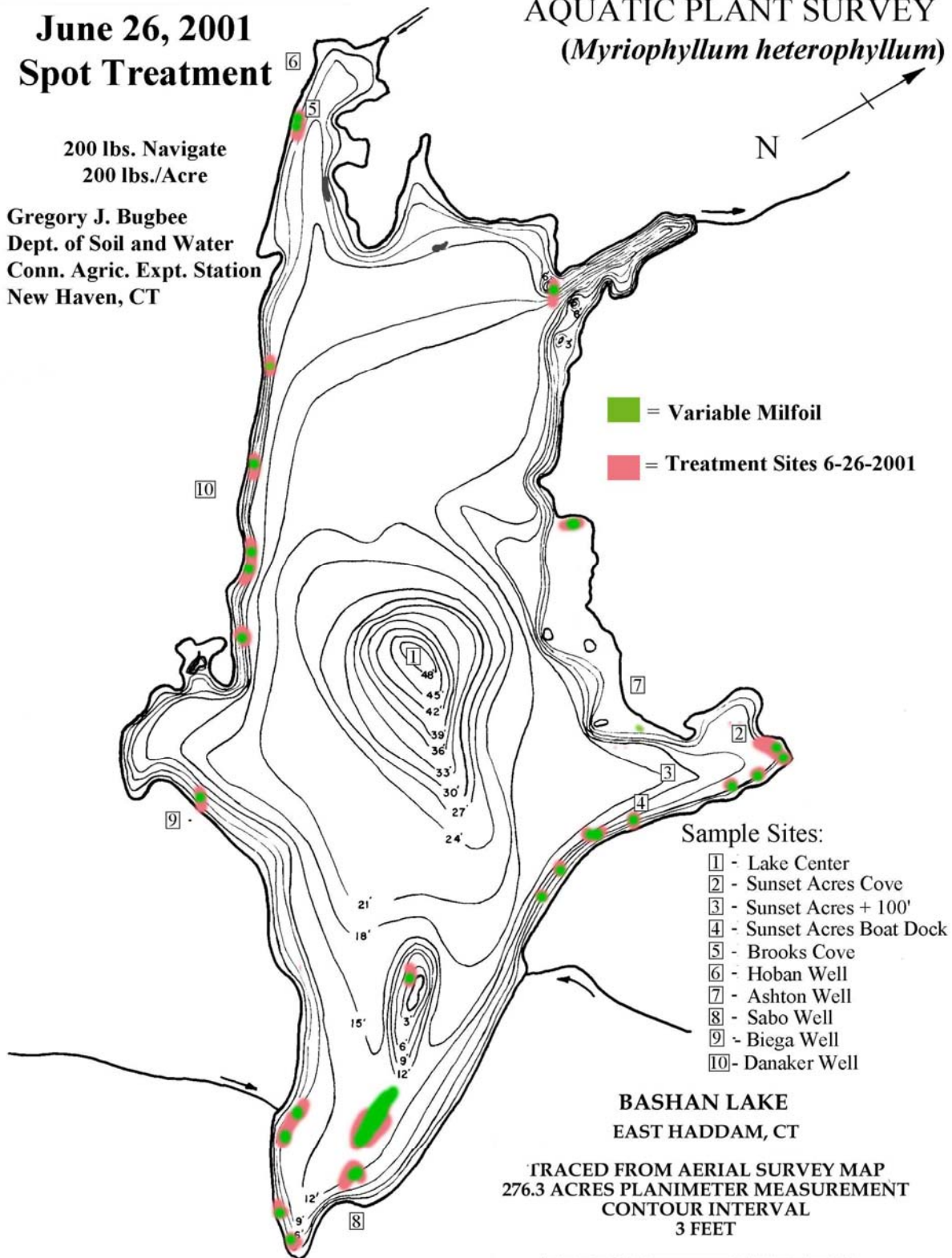


**June 26, 2001
Spot Treatment**

200 lbs. Navigate
200 lbs./Acre

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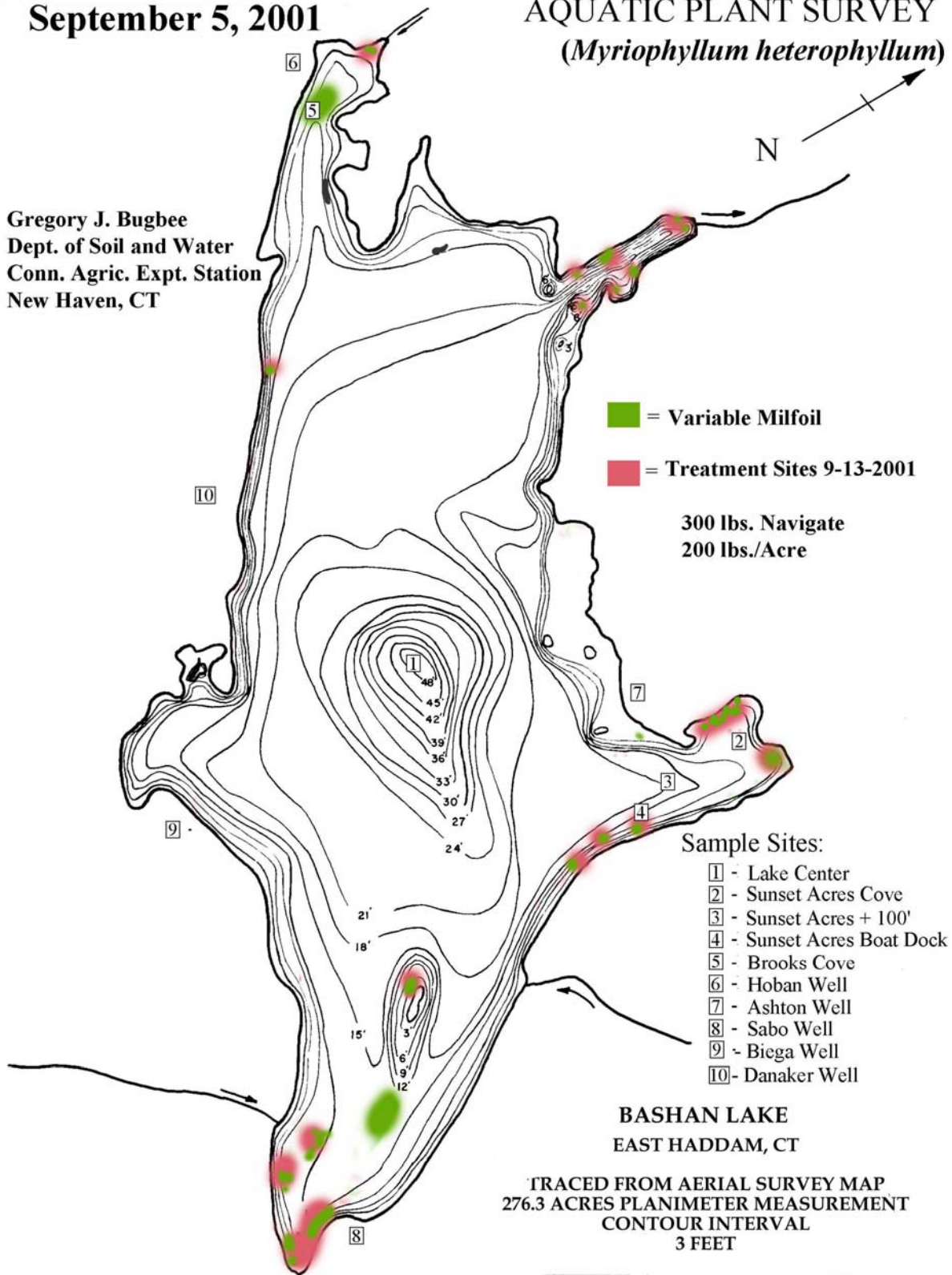
**AQUATIC PLANT SURVEY
(*Myriophyllum heterophyllum*)**



September 5, 2001

AQUATIC PLANT SURVEY
(*Myriophyllum heterophyllum*)

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Conn. Agric. Expt. Station
New Haven, CT



September 27, 2001

AQUATIC PLANT SURVEY
(*Myriophyllum heterophyllum*)

Gregory J. Bugbee
Dept. of Soil and Water
Conn. Agric. Expt. Station
New Haven, CT

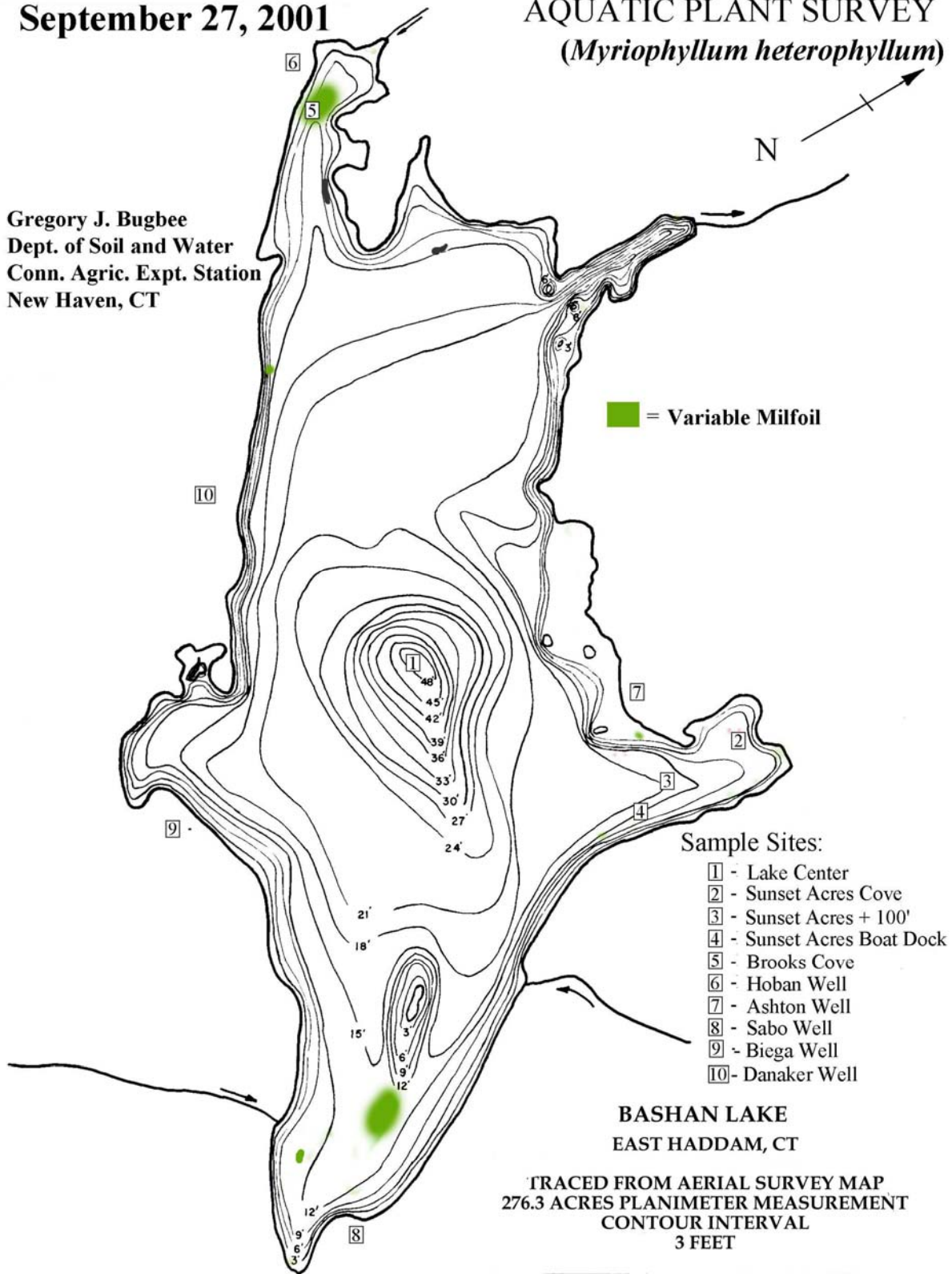
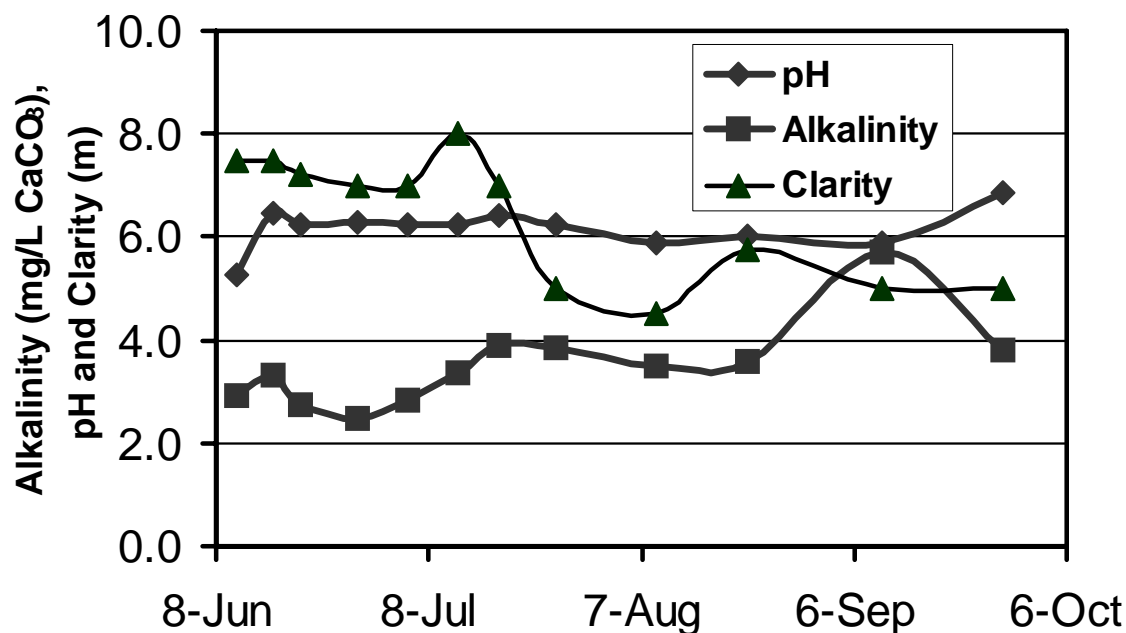


Figure 2: Alkalinity, pH and Clarity in Bashan Lake 2001.



On September 13 Navigate was applied to area of milfoil in Brooks Cove, Laurel Cove, Sunset Acres, the cove by the dam and a few other small patches throughout the lake (see Aquatic Survey Map, September 5). By September 27 (see map), nearly all the milfoil treated on September 13 was eliminated. If control in these areas holds in 2002, the use of Navigate during the late summer or fall could be a valuable tool for controlling milfoil outside the season when lake use is greatest. Where milfoil was eliminated by the June treatments, the bottom was often colonized by bladderwort. In small shallow areas of Laurel Cove the bladderwort reached the surface and was somewhat unsightly. In most other areas it remained close to the bottom and was not a problem.

Water Tests for pH, Alkalinity and Clarity

Because samples taken in June 2000 had pH's from 4.0 – 5.0 and low alkalinity (<5 mg/L CaCO₃), Bashan Lake may be becoming overly acidic. Lake wa-



ter is in less danger of acidification when the pH is above 6.0 and the alkalinity is >20 mg/L. Samples were tested for pH and alkalinity on June 11, 16, 20, 28, July 5, 12, 18, 26, August 9, 22, 11, and September 10 and 27. Sampling depth was 0.5 meters and sites were the same as for 2,4-D. Like samples taken in 2000 the most acidic water occurred in early June (mean pH 5.3). From mid-June thru September the pH generally ranged from 6.0 to 6.5. Alkalinities were very low throughout the testing period (<6 mg/L CaCO₃). The low alkalinities could allow significant changes in the pH of Bashan Lake based on the characteristics of the rainfall and watershed. Water clarity was measured using a Secchi disk at the same time lake water was tested for pH and alkalinity. From mid-June to mid-August water was very clear with Secchi measurements between 7 and 8 meters (20-25 feet). From mid-August thru September water clarity lowered to near 5 meters (15 feet). Bashan Lake continues to be one of the clearest lakes in Connecticut.

2001 Summary

As in 2000, Navigate proved extremely effective at eliminating variable milfoil from treated areas. Even treatments to small patches in September were nearly 100 percent effective. The greatest difficulty is locating all the milfoil particularly in areas where the water is deep. For the third year in a row no contamination of the nearby ground water wells occurred. This confirms that movement of 2,4-D through the lake bottom to wells is unlikely. The irrigation standard of 100 ppb was exceeded for only one week in 2001 compared to one month in 2000, probably because less Navigate was applied over a smaller and more diffuse area. Under this scenario interruption of irrigation with lake water is minimal.

Suggestions for 2002

Milfoil that remains in Brooks Cove and the area between the boat launch and the island should be treated in 2002. The lake should be surveyed for milfoil prior to a May or June treatment. All areas found to contain milfoil during this survey and areas marked on the September 27, 2001 aquatic survey map should be treated in early May. A mid-summer weed survey and mapping should be performed. Uncontrolled milfoil should be treated in early September. This schedule of treatments keeps herbicide treatments out of the peak lake use periods and limits the adverse affects on irrigation. Bashan Lake



should be surveyed and mapped for milfoil in late September. A report similar to this should be prepared and submitted to the BLA, CTDEP and town of East Haddam. If requested by the BLA, CAES will apply for a CTDEP permit to treat Bashan Lake with 1000 pounds of Navigate in 2001. This amount may not be necessary but it is prudent have it permitted just in case. Because the Navigate applications have been quicker acting than might normally be expected and water testing showed low levels of 2,4-D ester offers excellent control, it is suggested the rate of Navigate be lowered to 100 pounds per acre in 2002. This will allow a bag of Navigate to cover twice the area as in 2000 and 2001.

Water testing should be done prior to treatment for; 2,4-D, pH, alkalinity and clarity. These tests should be performed weekly thereafter levels of 2,4-D are below 100 ppb and irrigation can resume. Testing should be conducted in the center of three treatment sites. Samples should be obtained from the surface and near the bottom. The results of water testing for pH and alkalinity should be reviewed by a CTDEP fisheries biologist to determine if a threat exists to fish or other aquatic organisms. Little or no testing of ground water wells is suggested in 2001 because of no detections in 1999, 2000 and 2001. Testing of wells, however, may be required by the CTDEP.



APPENDIX



Public Notification



CAUTION

Lake Treated with Pesticide to Control Milfoil

PESTICIDE NAME: Navigate

DATE APPLIED: June 13, 2001

APPLICATOR: Greg Bugbee

TIME APPLIED: 6:30 – 3:30 PM

Department of Soil and Water

PHONE: 203 974-8512

Connecticut Agricultural Experiment Station

Do Not Use Water for the Following Purposes Until the Date and Time Noted Below:

Swimming or Other Water Contact: *No Restriction*

Fishing: *No Restriction*

Irrigation: *Do Not Use until testing determines water is safe for plants*

Drinking and Cooking: *Do Not Use*

Livestock Watering: *Do Not Use for watering dairy cattle or farm animals.*

Other: *Do Not Use for making pesticide spray solutions*

THIS SIGN MUST REMAIN POSTED UNTIL THE LATEST DATE ABOVE



CAUTION

Lake Treated with Pesticide to Control Milfoil

PESTICIDE NAME: Navigate

DATE APPLIED: June 27, 2001

APPLICATOR: Greg Bugbee

TIME APPLIED: 6:30 – 3:30 PM

Department of Soil and Water

PHONE: 203 974-8512

Connecticut Agricultural Experiment Station

Do Not Use Water for the Following Purposes Until the Date and Time Noted Below:

Swimming or Other Water Contact: *No Restriction*

Fishing: *No Restriction*

Irrigation: *Do Not Use until testing determines water is safe for plants*

Drinking and Cooking: *Do Not Use*

Livestock Watering: *Do Not Use for watering dairy cattle or farm animals.*

Other: *Do Not Use for making pesticide spray solutions*

THIS SIGN MUST REMAIN POSTED UNTIL THE LATEST DATE ABOVE



CAUTION

Lake Treated with Pesticide to Control Milfoil

PESTICIDE NAME: Navigate

DATE APPLIED: September 13, 2001

APPLICATOR: Greg Bugbee

TIME APPLIED: 6:30 – 3:30 PM

Department of Soil and Water

PHONE: 203 974-8512

Connecticut Agricultural Experiment Station

Do Not Use Water for the Following Purposes Until the Date and Time Noted Below:

Swimming or Other Water Contact: *No Restriction*

Fishing: *No Restriction*

Irrigation: *Do Not Use until testing determines water is safe for plants*

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Other: *Do Not Use for making pesticide spray solutions*

THIS SIGN MUST REMAIN POSTED UNTIL THE LATEST DATE ABOVE



Water Testing for 2,4-D, pH and Alkalinity and Clarity



Bashan 2001	2,4-D (ppb)									
	6/11/01	6/16/01	6/20/01	6/28/01	7/5/01	7/12/01	7/18/01	7/26/01	8/9/01	8/22/01
Site (depth 0.5 m)										
Sunset Acres -dock	<2.0	35.1	52.2	17.3	25.6	<2.0	4.0	7.2	4.7	5.7
Sunset Acres -cove	<2.0	12.4	25.3	22.5	13.3	4.5	6	5.4	4.8	6
Sunset Acres - +100'	<2.0		26.4	14.6	11.9	4.2	6.9	4.6	4.2	6.1
Brooks Cove	<2.0	162.6	35.7	14.8	11.4	<2.0	10.2	6.1	4.2	6.1
Center	<2.0	<2.0	<2.0	<2.0	<2.0	6.3	8.2	<2.0	5.8	6.1
Mean	<2.0	52.5	27.9	13.8	12.4	3.0	7.1	4.7	4.7	6.0

Wells

Ashton	<2.0
Biega	<2.0
Danaker	<2.0
Brooks Cove	<2.0
Mean	<2.0



Bashan 2001		pH											
		6/11/01	6/16/01	6/20/01	6/28/01	7/5/01	7/12/01	7/18/01	7/26/01	8/9/01	8/22/01	9/10/01	9/27/01
Site (depth 0.5 m)													
Sunset Acres -dock		5.2	6.6	6.2	6.4	6.3	6.1	6.4	6.2	5.7	5.7		7.7
Sunset Acres -cove		5.2	6.5	6.3	6.3	6.3	6.3	6.3	6.2	6	6		
Sunset Acres - +100'		5.2	6.4	6.3	6.3	6.3	6.3	6.4	6.4	6	6.1		
Brooks Cove		5.2	6.3	6.2	6.3	6.1	6.3	6.5	6.4	6	6.1	5.9	6
Center		5.5	6.5	6.2	6.2	6.2	6.3	6.4	6	5.8	6.1		
Mean		5.3	6.5	6.2	6.3	6.2	6.3	6.4	6.2	5.9	6.0	5.9	6.9

Bashan 2001		Alkalinity (mg/L CaCO3)											
		6/11/01	6/16/01	6/20/01	6/28/01	7/5/01	7/12/01	7/18/01	7/26/01	8/9/01	8/22/01	9/10/01	9/27/01
Site (depth 0.5 m)													
Sunset Acres -dock		2.8	3.6	2.3	2.3	2.7	3.1	3.6	3.4	3.5	2.6		
Sunset Acres -cove		3.3	3.3	2.9	2.4	2.8	3.5	4.1	3.6	3.1	4.8		
Sunset Acres - +100'		2.9	3.1	2.3	2.7	3.1	3.3	3.7	3.7	3.2	3.5		
Brooks Cove		2.7	3.5	2.8	2.5	2.7	3.5	3.9	4.1	3.5	3.6	5.7	3.8
Center		3	3.1	3.5	2.6	2.8	3.5	4.2	4.4	4.2	3.5		
Mean		2.9	3.3	2.8	2.5	2.8	3.4	3.9	3.8	3.5	3.6	5.7	3.8

Bashan 2001		Secchi (m)											
		6/11/01	6/16/01	6/20/01	6/28/01	7/5/01	7/12/01	7/18/01	7/26/01	8/9/01	8/22/01	9/10/01	9/27/01
Center		7.5	7.5	7.2	7	7	8	7	5	4.5	5.75	5	5



