Mt. Kemble Lake

Environmental Survey: Aquatic Flora

INTERIM REPORT

by

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INTRODUCTION

Mount Kemble Lake is used exclusively for the recreational purposes of local residents. In the past this man-made lake has experienced aquatic plant disturbances of nuisance of near-nuisance variety during the summer months. Although the exact nature of these aquatic plants has never been established, Mt. Kemble Lake has been treated with copper sulfate as a control measure. Copper sulfate is used exclusively as an algicide and would be ineffective as an herbicide directed against higher plants. Excessive application of $CuSO_4$ can prove harmful to aquatic fauna (e.g., fish), disturb normal ecological cycles, and sometimes leads to aquatic disturbances more severe than that which was originally encountered.

The primary objective of this survey is to establish a record of the aquatic plant life (including phytoplankton, attached and floating flora) during the spring and summer months of 1978. Documentation of any existing nuisance disturbances will permit estimation of the ecological status of Mt. Kemble Lake and suggest methods of prevention and/or control in order to ensure the continued viability of this surface water resource.

MATERIALS AND METHODS

Three sampling stations were established in Mt. Kemble lake. The locations of these stations are indicated in Figure 1. Beginning in April 1978 surface water samples were collected at these three sites at approximately two week intervals. Surface and bottom temperatures were also recorded at each sampling station. Water samples were collected in 1.0 liter opaque polyethylene containers and refrigerated prior to analysis.

At each sampling date Mt. Kemble Lake was observed by rowboat and from the shoreline. Macroscopic plant material was separately collected whenever such was available.

Water temperature at the Breeder Pond was also routinely recorded; macroscopic plant material was also collected from this location when available.

The pH of each water sample was determined by use of a Kelway portable pH meter. Water turbidity was also observed.

Following collections, analysis of phytoplankton samples and macroscopic plant material was made within 24 hours. Water samples were concentrated at less than 75 millimeters of mercury vacuum and collected on 0.45 uM pore-size Millipore filters. Following filter collection, phytoplankton populations were quantitatively and qualitatively analyzed by microscope using an AO Bright-Line Hemacytometer.

FIGURE 1. Location of sampling sites

Mt. Kemble Lake

Location of Sampling Sites

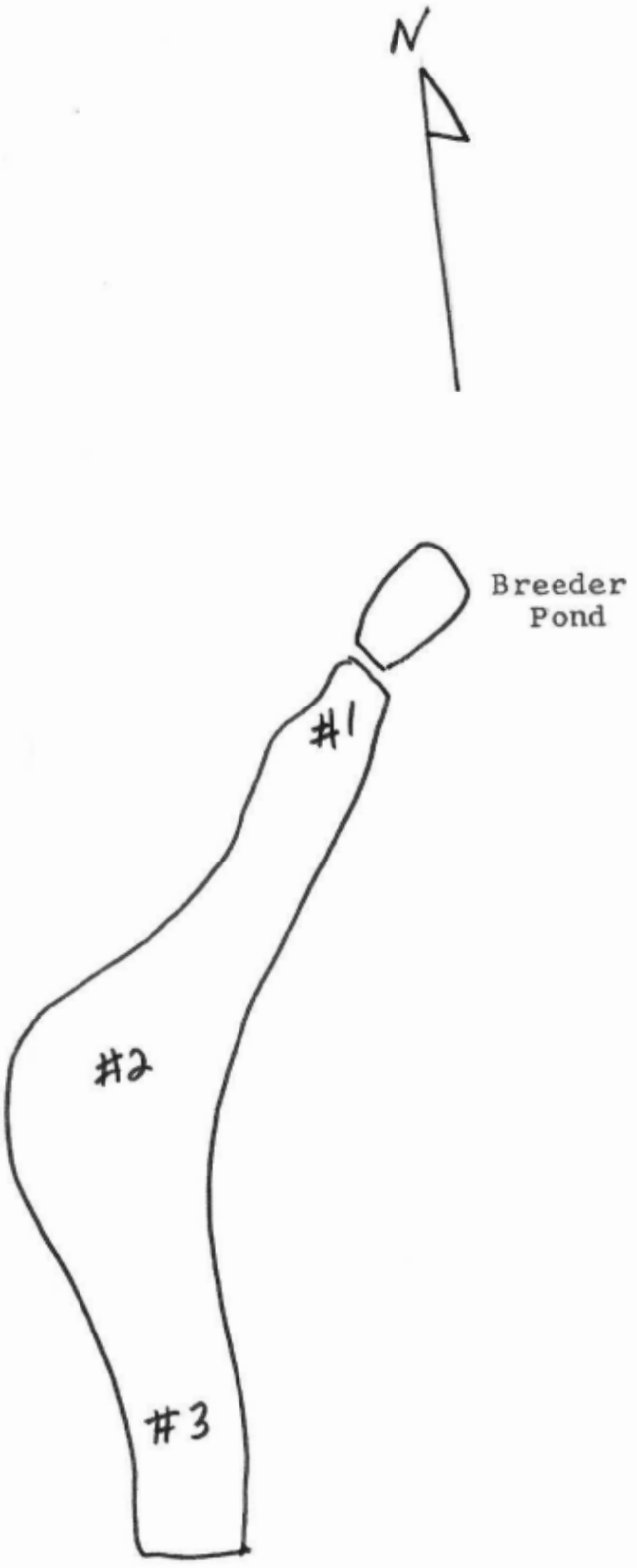

Fig. 1

RESULTS

Observations of Mt. Kemble Lake at the time of sample collection are presented in Table 1.

Temperature data for both surface and bottom lake waters at the various sampling locations are presented in Table 2.

Recorded pH values at sampling locations are enumerated in Table 3.

The results of phytoplankton counts at three sampling sites are presented in Table 4.

TABLE 1. Recorded observations of Mt. Kemble Lake at selected sampling dates.

TABLE 1.

25 April 1978. 4:00 pm

Sampling locations were established. Station #1 is in the northern shallow lake area adjacent to the Breeder Pond. Station #2 is opposite the main bathing beach. Station #3 is at the southern terminal end of the lake. The water level is low. Station #1 had an average depth of approximately 1 or 2 feet.

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10 May 1978. 4:00 pm

There is a moderate-sized bloom of Spirogyra sp. in the Breeder Pond. A few "clumps" of this alga are also found in the vicinity of Station #1 but appear to have been washed over from the Breeder Pond. Visibility in the Lake is between five and six feet. The water level is significantly higher than it was two weeks ago. There has been rain in the interim. The water level can be artificially controlled. The depth at Station #1 is approximately 3 feet vs approximately 1 foot at last sampling. There is not a great difference in depth between Station #1 and the Breeder Pond.

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25 May 1978. 4:00 pm

The Spirogyra bloom is still in progress in the Breeder Pond. Floating masses of this algo were observed passing over the dam into the upper portion of Mt. Kemble Lake. Clumps of Spirogyra were observed in the vicinity of Station #1 and appear to have been derived primarily from Breeder Pond inocula. The depth of the Lake at Station #1 is now approximately 3 feet. Water Temperature is not noticeably warmer at this point. It appears as if a portion of the algal bloom is dying as some detritis is evident at Station #1 and is usually associated with algal mats. Water is turbid. No odors are evident. The bloom of Spirogyra sp. is not yet of severe nuisance variety. There has been considerable rain in recent weeks. The water level of the lake is high.

Normal phytoplankton present. Asterionella bloom has died-out. More flagellates present.

TABLE 1. (cont.)

12 June 1978. 10:00 am

The Spirogyra bloom is still contained almost entirely to the Breeder Pond and is growing in submerged bottom mats. This alga covers most of the bottom of the Breeder Pond. No floating algal nuisance. No odors. There has been considerable rain in the last week which presumably provided enhanced flushing of the Lake. Phytoplankton counts (quantitative and qualitative aspects) appear quite normal for a dystrophic lake of this sort. Scenedesmus is becoming a dominant member of the phytoplankton. The temperature of the surface waters has warmed up considerably and stratification is evident in the deep water portions of the Lake. Healthy turtle population in the Breeder Pond.

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29 June 1978 1:00 pm

The Breeder Pond continues to maintain the bloom of Spirogyra sp. Bottom "clouds" are present and some surface clumps can be noticed.

Growth of Spirogyra spp. has progressed in the vicinity of Station #1. Quite noticeable bottom "clouds" of this organism are now present and surface clumps of reproducing and older material are commonly visible. Some bottom growth of Spirogyra can now be located along the eastern border of the Lake almost as far as Station #2, but this is not yet a nuisance. The western lake border in this same area is clear; the depth appears to be generally greater perhaps accounting for this distribution contrast.

The clarity of the water in the vicinity of the main bathing beach continues to be quite good. The only algal problem exists in the northern shallow portion of the lake adjacent to the Breeder Pond (i.e., Station #1).

Normal phytoplankton counts were obtained. Stratification evident at Station #2 and Station #3.

TABLE 2. Temperature profile.

TABLE 2.

DATE	Breeder Pond		Station #1		Station #2		Station #3	
	surface	bottom	surface	bottom	surface	bottom	surface	bottom
4/25/78			58 F (14.4 C)		58 F (14.4 C)	53 F (11.7 C)	59 F (15 C)	51 F (10.5 C)
5/10/78	54 F		57 F (13.9 C)	57 F (13.9 C)	57 F (13.9 C)	51 F (10.5 C)	57 F (13.9 C)	51 F (10.5 C)
5/25/78			63 F (17.2 C)	59 F (15 C)	63.5 F (17.5 C)	56 F (13.3 C)	64 F (17.8 C)	53 F (11.7 C)
6/12/78	63.5 F		72 F (22.2 C)	69 F (20.6 C)	72 F (22.2 C)	52 F (11.1 C)	72.5 F (22.5 C)	52 F (11.1 C)
6/29/78			81 F (27.2 C)	76 F (24.4 C)	79 F (26.1 C)	53.5 F (11.9 C)	79 F (26.1 C)	58 F (14.4 C)

TABLE 3. pH values of water samples

TABLE 3.

DATE	Station #1	Station #2	Station #3
4/25/78	6.9	6.9	7.4
5/10/78	6.9	6.9	6.9
5/25/78	6.9	6.9	6.9
6/12/78	6.9	7.0	7.0
6/29/78	7.0	7.0	7.0

TABLE 4. Phytoplankton counts

TABLE 4.

Cells·ml^{-1}

ORGANISM / DATE	4/25/78			5/10/78			5/25/78			6/12/78			6/29/78		
Station #	1	2	2	1	2	3	1	2	3	1	2	3	1	2	3
Asterionella	80	15900	11900	1500	2470	2000	83	-	-	-	-	-	-	-	-
Fragillaria	470	160	80	361	139	-	-	-	-	-	56	56	-	-	-
Misc. Unicells	220	310	170	278	220	420	778	833	806	611	472	583	440	1310	292
Scenedesmus	100	550	550	55	417	810	778	500	389	2280	2670	1920	220	-	83
Misc. Centrate Diatoms	55	55	55	56	11	-	83	1940	139	83	111	27.8	56	139	13.9
Misc. Pennate Diatoms	300	110	139	528	250	28	56	28	0	56	83	111	56.6	0	56
Navicula	220	360	830	110	28	56	389	83	56	27.8	-	-	83	28	-
Tabellaria	220	110	-	56	-	28	83	-	-	250	83	-	167		
Cymbella	83	-	-	56	-	83	306	-	-	-	-	-	-	-	-
Diatoma	30	-	-	-	-	28	56	-	-	-	-	-	-	-	-
Synedra	190	190	140	56	639	1000	222	111	1670	0	27.8	27.8	-	-	13.9
Nitzschia	-	-	-	28	-	-	-	-	-	-	-	-	-	-	-
Closterium	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ankistrodesmus	-	83	140	167	167	139	80	28	-	139	250	310	194	83	111
Misc. Desmids	-	60	30	28	28	-	-	-	-	56	83	139	-	28	28
Chlorella	60	-	60	139	83	139	1940	9170	220	472	222	194	310	361	210
Micratinium	-	-	-	56	-	-	56	111	83	139	444	-	28	140	
Flagellates- Misc.	-	-	-	56	28	28	22	111	361	-	-	-	-	28	-
Chlamydomonas	-	-	-	-	-	-	-	306	833	28	-	-	-	-	-
Chodatella	-	-	-	-	-	-	-	-	-	-	-	-	83	56	28
Oocystis	-	-	-	-	-	-	-	-	-	-	-	-	222	1390	1030

DISCUSSION

The following discussion should be interpreted as a preliminary description and partial interpretation of data gathered from 25 April 1978 through and including June 1978. Final analysis of the overall status of Mt. Kemble Lake's flora must be reserved until the survey is completed.

(A.) Phytoplankton Periodicity.

To date phytoplankton populations have been observed at all collection sites which are normal for a dystrophic man-made lake with adjacent moderate development. The terminal end of a presumed winter bloom of the diatom Asterionella was observed on 25 April and 10 May 1978. This macroscopic planktonic alga is a common lake inhabitant and usually reaches maximum populations in mid-winter and subsequently declines to form a minor portion of the summer's phytoplankton.

The colonial green alga Scenedesmus has been repeatedly observed as a significant portion of the phytoplankton. This alga experienced a pulse on 12 June (c.f., Table 4). Scenedesmus is generally regarded as a pollution-tolerant organism which usually can be found in high concentrations in enriched freshwater systems. At this point, the observed populations of Scenedesmsu suggest moderately-rich nutrient supplies. Since the genus Scenedesmus exhibits polymorphism, unequivocal identification of species is difficult when working with field collections. The predominant

Scenedesmus species appear to be S. quadricauda and S. obliquus.

The unicellular green alga Chlorella has been frequently encountered in the phytoplankton in large but not bloom concentrations. As with Scenedesmus, this surface water alga is capable of forming a bloom- most frequently doing so during the summer months.

A lake such as Mt. Kemble is normally capable of supporting large mixed groups of aquatic algae. The common algal forms are found in surface waters where light is present in sufficient intensity to permit these organisms to carry on active photosynthesis. Some species of algae are capable of developing abundant populations at depths of 10 or 20 or more feet below the surface, but this is not normally expected. Most surface algae do not grow well below three or four feet of water. A reasonable number of various kinds of common phytoplanktonic organisms is indicative of a balanced biological condition. To date the phytoplankton of Mt. Kemble Lake appear well within normal limits & do not present nuisance problems.

If one group of algae predominates (i.e., green algae, diatoms, blue-green algae) and diversity is low, undesireable biological conditions are usually present. Large populations of blue-green algae, which have not to date been observed in Mt. Kemble Lake, are perhaps the most serious nuisance algae & frequently indicate that the water has been enriched with organic matter or that previously there has been a superabundance of

diatoms. Large populations of green algae (i.e., Scenedesmus Chlorella, Spirogyra etc.) are often encouraged by the addition of mineral fertilizers (i.e., nitrates & phosphates). Many surface waters are sufficiently rich in the essential nutrients so that these chemicals do not always become limiting factors in determining the abundance of algae. Other factors such as turbidity, water temperature, predation, parasitism etc. may be more critical. Although it is generally assumed that physical and chemical factors in the environment most frequently determine the amount of algal production, the exact relationships remain obscure in many respects.

(B.) Algal Blooms.

An algal bloom is usually described as a concentrated growth or aggregation of plankton which is sufficiently dense so as to be readily visible. The only bloom organism encountered to date is the filamentous green alga Spirogyra. This alga has been observed in steadily increasing concentrations since 10 May 1978. Spirogyra normally grows as bottom green "clouds" in shallow waters which in later stages of growth can become surface "mats" or "blankets." These surface growths cause an unsightly appearance and may cause taste and odor problems or interfer with bathing. Sometimes mat forming algae are resistant to effective treatment with copper sulfate.

Spirogyra spp. forming bottom "clouds" and surface "mats" were first observed in the Breeder Pond in early Spring. Clumps of Spirogyra feel to the touch like threads of

silk. Growth of Spirogyra has become extensive in the Breeder Pond and numerous surface mats are present. During May and June Spirogyra spp. have spread to shallow waters in the vicinity of Station #1 and along the eastern border of the Lake almost as far as Station #2. Eastern border growth is not extensive. Growth of this organism cannot yet be regarded as a nuisance in Mt. Kemble Lake proper, but the treat of continued surface growths eventually reaching nuisance proportions and contaminating the main bathing beach remains.

It should be noted that Spirogyra growth first began in the shallow waters of the Breeder Pond, while seemingly comparable physical conditions (i.e., depth & water temperature) simultaneously existed in the adjacent waters of Station #1. This is suggestive of at least two explanations: (1.) chemical enrichment in the Breeder Pond -either from land leaching, sediment contributions, or feeder stream effluent; (2.) increased amounts of reproductive material (i.e., zygospores) ramaining in the Breeder Pond from last season's growth. It is obvious that sedimentation from the feeder stream to Mt. Kemble Lake is excessive. This suggests upstream soil erosion problems on the watershed. This sedimentation contributed to the growth of nuisance Spirogyra mats at least in part by providing the shallow physical environment which this alga prefers and perhaps enriching essential plant nutrients thereby providing the fertile chemical environment which this alga is known to prefer. Spirogyra is a common polluted water organism.

(C.) Higher Plant Blooms.

None have yet been observed.

(D.) Prevention and Control of Unwanted Algal Blooms and Other Nuisance Aquatic Plants.

Preliminary considerations:

(1.) Copper Sulfate
(2.) Herbicides
(3.) Dredging (Breeder Pond & Station #1)
(4.) Plant Harvesting
(5.) Septic Systems
(6.) Watershed Management

Extended discussion of the above-mentioned factors will be deferred until the Final Report pending aquisition of additional field data.