The Beaver Lake Monitor

A publication of the Beaver Lake Management District Advisory Board

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Beaver Lake Aquatic Plant Survey

Introduction

A Beaver Lake Monitor article last spring highlighted the importance of native aquatic plants to lake ecosystems as well as the dangers of non-native plants invading lakes. Following up on that idea, the BLMD asked King County Lake Stewardship Program (KCLSP) staff to survey Beaver Lakes for aquatic and shoreline plants. The resulting survey was carried out on August 27, 2008.

The survey was structured similar to a King County effort in 1994-95, in which 36 lakes around the county were divided into shoreline sections and assessed for aquatic plant species and distributions. Both Beaver Lake basins in 2008 were assessed by the same eight survey sections and by methods similar to the 1995 report, with the exception that Beaver-1 (north basin) was split into two sections, 6A and 6B, to separate the wetland shoreline from the residentially developed shorelines. Armed with maps, a GPS, a weed rake, and a viewing tube, the KCLS staff started in section 1 (Figure 1) and proceeded clockwise around the lake, ending back at the boat launch.

Figure 1. Sections surveyed for aquatic plants around Beaver Lake

Results

A wide variety of submersed plants were found in the lake, with the natives *Potamogeton robinisii* (Fern-leaf pondweed) and *P. pusillus* (Small-leaf pondweed) being the most widespread throughout the lake basins.

Bladderwort (*Utricularia spp*), a free floating plant usually found in shallow water margins, was also abundant, especially in the channel connecting the two basins. Bladderwort can easily be misidentified as watermilfoil, but during this survey the only watermilfoil found in the lake was a native milfoil (*Myriophyllum spp*), not the invasive Eurasian water milfoil. No invasive milfoils have been found in Beaver Lake to date, thankfully!

The most abundant plant in the lake was the invasive floating-leaved plant called *Nymphaea odorata* (fragrant water-lily). The waterlilies were found in almost every section, although there were lower densities in Sections 4, 6B and 7. In those sections the native yellow-flowered water lily, *Nuphar luteum*, was common. The common watershield, *Brasenia schreberi*, was also abundant in six of the eight sections.

There were numerous emergent plants along the shoreline including cattails, various rushes and sedges, and a few non-native species that are commonly found along lake shorelines in our region, including yellow-flag iris (*Iris pseudacorus*) and reed canary grass (*Phalaris arundinacea*).

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Beaver Lake Aquatic Plant Survey *Continued from Page 1*

Discussion

The survey was an excellent way to tabulate the plants found growing in and on the margins of Beaver Lake at this time, and it was good to discover that no other invasive plants were present beyond the ubiquitous yellow flag iris, fragrant waterlilies, and reed canary grass.

One problem that occurred during the 2008 survey was that the wind picked up while surveying sections 7 and 8, making it very difficult to see the submerged plants through the waves. Few plants found in the 36 Lake Survey on Beaver Lake were not found during the 2008 survey, but this does not mean that these plants are no longer present at the lake, but only that those particular plants seen in 1995 may have been missed during this effort.

Of the few invasive species found in the lake, the most problematic is fragrant water-lily. This species has the potential to fill in shallow water around the lake margins and shade out many of the native, submersed aquatic weeds that provide food and shelter for lake creatures. Eradication can sometimes be very difficult without the use of herbicides, but good control around docks can be achieved through repetitive cutting of the floating leaves, pulling them out by hand, or other manual methods.

The other invasive species included yellow-flag iris and reed canary grass. The iris has firmly established itself along the shoreline, so eradication is going to be difficult but again control can be achieved through digging them out by the roots or cutting off the seed heads in later summer to keep the plants from spreading to other areas.

Overall, Beaver Lake continues to host a diverse, healthy plant community. Excellent habitat exists for the fish, birds and other animals that use the lake. A few invasive weeds need to be monitored and controlled if possible, such as fragrant water lily and yellow-flag iris. Residents of the Beaver Lake area should be on the look out for Eurasian water milfoil and purple loosestrife(see photo), as early detection of these plants is important for effective control before they become a problem in the lake.

LATIN NAME	COMMON NAME	Section 1		Section 2		Section 3		Section 4		Section 5		Section 6A		Section 6B	Section 7		Section 8	
		2008	1995	2008	1995	2008	1995	2008	1995	2008	1995	2008	1995	2008	2008	1995	2008	1995
Submerged Plants																		
Alisma gramineum	narrowleaf water-plantain								X		X							
Ceratophyllum demersum	coontail		X				X				X	P	X					
Chara or Nitella spp	plant-like algae	P		P									X	P		X		
Elodea canandensis	American waterweed	C				P		P			X		X		P	X	P	
Mentha sp	mint																	X
Myriophyllum spp	Watermilfoil (native spp)	P		P		P				P				P				
Najas flexilis	water-nymph			P							X		X		P			
Potamogeton amplifolius	big-leaf pondweed										X				P			
Potamogeton crispus	curly-leaf pondweed										X							
Potamogeton epihydrus	ribbon leaf pondweed								X		X							
Potamogeton pusillus	small pondweed	P		P		P		P		P	X	A	X	A	P	X	P	X
Potamogeton robbinsii	fern-leaf pondweed	C	X	C	X	P	X	P	X	C	X		X		P/C	X	P/C	X
Potamogeton zosteriformis	flat-stemmed pondweed	P		P		P												
Utricularia spp	bladderwort	P	X	P	X	P	X	P	X	P/C		P	X	P		X	P	
Floating Leaved																		
Brasenia schreberi	watershield			P		P	X					P	X	P	P	X	P	X
Hydrocotyle sp	water pennywort															X		
Ludwigia palustris	water purslane		X															X
Nuphar luteum	spatterdock	P	X					P	X		X	C		C	C	X		X
Nymphaea odorata	fragrant water-lily	A	X	A	X	A	X	C	X	A	X	A	X	P/C	P/C	X	C/A	X
Emergent																		
Carex spp	sedge (native spp)			P				P										
Eleocharis spp	spike rush (native spp)																	X
Iris pseudacorus	yellow-flag iris	P/C	X	P/C	X	P	X	P	X					P	P	X	C	X
Juncus spp	rush (native spp)			P	X	P		P	X	C	X	C	X		P	X		X
Phalaris arundinacea	reed canary grass														P			X
Potentilla palustris	marsh cinquefoil				X		X						X	P	P	X		X
Spiraea douglasii	hardhack		X		X		X		X		X		X			X		X
Typha latifolia	common cattail	P			X	P	X	P	X	P					P	X		X

Table 1: Comparison of 2008 plant survey with results from 1995 plant survey

***A = abundant, P = present, C= Common**

Water Quality Update

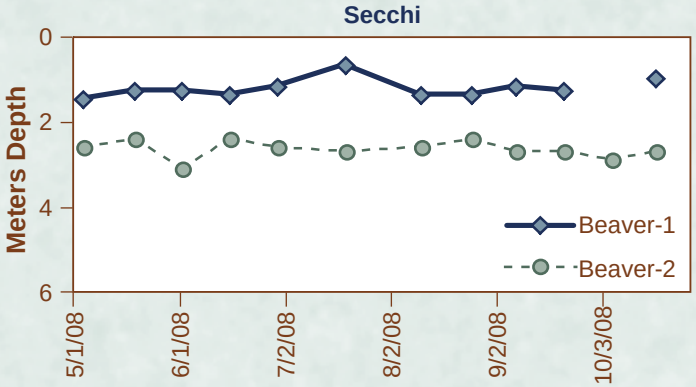
Beaver Lake Water Quality Monitoring Program

The Beaver Lake Management District (BLMD) contracts with the King County Lakes Program to track water quality late fall through spring in the two creeks that enter Beaver Lake, as well as the two lake basins. From May through October when the inlets are essentially dry, the City of Sammamish contracts with King County to make lake water quality measurements during the recreational season, with the help of volunteers working with the KC Lake Stewardship Program.

Results

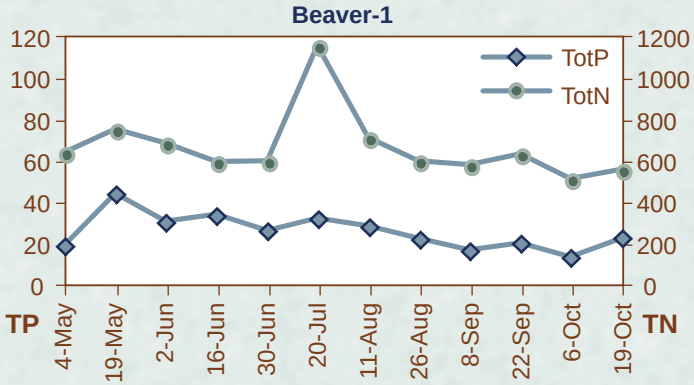
Although many types of measurements are important in determining overall water quality, in summer there are a number of parameters that are of particular interest: Secchi transparency, phosphorus, nitrogen, and chlorophyll. Changes in these parameters are often associated with increased development and may foreshadow nuisances or problems in the future.

Secchi transparency measures water clarity, usually evaluated in the middle of the lake. While winter decreases in water clarity may be correlated with storm events that bring silt into the lake water, summer clarity is nearly always associated with algae populations and water color. Changes in water clarity often indicate something happening in the lake that should be investigated further.

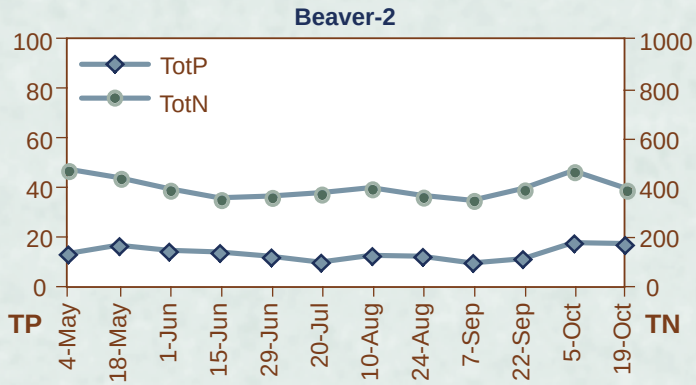


In both basins, water clarity remained steady through the season. Beaver-1 (the north basin) is consistently less clear than Beaver-2 (the main basin). This is because the water in Beaver-1 is more highly colored due to a high quality wetland feeding the main tributary to the lake and to a wetland fringe along the western shoreline. The tea color is a natural feature of the lake, and the lake dwelling species are adapted to it.

Phosphorus is a naturally occurring element that is necessary for life in small amounts. However, human actions associated with residential development can increase concentrations that can lead to more frequent and dense algae blooms – a nuisance to residents and lake users, and a potential safety threat if blooms are dominated by species that can become toxic. **Nitrogen** is another plant nutrient, which is usually higher in concentration that phosphorus. However, the ratio between the two can determine which algal species do well in the lake water.



In Beaver-1, the ratio between total phosphorus and total nitrogen remained steady throughout the season, with the exception of one high value for total nitrogen in late July. Both nutrients are found in higher concentrations in Beaver-1 than in Beaver-2, which correlates with more algae present as well. There was a slight decline in nutrients between the beginning and end of the season.

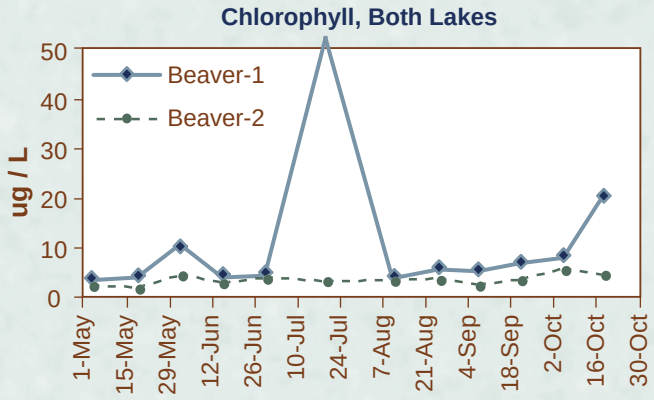


See other side for more Water Quality Updates ☛

Water Quality Update *Continued from Page 3*

For Beaver-2, the ratio between total phosphorus and total nitrogen similarly remained steady throughout the season, with a slight increase in the fall. Both nutrients are found in lower concentrations in Beaver-2 than in Beaver-1, which correlates with lower algae present.

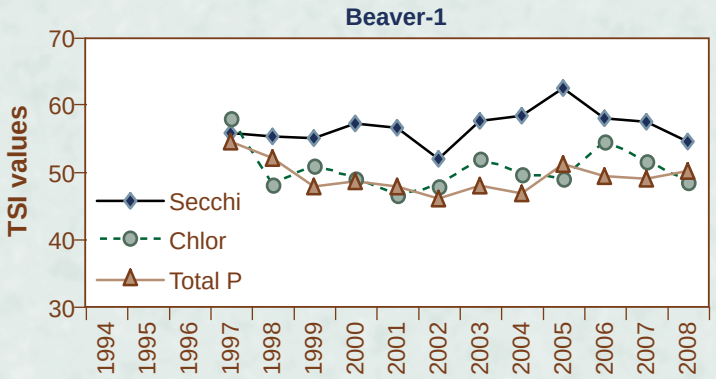
Chlorophyll is a measure of the algal population present, as all algae must have some chlorophyll in order to carry out photosynthesis, which converts nutrients and sunlight into energy and energy storage products.



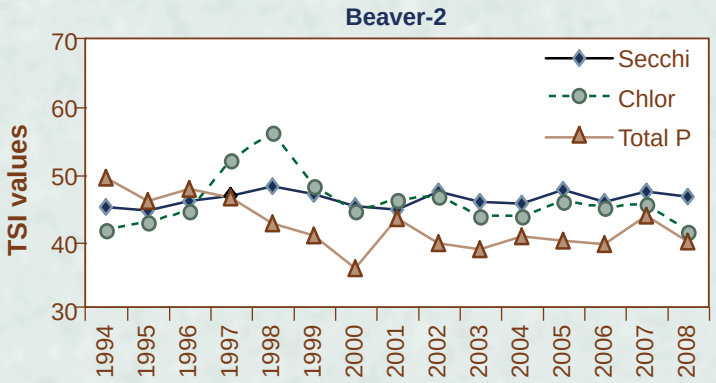
Throughout much of the season, chlorophyll in the two lake basins was very similar, although Beaver-1 was generally slightly higher than Beaver-2. There were three dates with exceptions: late May, Late July and at the end of the sampling period in October. On all three occasions, Beaver-1 was significantly higher than Beaver-2, reflecting its overall higher productivity.

Trophic state indicators (TSI) are values calculated from nutrient, Secchi transparency and chlorophyll measurements that relate to algal productivity. TSI values allow for classification of a water body into three different levels of production based on the results: high (eutrophic), medium (mesotrophic) and low (oligotrophic). The threshold between oligotrophic and mesotrophic is a value of 40, while the threshold between mesotrophic and eutrophic is 50.

While lakes can place in any of these classifications naturally, accelerated watershed development and human activities can artificially move a lake from a lower classification to a higher one. This often occurs due to increases in the amounts of nutrients entering the lake, thus stimulating algae growth (which increases chlorophyll) that may also cloud the water, thus decreasing water clarity. Tracking TSI values over time can produce a great deal of information about the direction of water quality in a lake.



TSI values have been calculated for Beaver-1 since 1997. Nutrients and chlorophyll have been relatively close together each year and have varied from year to year without any trend over time, appearing relatively stable. The Secchi TSI has rated significantly higher, most likely related to the dark color of the water, which impacts clarity aside from nutrients and algae concentrations. Beaver-1 is on the threshold between mesotrophy and eutrophy. Some large algae blooms have been recorded for this lake basin over time, particularly made by the cyanobacterium *Aphanizomenon*.



TSI values have been calculated for the Beaver-2 lake basin since 1994. The early years showed a steady increase in chlorophyll that peaked in 1998 and has declined since then. Phosphorus has also declined over time, a trend that has statistical significance. Currently, the lake rates in the lower third of the range for mesotrophy. With the exceptions of 1997,1998, and 2008, chlorophyll and Secchi TSI values have tracked each other closely, while phosphorus has generally been lower than the other indicators.

Summary

Generally speaking, the water quality parameters that have been measured for the Beaver Lake basins have remained stable in recent years, and water quality remains good. This suggests that current city land use controls and practices have been effective in keeping development from impacting the lake to date. This does not mean that algae blooms that cloud the water or create other nuisances will never occur, but rather that they should be fairly rare and limited over time.

Lake fecal coliform monitoring 2008

This year marked the fourth season of fecal bacteria monitoring in Beaver Lake by the King County Lake Stewardship Program for the Beaver Lake Management District. This study was started because of lake users' interest in knowing if bacteria harmful to themselves or their pets might be in the lake water.

Escherechia coli (E-coli) are introduced into the environment from warm-blooded animal feces, and their concentrations can be used to indicate potential health threats in fresh water. Under Washington State and Federal Environmental Protection Agency guidelines, recurring concentrations of fecal coliform bacteria above a threshold of 100 colony forming units per 100 milliliters (cfu/100mL) are considered a violation for primary contact activities, such as swimming.

E-coli can originate from several different sources, including pet waste, goose poop and leaking septic systems. Since E-coli move freely through water, results can also be quite variable over time and space. One station may produce a high E-coli count at one time, but be below detection levels the next. It is important to sample stations repeatedly to look for over-all patterns. To measure E-coli in a cost effective manner, the Coliscan EasyGel method was used. This method has been shown to be a reliable test for E-coli and is approved by EPA in Region 4 (SE United States), although it is not yet officially approved in our EPA region (Region 10).

Between 2005 and 2008, sampling on Beaver Lake occurred once a month between June and September. Since 2005, the tested stations have changed slightly, with more shoreline sites added and the two mid-lake stations monitored in the 2005 have been dropped due to consistently low E-coli concentrations. In 2008 there were 21 sites that were monitored throughout the lake (Figure 1)

The results over the last four years have been very encouraging, with only one station having a value at or over 100 cfu/100mL twice in one season (BVR 02 in 2006). In 2007 and in 2008, fewer than a quarter of the stations had values at 100 cfu/100mL or higher, and no station in the last three years produced consistently high E-coli values (Figure 2). The average E-coli concentrations from 2006-2008 have been below 100 cfu/100mL at every station. This monitoring effort suggests that generally Beaver Lake is low in E-coli concentrations and should be considered safe for swimming and other recreational activities.

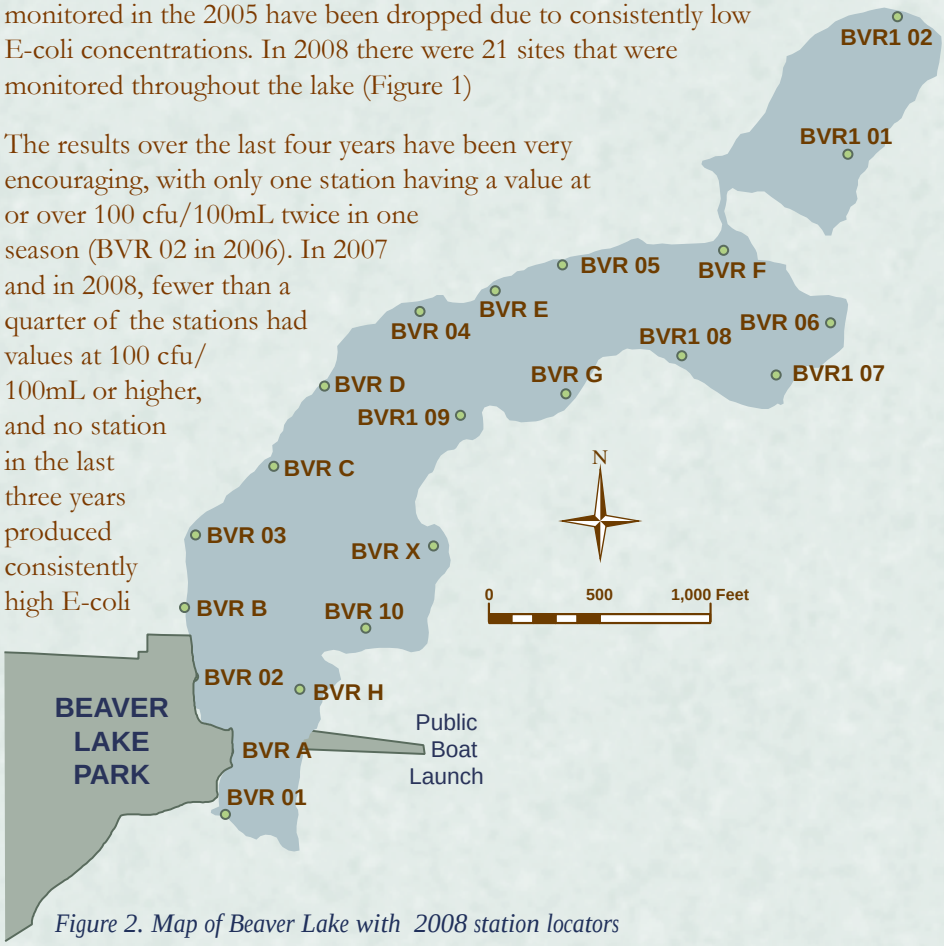


Figure 2. Map of Beaver Lake with 2008 station locators

Although no Beaver Lake stations were in violation of the state standard, continued monitoring is desirable to insure that any increased concentrations are detected and do not lead to a health threat.

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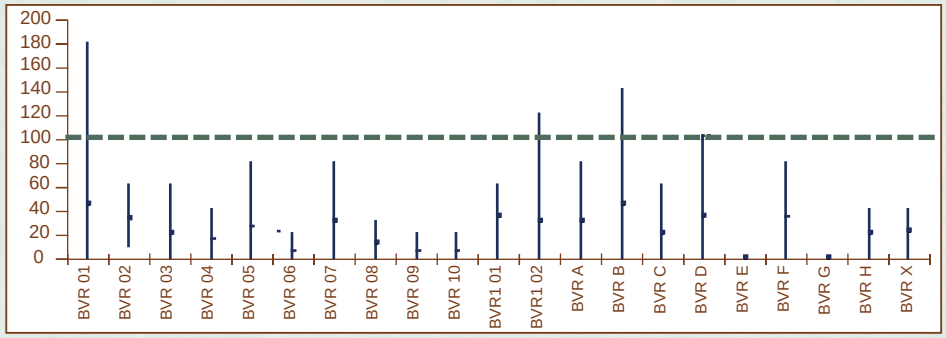

Figure 3. Beaver Lake Stations with maximum, minimum and average E-coli values for 2008.

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At this time of year, winter storms with heavy rain and strong winds can push leaves, branches and debris across the grated openings of city storm drains, clogging the openings. This can cause water to back up into streets and can even generate some minor flooding in the drain vicinity.

While Sammamish staff do clear storm drains, many times residents can identify and clear the drains much faster than the city crews can get to them, thus saving others from annoyance and preventing property damage. If you do see a clogged drain and can clear it with a rake or shovel, please take the time to remove the clog.

If you are unable to clear drains, please call the City crew at 425-295-0500 to report the clog. If you can provide a description of the nearest intersection or a power pole number, that will help the crew locate the drain in question.

Lake fecal coliform monitoring 2008

Continued from Page 5

Changes could occur in the future, as development continues, and more pets, people and birds utilize the lake, in addition to septic systems aging. Most stations have produced at least one value of 100 cfu/100mL or higher, suggesting that there is a potential for increased concentrations. It is noteworthy that the BVR 02 station located just off the park beach had an average concentration close to the threshold in 2008. This is a site with frequent public access by both pets and children, as well as fishermen, and it should be followed closely.

The Beaver Lake Monitor

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