

AQUATIC VEGETATION
REPORT FOR
WEQUAQUET LAKE
(Including Gooseberry & Berses Pond)
BARNSTABLE, MASSACHUSETTS
2010



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Introduction

Lake Characteristics

Wequaquet Lake is a 654-acre lake located on Cape Cod in the town of Barnstable, Massachusetts. The lake has a maximum depth of 34 feet, with an average depth of approximately 12 feet. It includes three distinct basins – the main lake (which may be broken into north and south portions), Bearses Pond, and Gooseberry Pond. The lake is fed by watershed runoff and groundwater. Water flows out of Wequaquet Lake over a dam at Phinney’s Lane to the south, and continues south through a dug herring run to Long Pond where it eventually joins the Centerville River estuary system.

The nearly 7.5-mile shoreline is heavily developed with year-round and seasonal housing as well as several commercial properties. The lake is used for recreational purposes – swimming, fishing, and boating – by the residents and visitors of the lake, as well as the general public. The Town of Barnstable maintains a boat ramp and small parking area along Shootflying Hill Road.

Fanwort

Fanwort (*Cabomba caroliniana*) is a non-indigenous species which grows rapidly, branching profusely at the surface where it can form dense floating mats, choking and shading out all other plants in the area. If allowed to propagate unhampered, infestations render waters unsuitable for boating, swimming, fishing, and other recreational uses. Growth of this species can be detrimental to the ecology of a water body.

- This species may reduce biodiversity by out-competing native species which provide food and shelter to fish and wildlife
- Mats, leaves, and flowers that reach the surface of the water can hamper recreational activities. These limitations on water use can negatively impact real estate values and recreation.
- Dense vegetative growth associated with these species can reduce sunlight and oxygen available to beneficial, low-growing, indigenous species as well as fish.
- Natural decay of these species (especially in large quantities) can cause a significant decrease in availability of oxygen in the water column, creating the potential for fish kills and harmful conditions for other wildlife, both during the summer and in the winter under the ice.

History of Fanwort in Wequaquet Lake

Fanwort has been known to exist in Wequaquet Lake for the past decade. Several management strategies including hand harvesting by SCUBA divers and herbicide treatments have been undertaken in areas of Bearse Pond, Gooseberry Pond, and along Johnson’s Lane in the main part of the lake. Although management of fanwort with herbicides has been seasonally successful, growth continues in several areas of the lake.



Survey Methods

Collection of quantitative data is an important element of environmental management. Quantitative data provides an objective analysis of management requirements and outcomes, while allowing comparability of data between multiple observers. Data collection for management of aquatic vegetation may use point intercept methods, line intercept methods, or a combination thereof. Due to the large size of Wequaquet Lake, the point intercept method was chosen as the primary data collection technique. This method allows for analysis of many points, providing an accurate representation of species presence/absence, as well as species diversity. A shoreline survey of the lake's littoral zone was also conducted in order to locate any invasive species which may be present.

Point Intercept Method

Prior to the survey, an 80 m (~260 ft) grid was generated and applied to the outline of Wequaquet Lake to locate a total of 88 survey points. The 88 points were uploaded to a high-sensitivity GPS unit, and printed on data sheets for use in the field.

During the survey, a boat was used to navigate to each predetermined point. The following data was collected at each point:

Species Identification

The rake toss method, based on protocols developed by Cornell University, was used to retrieve submersed aquatic vegetation. Two rake tosses were done at each point, one on either side of the survey vessel. Each species found on the rake was identified and recorded. Plant species observed in the immediate area, but not found on either rake toss were also recorded. Any species not readily identified *in situ* was placed into a plastic bag labeled with the data point number and returned to the lab for further analysis.

Relative Abundance

The abundance scale, developed by the US Army Corps of Engineers and modified by Cornell, was used to categorize total growth of each species.

Notation	Description
Z	<i>Zero</i> : no plants on rake
T	<i>Trace</i> : fingerful on rake
S	<i>Sparse</i> : handful on rake
M	<i>Moderate</i> : rakeful of plants
D	<i>Dense</i> : difficult to bring into boat

Percent Cover

Percent cover is defined as the percent of bottom sediments obscured by vegetation. In general, an area in which no sediments are visible is classified at 100% cover; at times however bottom sediments are not visible due to water clarity, regardless of vegetative growth. These points were given a null (\emptyset) designation, for data recording purposes.

Biomass Index

The biomass for each data point was recorded on a scale from zero to four. In areas where growth in the water column was not visible, biomass index was inferred based on the growth characteristics.



0	No biomass	No plants
1	Low biomass	Very low growth
2	Moderate biomass	Growth extending up, into water column
3	High biomass	Growth in water column and possibly to surface, may be considered a recreational or habitat nuisance
4	Very high biomass	Growth filling the water column and covering the surface

Invasive Species Percentage

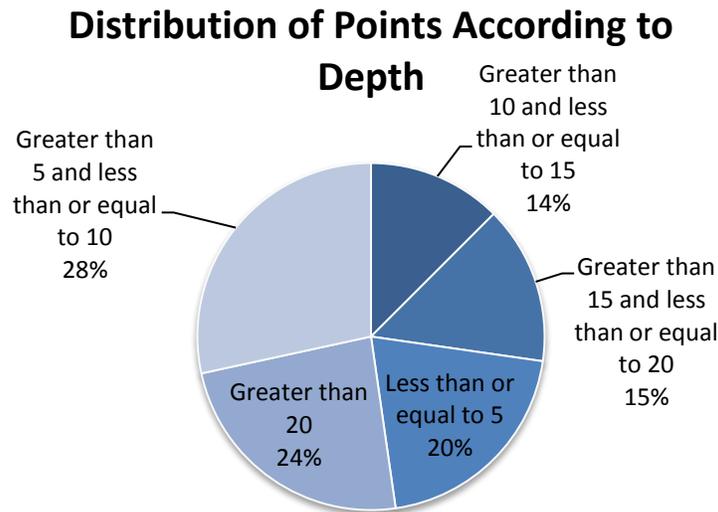
The immediate area around the boat was observed for growth of invasive species and each point was assigned a percentage.

Invasive Species Bed Identification

In order to identify target species bed perimeters, a boat was used to navigate around the lake while surveyors recorded the visual density of each bed. A GPS unit was used to track the boat as it moved around plant beds. This GPS track was then uploaded to an ESRI mapping program and used to develop maps detailing the overall Fanwort, Milfoil, and Hydrilla situation in the lake including relative densities of beds.

Survey Results

The 88 randomly generated September survey points were located in depths between two and 31 feet. Approximately fifty-six percent (56%) of these points were located within the littoral zone (less than 15 ft. deep) where aquatic vegetation is generally found, as light is able to penetrate to the bottom of the water body.



Distribution of Points According to Depth (September 2010)



A total of fourteen (14) species of rooted aquatic macrophytes were identified at the time of the evaluation. Tape Grass (*Vallisneria americana*) was the most prevalent species, occurring at 17% of the points surveyed, followed by Claspingleaf Pondweed (*Potamogeton perfoliatus*), and Coontail (*Ceterophyllum demersum*). Fanwort was present at one survey point in Bearse Pond.

Table 1: Aquatic Vegetation and Frequency of Occurrence

Species	Common Name	Number of Occurrences	Frequency of Occurrence (%)
<i>Vallisneria americana</i>	Tape Grass	19	17
<i>Potamogeton perfoliatus</i>	Claspingleaf Pondweed	17	15
<i>Ceterophyllum demersum</i>	Coontail	16	14
<i>Nitella</i>	Stonewort	15	13
<i>Potamogeton robbinsii</i>	Fern-Leaf Pondweed	13	11
<i>Potamogeton pusillus</i>	Tiny Pondweed	5	4
<i>Elodea canadensis</i>	American Waterweed	5	4
<i>Utricularia</i> spp.	Bladderwort	3	3
<i>Musci</i>	Aquatic Moss	3	3
<i>Potamogeton epihydrus</i>	Ribbon-Leaf Pondweed	2	2
<i>Isotes</i>	Quillwort	2	2
<i>Elodea nuttallii</i>	Eastern Waterweed	1	1
<i>Cabomba caroliniana</i>	Fanwort	1	1
<i>Najas</i>	Bushy Pondweed	1	1

Maps showing relative abundance of each observed species are included in Appendix A (Figure 4 A-D).



Image 1: Claspingleaf Pondweed and Coontail



Image 2: Tape Grass

In general, vegetative coverage throughout the littoral zone was considered light (0-25% coverage), with areas of moderate to dense growth isolated to shallow coves. The majority of plant growth was found in depths up to eighteen (18) feet, with an average of twelve (12) feet. Plant density and biomass was generally low, with no biomass at survey points exceeding three (3) (Figure 2).

Distribution of Invasive Species

The three species of concern in this water body, due to historical presence or presence in local water bodies, are Variable Milfoil, Hydrilla, and Fanwort. As discussed above, the entire shoreline of Wequaquet Lake was surveyed for presence of these three invasive species; however only Fanwort was observed.

Beds of Fanwort are located in Bears Pond and along Johnson's Lane in the northern portion of the main body of Wequaquet Lake. There are currently five (5) distinct bed locations. These areas are mostly isolated to coves and individually do not exceed 1.5 acres (Figure 5 A & B). Densities within these areas vary from light to heavy with areas of 60-70% coverage most common.



Image 3: Fanwort on rake

Point	Latitude	Longitude	Depth	Percent Cover	Biomass Index	Percent Invasive	Potamogeton epihydrus	Potamogeton perfoliatus	Vallisneria americana	Ceratophyllum demersum	Nitella	Potamogeton pusillus	Elodea canadensis	Elodea nuttallii	Potamogeton robbinsii	Utricularia	Musci	Isotes	Cabomba caroliniana	Naiad	Filamentous algae
1	41.660470	-70.335389	4.0	10	1	0	S	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	41.662411	-70.340157	6.0	10	2	0	-	S	-	-	-	-	-	-	-	-	-	-	-	-	-
3	41.662066	-70.337700	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	41.662041	-70.335299	6.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	41.662017	-70.332898	5.0	30	2	0	-	M	M	-	-	-	-	-	-	-	-	-	-	-	-
6	41.663940	-70.344871	12.0	30	2	0	-	M	T	M	-	-	-	-	-	-	-	-	-	-	-
7	41.663916	-70.342470	7.0	25	3	0	-	M	-	-	-	-	-	-	-	-	-	-	-	-	-
8	41.663891	-70.340069	7.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	41.663867	-70.337668	4.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	41.663842	-70.335267	16.0	u	1	0	-	-	T	-	M	-	-	-	-	-	-	-	-	-	-
11	41.663817	-70.332865	4.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	41.665740	-70.344839	21.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	41.665716	-70.342438	25.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	41.665692	-70.340036	5.0	-	-	-	-	-	-	-	-	T	T	-	-	-	-	-	-	-	-
15	41.665667	-70.337635	10.0	u	3	0	-	H	S	-	-	-	-	-	-	-	-	-	-	-	T
16	41.665642	-70.335234	13.0	30	3	0	-	M	T	T	-	-	T	-	-	-	-	-	-	-	-
17	41.665618	-70.332833	22.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	41.665593	-70.330432	17.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	41.665625	-70.329065	7.0	10	2	0	-	T	-	-	-	-	-	-	-	-	-	-	-	-	-
20	41.667541	-70.344806	5.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	41.667517	-70.342405	27.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	41.667492	-70.340004	31.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	41.667468	-70.337602	22.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	41.667443	-70.335201	4.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	41.667418	-70.332800	20.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	41.667394	-70.330399	21.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
27	41.667369	-70.327997	9.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	T
28	41.669342	-70.344774	7.0	30	3	0	-	M	-	-	-	-	-	-	-	-	-	-	-	-	-
29	41.669317	-70.342372	25.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	41.669293	-70.339971	20.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	41.669268	-70.337570	25.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
32	41.669244	-70.335168	12.0	u	1	0	-	-	T	-	T	-	-	-	-	-	-	-	-	-	-
33	41.669219	-70.332767	8.0	95	3	0	-	H	T	-	T	-	-	-	T	-	-	-	-	-	-
34	41.669194	-70.330366	2.0	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
35	41.669170	-70.327964	13.0	u	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	T
36	41.669145	-70.325563	17.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
37	41.671166	-70.347143	16.0	u	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	T
38	41.671142	-70.344741	24.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
39	41.671118	-70.342340	16.0	u	2	0	-	-	-	T	T	-	-	-	M	-	-	-	-	-	-
40	41.671093	-70.339938	18.0	60	3	-	-	M	-	T	-	-	-	-	M	-	-	-	-	-	-
41	41.671069	-70.337537	12.0	-	-	-	-	T	S	T	-	T	-	M	-	-	-	-	-	-	-
42	41.671044	-70.335136	21.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
43	41.671020	-70.332734	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
44	41.670995	-70.330333	4.0	20	1	0	-	-	T	-	T	-	-	-	-	-	-	-	-	-	-
45	41.670970	-70.327931	10.0	-	-	-	-	-	-	-	T	D	-	-	-	T	-	-	-	-	-
46	41.670945	-70.325530	9.0	u	1	0	-	-	-	-	-	-	-	-	-	-	T	-	-	-	-
47	41.670923	-70.323372	7.0	30	1	0	-	-	S	-	-	-	-	-	-	S	-	-	-	-	-
48	41.673623	-70.348769	9.0	u	2	0	-	T	-	T	T	-	-	-	T	-	-	-	-	-	-
49	41.672967	-70.347110	12.0	u	3	0	-	-	-	T	T	-	T	-	T	-	-	-	-	-	-

Point	Latitude	Longitude	Depth	Percent Cover	Biomass Index	Percent Invasive	Potamogeton epihydrus	Potamogeton perfoliatus	Vallisneria americana	Ceratophyllum demersum	Nitella	Potamogeton pusillus	Elodea canadensis	Elodea nuttallii	Potamogeton robbinsii	Utricularia	Musci	Isotes	Cabomba caroliniana	Naiad	Filamentous algae	
50	41.672943	-70.344709	25.0	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
51	41.672918	-70.342307	19.0	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
52	41.672894	-70.339906	9.0	20	2	0	-	-	T	-	-	-	T	-	T	-	-	-	-	-	-	
53	41.672869	-70.337504	8.5	20	2	0	-	-	T	S	-	-	-	-	T	-	-	-	-	-	-	
54	41.672845	-70.335103	5.0	50	2	0	-	-	-	-	-	-	-	-	M	-	-	-	-	-	-	
55	41.672820	-70.332701	3.0	10	1	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
56	41.672795	-70.330300	16.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
57	41.672364	-70.323894	5.0	60	3	0	-	-	T	-	T	M	-	-	-	-	-	-	-	-	-	
58	41.674792	-70.349479	10.0	10	1	0	-	-	-	T	T	-	-	-	-	-	-	-	-	-	-	
59	41.674768	-70.347078	23.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
60	41.674743	-70.344676	21.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
61	41.674719	-70.342275	21.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
62	41.674694	-70.339873	8.0	u	2	0	-	-	T	-	-	-	-	-	-	-	-	-	-	-	-	
63	41.674876	-70.334753	14.0	20	2	0	-	-	-	T	T	-	-	-	-	-	T	-	-	-	-	
64	41.674621	-70.332668	10.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
65	41.674596	-70.330267	10.0	20	2	0	-	T	T	-	T	-	-	-	-	-	-	-	-	-	-	
66	41.676607	-70.350873	4.2	10	2	0	-	-	-	-	-	-	-	-	-	-	T	T	-	-	-	
67	41.676592	-70.349447	13.0	u	2	-	-	-	-	M	-	-	-	-	T	-	-	-	-	-	-	
68	41.676568	-70.347045	24.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
69	41.676544	-70.344644	23.4	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
70	41.676519	-70.342242	27.0	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
71	41.676495	-70.339840	9.0	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
72	41.677022	-70.337794	7.0	60	3	0	-	M	T	-	-	-	-	-	T	-	-	M	-	-	-	
73	41.676446	-70.335037	12.0	60	3	30	-	-	-	-	-	-	-	-	-	H	-	-	M	T	-	
74	41.676421	-70.332635	18.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
75	41.677368	-70.331435	20.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
76	41.677814	-70.350913	3.0	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
77	41.678393	-70.349414	8.3	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	T	
78	41.678369	-70.347013	24.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
79	41.678344	-70.344611	24.7	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
80	41.678320	-70.342209	23.5	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
81	41.678302	-70.340417	3.5	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
82	41.679198	-70.334256	7.0	80	3	0	-	H	-	T	-	-	-	-	H	-	-	-	-	-	-	
83	41.678222	-70.332603	16.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
84	41.678208	-70.331237	6.0	-	-	-	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
85	41.679804	-70.346987	7.0	-	-	-	-	-	M	-	-	-	-	-	-	-	-	-	-	-	-	
86	41.680145	-70.344578	4.5	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
87	41.680120	-70.342177	14.0	u	2	0	-	-	-	M	-	-	-	-	-	-	-	-	-	-	-	
88	41.680096	-70.339775	12.0	u	2	0	-	-	-	T	T	T	-	-	-	-	-	-	-	-	-	
							Trace	0	4	12	10	12	3	4	0	7	1	3	1	0	1	5
							Sparse	1	1	3	1	0	0	0	0	1	0	0	0	0	0	0
							Moderate	1	7	2	3	1	1	0	1	3	0	0	1	1	0	0
							Heavy	0	3	0	0	0	0	0	1	1	0	0	0	0	0	0
							Total	2	15	17	14	13	4	4	1	11	3	3	2	1	1	5
							Percentage	2	17	19	16	15	5	5	1	13	3	3	2	1	1	6