



**Observations on the Effect of Beaver Dams on Water Quality  
in Somenos Creek and Somenos Lake**

**Somenos Rapid Science Communication 2018-02**

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### **About Somenos Rapid Science Communications**

The Somenos Rapid Science Communication series is produced by science staff of the Somenos Marsh Wildlife Society. The purpose of this series is to provide objective assessments of topical and newly emergent concerns related to ecosystems in the Somenos basin and adjacent aquatic areas. Reports in this series will present analyses of data collected by science staff and volunteers working for the Somenos Marsh Wildlife Society. This series is intended to be informative to a broad audience including the public, the business community, scientists, government management staff, elected officials, and First Nations. These documents are made widely available to foster collaboration between stakeholders in the Somenos basin.

## **Observations on the Effect of Beaver Dams on Water Quality in Somenos Creek and Somenos Lake**

### **Summary**

Analysis of water quality monitoring data recorded in Somenos Lake in early June 2017 and 2018 suggests that there was little qualitative difference between the two years. Although lake elevation was somewhat higher due to the influence of a beaver dam in lower Somenos Creek water turbidity was lower and water clarity was higher in 2018 than 2017. It has been well established that Somenos Lake is currently in a severely degraded environmental state due to the presences of high phosphorus levels and persistent summer cyanobacteria blooms. However, the higher water levels do not appear to be worsening the aquatic habitat in the lake or in Somenos Creek

### **Observations**

This review is in response to questions and concerns raised recently by several residents near Somenos Lake. In particular there has been uncertainty over the potential of harmful ecosystem effects that may be associated with the apparent poor drainage of the lake. As you know the Somenos Marsh Wildlife Society has been conducting extensive water quality monitoring in the lake and the watershed for the past 4 years. A review of this work shows that the current state of water quality in the lake is not different from previous years. Therefore although the lake level is marginally higher than would be expected, the underlying ecosystem processes (many of which are highly undesirable) remain unchanged.

It is important to bear in mind that over the last 150 years Somenos Lake and Somenos Creek have both become severely degraded in terms of their capacity to provide fish habitat. This change is primarily manifested as persistent lethal conditions of both temperature and dissolved oxygen in different parts of the water column. For at least the past two decades the lake has been subject to cyanobacteria bloom of increasing length and strength. These cyanobacteria bloom have had the result of degrading trout and salmon summer habitat below 5m in the lake by creating anoxia near the bottom and heating up the surface waters. This process leaves the surface unfit for salmonids due to high temperatures (often in excess of 21°C through June July and August and the depths unfit for salmonids due to lack of oxygen (Preikshot 2016).

In most summers Somenos Lake reaches a 'base level' near 4.7m when the effective drainage becomes almost zero. At this point the only source of water is the mouths of Bings and Averill Creeks which may dry up before reaching the lake. Because the mouth Of Richards Creek has been dredged to just above Herd road there is little water that reaches the lake due to evaporation and infiltration along the way.

Evaporation on the lake likely removes most of the water that might otherwise drain out via Somenos Creek. A simple evaporation model (Linacre 1977) estimates that in typical spring conditions, when the average daily air temperature is 17°C, there is about 3mm of evaporation per day. In summer conditions, when the average temperature is about 25°C, evaporation is more than 5mm per day. In terms of volume this is approximately 3-5 million litres per day.

These volumes are likely similar or slightly greater than that of water entering the lake from its tributary streams. This evaporation is the likely cause of observed stagnant or very slow discharge in recent summers. It is likely that much of the meager Somenos Creeks discharge in the summer originates in ground water from the lands between the Somenos lake and the Cowichan River, see, e.g., Burns (1999). It is also likely that the low grade between Somenos Lake and the Cowichan River, the creek bed drops about of ~0.5 m over 3 km (NHC 2005), results in much of the summer ground water in Somenos Creek making its way to Somenos Lake even in the absence of beaver dams.

Poor drainage of Somenos Lake likely became most acute after changes were made in how Somenos Creek enters the Cowichan River in the 1950s. The bed of Somenos Creek was shifted to meet the Cowichan River several hundred meters upstream of the pre-existing confluence. The effect of this was to reduce the elevation difference between the head and mouth of the creek, i.e., reduce the potential for drainage. Hydrological modelling suggested that Somenos Lake levels are influenced by the Cowichan River when discharge in the river is greater than 25m<sup>3</sup>/s. Therefore for about 75% of the year we would expect poor drainage or backwatering to be a frequent occurrence.

The back watering events in the winters are usually associated with large rain events in which the Cowichan River rises much quicker than Somenos Lake. Examples of the magnitude of such events can be seen in:

- January 2018 when backwatering raised Somenos Lake and Somenos Creek high enough that water was at the edge of the Island Highway and had blocked Tzouhalem Road. The inundation was sufficient to entice a sea lion in search of food. Typically sea lions will forage in the main stem of a salmon bearing river.
- November 2009 when flooding in the Cowichan River caused extensive damage to residential property in the Lakes Road area and inundated agricultural lands as far inland as Herd Road in the Somenos watershed.

The back watering observed in Somenos Creek during the period from 25 May 2018 and 15 June 2018 is of far lower magnitude than what is observed during winter backwatering events. The likely source of the recently observed back watering is a combination of a beaver dam on lower Somenos Creek and ground water intrusion from the area around Somenos Creek. During this period the average height of Somenos Lake was observed to be approximately 20cm higher than it had been the previous year.

Another factor influencing drainage in the area has been the rapid spread of Parrot's Feather (*Myriophyllum aquaticum*). This invasive plant species has colonised most of the run of Somenos Creek between the lake and the JUB sewage lagoons. A survey during Summer 2017 noted that in the upper two thirds of Somenos Creek, Table 1. Parrot's Feather covered approximately 26% of the total water surface area surveyed in 2017. In two patches the coverage was almost 100 percent. When Parrot's Feather reaches such high levels of

abundance it can be associated with degraded water quality by slowing flow and promoting anoxia (Kelly and Maguire 2009).

## Discussion

There is significant concern from the local community that lack of drainage in the lake is due to a combination of Parrot's Feather and the beaver dams. While it is true that drainage has slowed at an earlier time than last year due to the presence of the beaver dam, it is also true that at some point in June the lake has always ceased to drain. The Parrot's feather and beaver dam have not significantly altered this state of affairs. The one significant difference is that there is more water in the system as demonstrated by higher gauge readings. Monitoring by the Somenos Marsh Wildlife Society shows that there is little difference between significant water quality parameters between early June 2017 and the current year, Table 2. The most noticeable difference between the two years is that turbidity (total dissolved solids) is lower in 2018 than 2017 and that visibility (Secchi disk depth) is greater in 2018 than 2017.

If there is a threat to life and property posed by the 20cm increase of lake level in 2018 versus 2017 this concern should be addressed. In terms of threats to ecological values, however, it would appear that the already highly degraded state of Somenos Lake in the early summer is not appreciably lowered by the presence of the beaver dam in the lower portion of Somenos Creek. In the absence of the beaver dam the lake would simply cease to drain at a slightly lower elevation. If the beaver dam is removed it is likely that the creek would drain the lake for a couple of days and resume its stagnant or backwatering behaviour at a lower level. The beaver dams also appear to be preventing the spread of Parrot's Feather into the lower Cowichan River. Furthermore, because Parrot's Feather can grow under water, on the water surface and on dried out banks, it has a significant advantage over other aquatic plants. Because the Beaver Dam is acting to keep the creek levels somewhat higher it may also be limiting potential dried out bank habitat to Parrot's Feather.

## References

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**Figures**

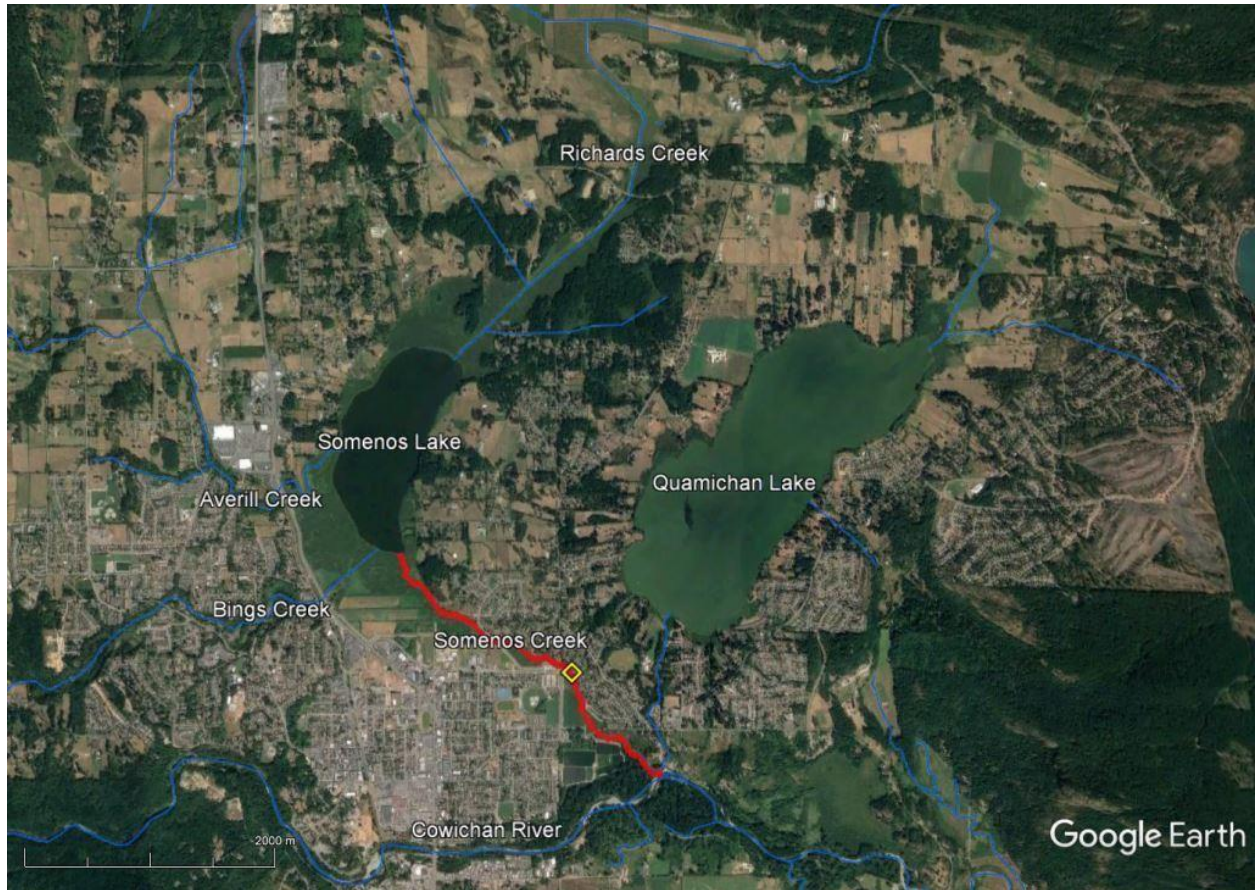


Figure 1: Somenos Lake and Somenos Creek, red line, with connected lakes and streams in the lower Cowichan River area.



Figure 2: Extent of Parrot's Feather infestation in the upper two thirds of Somenos Creek based on monitoring sites visited in June 2017. The head of Somenos Creek, at Somenos Lake, can be seen just above the point of the North arrow. The yellow lines indicate the extent of continuous growth at Site 1 in the northwest and Site 14 in the southeast.

**Tables**

Table 1: An inventory of the density and extent of Parrot's Feather at monitoring sites along Somenos Creek on 19 June, 2017. Note that at Site one Parrot's feather was continuous for approximately 500m at site 1 and 150m at site 14. Estimations of total and infested area assumed that the wetted width of the river was 5m at the time of the survey. Total index area was estimated as the distance from the head of the creek, at Somenos Lake to the observed end of the patch at site 14 (2,050m) multiplied by 5m wetted width.

<b>Site</b>	<b>Latitude</b>	<b>Longitude</b>	<b>% cover</b>	<b>m<sup>2</sup></b>
1start	48.7913	-123.7009	90	2025
1end	48.7889	-123.6961	25	62.5
2	48.7887	-123.6952	10	10
3	48.7878	-123.6937	10	10
4	48.7872	-123.6915	20	10
5	48.7869	-123.6900	10	20
6	48.7865	-123.6889	20	10
7	48.7858	-123.6874	10	5
8	48.7858	-123.6878	20	5
9	48.7858	-123.6871	10	5
10	48.7858	-123.6862	20	20
11	48.7858	-123.6862	20	20
12	48.7854	-123.6852	10	10
13	48.7850	-123.6839	33	20
14start	48.7848	-123.6838	30	60
14end	48.7837	-123.6832	80	400
total Parrot's Feather area (m <sup>2</sup> )				2,693
total estimated index area (m <sup>2</sup> )				10,250
<b>% infested area</b>				<b>26.27</b>



Somenos Rapid Science Communication 2018-02

Table 2: Water Quality parameters measured in Somenos lake in June 2017 and June 2018 by the Somenos Marsh Wildlife Society Salmon Habitat monitoring program. Parameters below provincial guidelines for salmonid health (Ministry of Environment 2015) are highlighted in yellow, those lethal to salmon are highlighted in red. T=temperature, DO=dissolved oxygen, TDS=total dissolved solids. Level is lake elevation by the gauge at the Forest Discover Centre trestle.

06 Jun 2017							05 Jun 2018						
depth (m)	T (°C)	DO (mg/l)	pH	TDS (mg/l)	Level (m)	Secchi Depth (m)	depth (m)	T (°C)	DO (mg/l)	pH	TDS (mg/l)	Level (m)	Secchi Depth (m)
0	20.5	11.2	7.7	91.0	4.8	1.5	0	18.1	8.1	7.1	87.8	5.0	1.7
1	19.3	11.0	7.6	91.0			1	18.1	8.2	7.1	87.8		
2	19.1	11.3	7.5	91.0			2	18.0	7.6	7.1	87.8		
3	16.5	2.8	7.2	89.7			3	17.8	7.8	7.1	87.8		
4	14.0	0.1	6.9	89.7			4	17.4	5.7	7.0	87.8		
5	13.1	0.1	6.7	93.6			5	14.1	0.0	6.8	91.7		
6	12.7	0.1	6.6	100.1			6	12.0	0.0	6.7	97.5		

14 Jun 2017							12 Jun 2018						
depth (m)	T (°C)	DO (mg/l)	pH	TDS (mg/l)	Level (m)	Secchi Depth (m)	depth (m)	T (°C)	DO (mg/l)	pH	TDS (mg/l)	Level (m)	Secchi Depth (m)
0	18.0	10.7	7.6	91.0	4.8	0.9	0	18.2	9.1	7.1	87.8	5.0	1.7
1	17.7	9.6	7.5	91.0			1	18.1	8.8	7.2	87.8		
2	17.6	8.8	7.3	91.7			2	17.9	8.3	7.1	87.8		
3	17.4	8.2	7.3	91.7			3	17.2	7.6	7.1	87.8		
4	17.1	6.8	7.1	91.7			4	16.9	6.8	7.0	88.8		
5	13.9	0.1	6.8	97.5			5	15.7	1.5	6.8	89.7		
6	13.1	0.1	6.7	103.4			6	12.6	0.0	6.7	100.8		