Shawnigan Basin Society

Conservation of Environment - Milfoil Removal, Mapping & Result Testing

The purpose of this program is to remove (and monitor the effectiveness of removal) highly invasive Eurasian watermilfoil from Shawnigan Lake, a water body 50km northwest of Victoria on Vancouver Island that is highly valued and used by a growing population of permanent residents, First Nations communities, and seasonal visitors. Introduced in the 1970s, the prolific spread of Eurasian watermilfoil throughout the lake is now having significant impacts on Shawnigan Lake water quality, disturbing the lakeshore ecosystem, and reducing opportunities for recreational use by boaters, swimmers, and fishermen.

Shawnigan Lake is an important source of drinking water for the residents of Shawnigan Lake. Water quality, including suitability for drinking, is affected by the presence of the Eurasian watermilfoil in two key ways.

Water milfoil growth is enhanced by increased nutrient concentrations in the lake, particularly phosphorus. The nutrients have two main sources: the sediment loads from incoming streams (Photo 1) and the death and decay of Eurasian watermilfoil (Photo 2). When milfoil plants and fragments die and decompose using oxygen, the oxygen levels in the water and sediment decrease, leading to the release of adsorbed phosphorus. This, in turn, creates a vicious cycle, as increased phosphorus can further increase the growth of the invasive European watermilfoil, and the decreased oxygen can limit habitat for important aquatic species such as plankton, algae, invertebrates, and fish in the lake. Removing the invasive Eurasian watermilfoil through our program will remove nutrients contained in the milfoil and also curb the low oxygen/high phosphorous cycle that has allowed Eurasian water milfoil to continue spreading in Shawnigan Lake.

Although we cannot change the input of sediments from nearby landfills, we will continue to monitor their affects on our waterways. Volunteers of the SBS have been proactively monitoring landfill sites for possible violations. This has resulted in some reduction of sediment entering the streams that feed the lake. These sediments contain organic matter and phosphorus, which promotes the spread of Eurasian watermilfoil. The Shawnigan Basin Society (SBS) will monitor the water quality notably the concentrations of nutrients (nitrogen and phosphorus) and dissolved oxygen and chlorophyll a (productivity) before and after the Eurasian watermilfoil is removed. Established lake sampling sites will be used.

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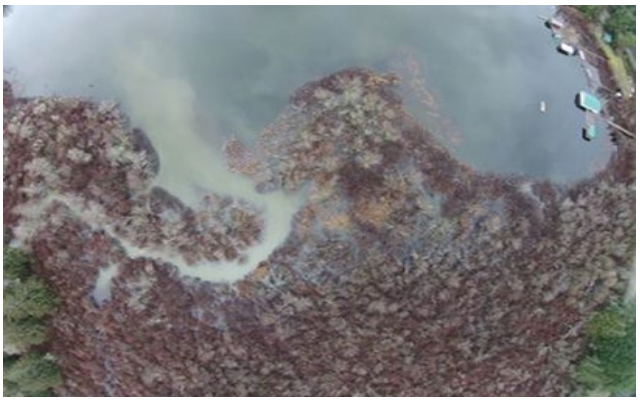

Photo 1. By Russel Robertson, by permission

Sediment plume from South Shawnigan Creek January 17, 2016

Photo 2. By Ed Wiebe, by permission

Example of a mat of Eurasian watermilfoil in Summer 2019

The nearshore waters area of Shawnigan Lake also contains a diversity of plant species and benthic (bottom) organisms (e.g., insects and crayfish), which, in turn, provide food for fish such as smallmouth bass. It is also the area in the lake where some of the fish species (e.g., kokanee, smallmouth bass, yellow perch and pumpkinseed) spawn. The spreading of Eurasian watermilfoil is therefore eliminating native species and reducing available habitat for benthic organisms and fish populations.

Changes in water quality and the lakeshore ecosystem are having a major impact on the use and enjoyment of Shawnigan Lake for recreational purposes, including swimming, boating, and fishing.

The lake is used by a growing population of permanent residents (in 2016 approximately 8,558 people according to Cowichan Valley Regional District 2016 census for Area B - Shawnigan), as well as seasonal visitors from Victoria and the mainland who bring significant economic opportunities to the region. Summer is the busiest time on the lake with the number of people close to doubling. In addition to constituting a serious problem in the lake, the milfoil also washes up onto beaches where it rots, making these popular beaches unsuitable for recreational use. Our program to monitor and remove this highly invasive Eurasian water milfoil will enhance water quality and important ecosystem health and habitat, thereby also allowing for enhanced recreational use of Shawnigan Lake.

Shawnigan Lake is highly valued by local First Nations, and specifically Malahat Nation and Quw'utsun Tribes; indeed, the name Shawnigan Lake comes from the Hul'qumi'num word Showe'luqun.

We have evaluated several options and performed trials of other removal methods to reach the conclusion that the program outlined in the following pages is the most appropriate and of greatest benefit to the lake and communities that rely on it.

SBS summarized some of the different methods that have been tried to remove the invasive Eurasian watermilfoil from Shawnigan Lake in the past. Eurasian watermilfoil propagates via seeds and by fragmentation. Effective removal must therefore both reduce fragmentation and limit the production of new plants. Previous removal efforts & trials included:

(viii) When removed by hand, the plants easily fragment and if done in spring and summer when the water temperatures are above 15 C, the stolons readily form new plants. Hand removal that has been attempted in Shawnigan Lake has enhanced the spread of the invasive Eurasian watermilfoil.

(ix) A nano-bubble system, which did not increase oxygen concentration to required levels, and while it did not lead to the further spread of the plant, it did not help in removing the milfoil, either.

(x) Removal by scuba diving teams by cutting the plants and bringing them to waiting boats has helped reduce fragmentation, but its use has not been consistent in Shawnigan Lake.

The results contained in the following two reports showed decreasing oxygen concentrations and increased productivity in the shallower West Arm where the invasive milfoil is particularly dense and at the station closest the input from south Shawnigan Creek. In both cases, the water quality objectives were not met. The locations of the numerous landfills along the creek are shown.

Gregory, L, D. Munday, B. Juurlink, and C. Evans. 2021. Shawnigan Lake 2020 Water Quality Report: Including Attainment of the Water Quality Objectives.

Gregory, L, D. Munday, B. Juurlink, and C. Evans. In prep. Shawnigan Creek 2020 Water Quality Report.

For this program, we will rely on a removal method that has been used successfully in marine shorelines to remove unwanted vegetation. Commercial surface supply divers remove the plants, including the roots, but instead of putting them in a boat, the plants are added to a suction hopper managed by the divers. The hopper feeds to a suction/trash pump with a macerator and ultimately to bulk bags that contain all fragments. The bags are then taken to shore to dry, and the captured milfoil can safely be disposed of at a compost facility.

Based on the method selected for effective milfoil removal, the SBS has established collaborations with the Ministry of Forests, Lands and Natural Resource Operations (FLNRO) and have the requirements needed to get permission to remove the invasive Eurasian watermilfoil at the most appropriate time of year – November - based on past water temperatures. The requirements are to obtain the necessary monies and to map the distribution of the invasive milfoil and any native plants that may be present. This is possible due to SBS' membership in the British Columbia Lakes Stewardship Society (BCLSS)

(i) The BCLSS has agreed to conduct a one-day training program for SBS volunteers on the identification of the Eurasian watermilfoil as well as native species of Mryiophyllum and other common native aquatic plants. Once the first training is complete, those people can then train the divers who will be removing the invasive European watermilfoil and Shawnigan Lake residents.

(ii) The BCLSS has also arranged to assist SBS volunteers in completing a survey of the distribution of the invasive milfoil and native plants in the lake

The main activities associated with this program are:

(i) Removing the milfoil

Removal of the Eurasian watermilfoil is primarily conducted by specialists Divers, using their own equipment. Organizing the removal and disposal of the bulk bags to a composting facility will be done by SBS volunteers and some paid labour if we are successful in obtaining funding which will allow us to remove a greater amount in each project period. A local resident is volunteering the use of his pontoon vessel needed for the removal process.

(ii) Educating public about the process

(iii) Mapping distribution to allow for qualitative analysis

Before mapping the distribution of the invasive milfoil, the BCLSS will have a workshop for the SBS on identifying aquatic plants, including invasive Eurasian watermilfoil. The actual mapping will have two components. First, with the help of the BCLSS, the SBS will survey the lake by boat. At the same time, a drone - belonging to a volunteer - will be used for comparison with the on-site data/data collected by boat. Subsequent surveys will be drone surveys. A SBS volunteer will manage the drone. Additional workshops on identifying the Eurasian watermilfoil and native plants will be conducted by the SBS. Opportunities for local school groups to participate will be available. The projected participant #s for the mapping component ranges from 50 to 300 depending on volunteer and school interest.

Who benefits from the program?

This program will enhance water quality, including drinking water, enhance recreational use of Shawnigan Lake for lakeside residents and residents of the community of Shawnigan Lake and adjacent communities (notably Cobble Hill, Mill Bay, and Malahat Nation), as well as seasonal visitors from who are primarily from the Greater Victoria area and the mainland of BC and further abroad.

In addition to providing an important source of drinking water, the lake is used for swimming, boating, water-skiing, recreational fishing, watercraft training, and high school athletics programs. There are three popular beaches on the lake, as well as two provincial parks and several boat launching sites.

Overall benefits

There are about 650 residents on the lake itself, and the population of Shawnigan Lake was 3,945 according to the Federal Government 2016 census but Area B (Shawnigan in it's entirety by electoral area) is stated as 8,558. Many of the residents who live on the lake have tried to individually remove the invasive milfoil from their property areas, but the resulting plant fragmentation has led to increased growth. Three residents bought nano bubblers and some residents have hired divers, but only for small areas. The SBS receives frequent requests on how they can help to remove the milfoil. This all indicates that the local residents want the milfoil removed in a way that will keep it from returning or spreading.

This program focuses on milfoil removal from complete areas on the lake, rather than from isolated waterfront areas.

There are two licensed drinking water intakes from Shawnigan Lake. One has two reservoirs with a total capacity of 265,000 gallons. This water supplies the Shawnigan Beach Estates subdivision, a condominium and Discovery Elementary School. The second drinking water intake for Shawnigan Village Waterworks supplies approximately 550 residences primarily in the urban containment boundaries of Shawnigan Lake village. Maintaining the water quality of the lake is therefore imperative.
There are also indirect benefits to the removal of the invasive milfoil and enhancing water quality in Shawnigan Lake. The mats of Eurasian watermilfoil that spread across the bottom of the lake eliminate the native and naturally-occurring vegetation and disrupt the lakeshore ecosystem—an area is important for benthic (bottom) animals, fish, and as well as native plants. And people want to use clean water and have a weed-free lake.

The removal of the milfoil will be conducted when the lake water temperature is less than 10 degrees C, which is the temperature below which milfoil fragments won't root & produce new plants.

Water quality monitoring

The SBS directors will conduct water quality monitoring from a boat provided by one of the Directors on Shawnigan Lake. The GPS locations for each site will be recorded so all the monthly samples are from the same locations.
Water quality monitoring will occur monthly using a YSI Pro DSS meter. The parameters measured are dissolved oxygen, pH, turbidity, and specific conductance. In addition, samples will be collected four times per year for analysis of nutrients (nitrogen and phosphorus species), chlorophyll a (productivity) and suspended sediments. Because these samples will be collected before and after the invasive milfoil is removed, the effect of removing the milfoil on the water quality can be documented.

Workshops on identification of aquatic plant species

The workshops on identifying the Eurasian watermilfoil and other aquatic plants will take place in the SBS office or by the lake.

Mapping and monitoring the distribution of the Eurasian watermilfoil. Monitoring the distribution of the Eurasian watermilfoil and other aquatic plants as needed will be from a boat on the lake as well as by a manned drone from various locations on the shoreline.

Removing the invasive Eurasian watermilfoil

A specialist scuba diving team will remove the invasive Eurasian watermilfoil in the lake (see How?)

How is the program delivered? Who delivers the program? and how many people deliver the program?

The central component of the program is the removal of the invasive Eurasian watermilfoil and its accumulated nutrients. This will be done by Divers. They will work for 22 days (three to four days / week) to remove the plant and all roots, and place the plants in a hopper, which feeds into a suction/trash pump with a macerator. The outflow from the pump is to bulk bags, which will be on the waiting pontoon vessel. The bulk bags will be transported to shore to dry, and then taken to a composting facility for disposal. The bulk bags will be cleaned and reused. There are 10 bulk bags, each of which holds one to two cubic meters. We estimate that we can fill 3 to 4 of these bulk bags per day.

The divers will fill 10 to 12 bulk bags per week. Over a seven-week program, this means that 12 x 7 = 84 bags each with 1.5 cubic meters of Eurasian watermilfoil will be removed. This is a total of at least 125 cubic meters of Eurasian watermilfoil. It is not known the exact volume of the invasive Eurasian milfoil in the lake, so the removal will start where it is the densest and work to remove the most concentrated infestations of milfoil in the lake.

The divers will have a remotely operated vehicle and can take videos of the removal process and the condition of the lake bottom after removal.

The SBS Directors will guide volunteers for discrete stages of the program.

After the initial workshop on the identification of the Eurasian watermilfoil and other milfoils that may be present, the attendees (SBS Directors and members) will then hold subsequent workshops for the scuba divers, who will remove the milfoil, and for the residents, who will control the areas where the milfoil has been removed.

Volunteers from will be shown how to calibrate and use the YSI Pro DSS meter. Only 2- 3 people will be in the boat at any one time, but different groups can work different months. We expect a total of 24 people will be shown how to use the YSI Pro DSS meter.

The divers removing the invasive milfoil will have a remotely operated vehicle and will take videos of the removal process and the condition of the lake bottom after removal. These videos will be used to explain to the residents how to remove the Eurasian watermilfoil without leaving fragments.

Why the program is needed in the community, how it protects and improves the environment & supports wildlife.

Removal of the invasive European watermilfoil is needed: (i) to control and maintain the water quality of Shawnigan Lake, which is an important drinking water source; (ii) to allow continued use of the lake for recreation – swimming, boating, fishing; and (iii) to restore the lakeshore area ecosystem.

The invasive Eurasian watermilfoil is related to water quality in several ways. The death and decomposition of these highly successful plants and plant fragments use oxygen, creating conditions that allow for the release of nutrients—notably phosphorus—into the water, creating a vicious cycle of increased growth of the invasive milfoil. Although the plants are in the lakeshore area up to 5m, fragments move through the water to deeper areas, where they sink to the bottom and die and decompose. Removal of the invasive milfoil as well as the accumulated nutrients in the plants will limit the reduction of oxygen and the release of adsorbed phosphorus, therefore limiting the spread of milfoil in Shawnigan Lake.

In addition to the organic matter in the Eurasian watermilfoil plants, there are about ten soil landfills along south Shawnigan Creek and runoff from these landfills brings sediment plumes to the lake during periods of heavy rain. These landfills are under the auspice of the CVRD, members of the SBS monitor these areas monthly and report their findings to the CVRD soil bylaw officer. This has resulted in some improvements. This monitoring must continue to ensure operation of these landfill sites follows regulations.

The dense mats of the invasive milfoil along the shores of Shawnigan Lake limit the movement of watercraft and also limit the use of water for swimming (see photo 2). Lakeshore residents—as previously indicated— have tried and been unsuccessful at removing the milfoil, and thus welcome a lake-wide approach. organisms such as insects and crayfish, which are, in turn, important for several fish (e.g. kokanee and smallmouth bass) species present in the lake. This ecosystem is completely disrupted by the mats of Eurasian watermilfoil that have replaced native habitat.

How is the community made aware of the organization’s program?

The residents have made it clear they want the Eurasian watermilfoil removed, but they may not know why it is critical to remove the whole plant and dispose of the plants away from the lake in a composting facility. Also, they may not be aware of the effects of the decomposition of the plants on the water quality of the lake.

Information provided to residents will be about:

When the program is happening and why it is important to do a large are of the lake. Why only the invasive milfoil should be removed and how to identify the Eurasian watermilfoil as distinct from the other plants. How the invasive milfoil should be removed.

Many people have written to the SBS to indicate their support for this program, and more people have contacted the SBS inquiring about methods for effectively removing milfoil, illustrating widespread interest and support, particularly because of the milfoil's effects on recreational activities on Shawnigan Lake.

We have several letters of support on file that were specific to the Milfoil removal investigation & oxygenation technology including large scale stakeholders such as Ministry of Environment, Mosaic Forestry and Malahat Nation that we are pleased to forward to you if desired.

Project team experience

The directors of the Shawnigan Basin Society have a variety of backgrounds, but all have been involved in environmental issues in the Shawnigan area and in past professions. More details are available at https://www.shawniganbasinsociety.org/shawnigan-basin-society.html

Particularly relevant to this project are Dave Munday and Linda Gregory. Dave (B.Sc., MBA.), the president, is a Senior Environmental Specialist with over 30 years of experience, he has participated as Project Director, Project Manager and Environmental Coordinator for a diverse range of domestic and international projects. He is a registered professional biologist (RPBio.) in British Columbia, and specializes in marine biology, environmental impact assessment, and permitting for aquatic and terrestrial developments. Linda (BA., MSc., PhD) worked with the BC Ministry of Environment, largely collecting, analyzing, and summarizing water quality data. She also taught a variety of courses - primarily in the Biology Department - at the University of Victoria, and prepared contract reports for the BC and Federal Ministries of Environment. These reports focused on different aspects of water quality: analyses and summaries of existing data, developing groundwater quality objectives (Osoyoos), and preparing sampling training programs. In addition, she prepared several species summaries for COSEWIC (Committee on the Status of Endangered Wildlife in Canada). She is now retired, but is a director with the Shawnigan Basin Society. Our current Treasurer and President have extensive project and financial management experience in the corporate realm.

Project management capacity

The Directors of Shawnigan Basin Society have years of management experience as indicated in the SBS website - see project team experience. Dave Munday, who will lead this initiative, has over 35 years' experience as an Environmental Consultant managing and directing large Impact assessments. These projects ranged in value from $20,000 to over $6,000,000 with teams of specialists that, in the case of larger projects, exceeded 200 specialists.